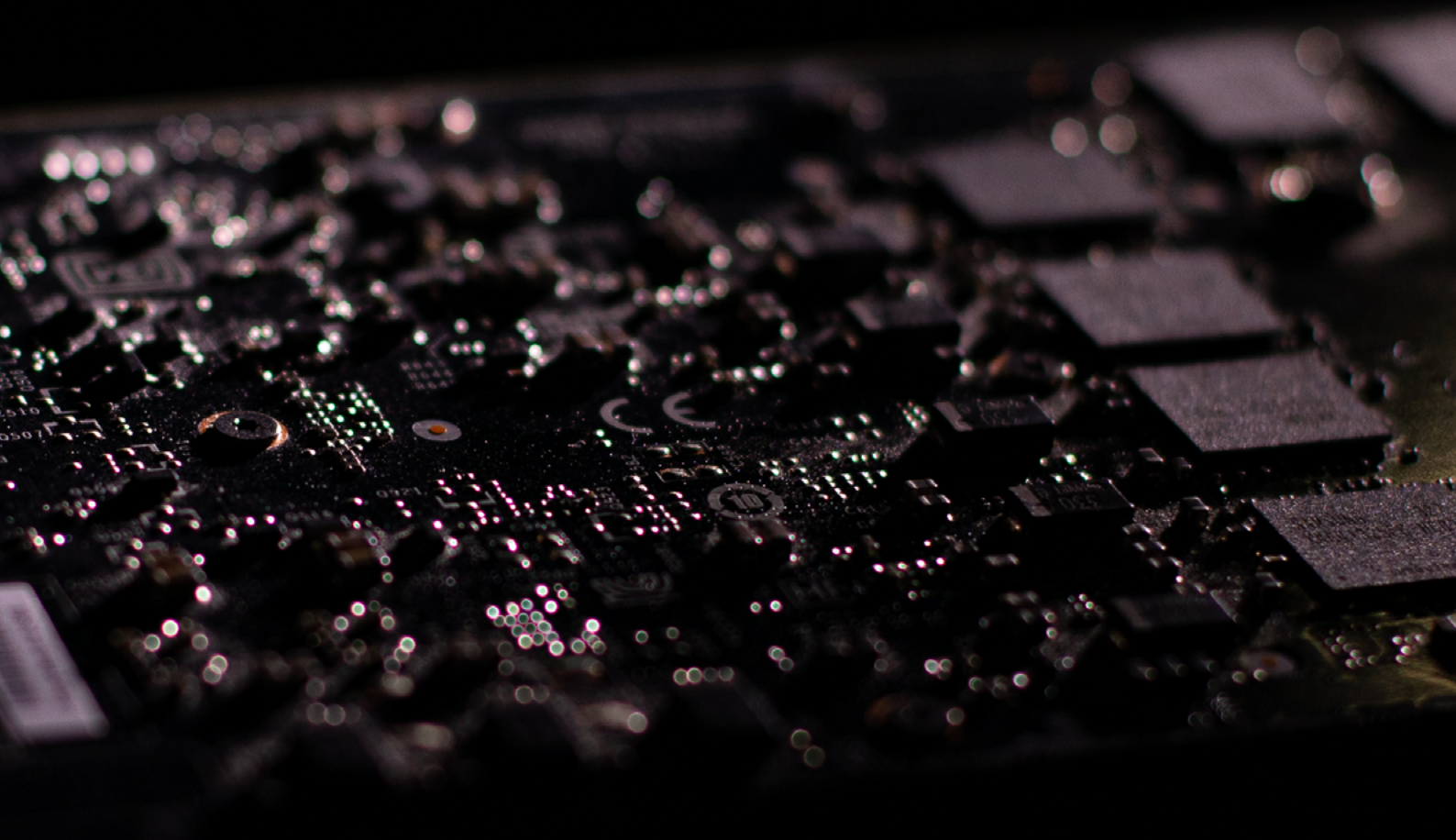
Academic Year
2019 - 2020



Aalto University

Department of Computer Science

Contents

Academic Year 2019-2020 in Department of Computer Science at Aalto University

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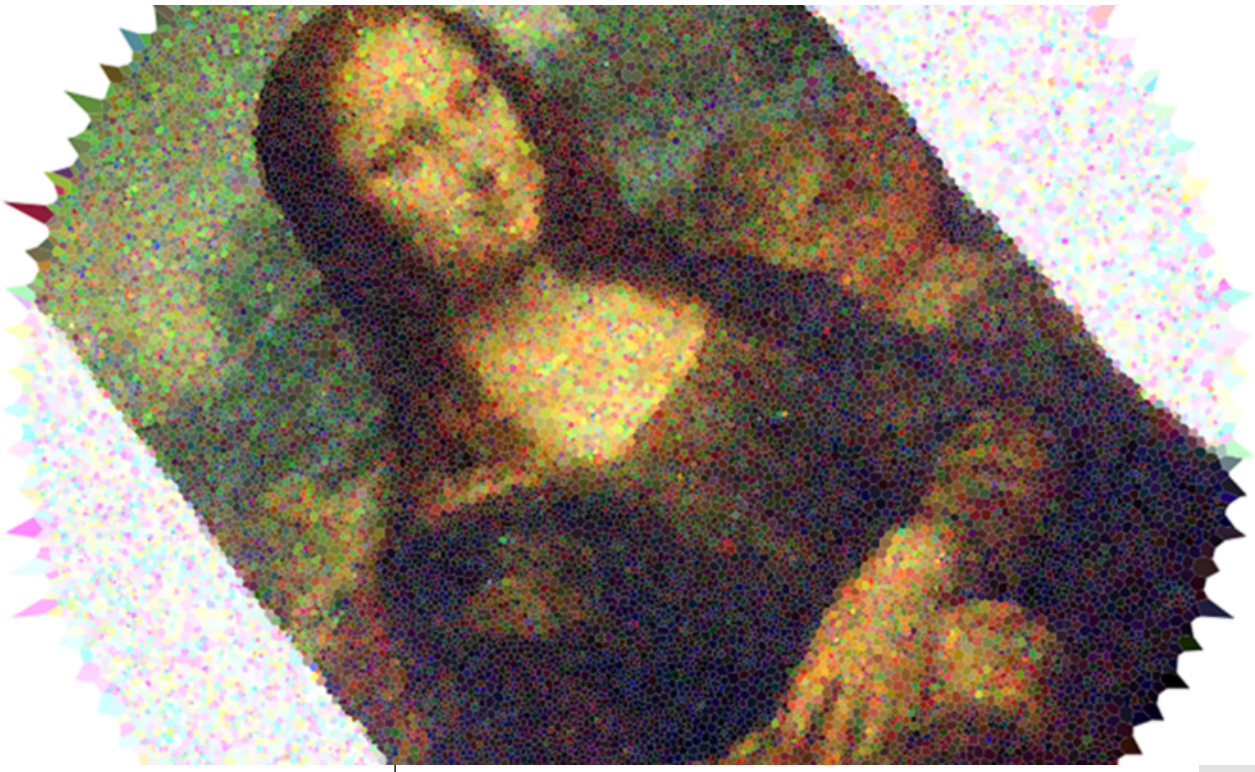
Research News

Researchers at Aalto and Karolinska developed a microscope without a microscope

DNA microscopy makes it possible to view biological molecules on micro-level without expensive optics.

Research, published: 6.9.2019



DNA microscopy being demonstrated on a renaissance painting.

Researchers at Aalto University and Karolinska Institute in Stockholm, Sweden, have developed a novel microscopy method that helps in seeing where molecules of cells and tissue samples are– without using any optics. Unlike traditional microscopy technology, the new method called DNA microscopy is not based on light, rather it makes use of DNA sequencing and computer algorithms. This method has potential to become more common because it is for many applications much more convenient than traditional optical microscopy.

'The new approach holds great potential for the study of cellular phenomena, and it shows how versatile the basic methods of DNA nanotechnology are. The combination of nanoscale programmable material and efficient algorithms is very powerful,' says Professor Pekka Orponen, one of the authors of the article.

The new method allows scientists to search for multiple target molecules at the same time over a large area, such as searching for antibodies on the surface of a single cell. As a result of this, researchers can, for instance, study how such 'micro-environments' influence the life cycle of a cell or the development of a disease. In traditional microscopy, target molecules need to be detected one or at most a few at a time, which makes the process very slow.

In DNA microscopy, the cell or tissue sample connects to single-stranded DNA snippets that bind to the molecules of interest. If one wants to study a certain protein, short DNA snippets would be used for binding that protein. By using enzymes, these DNA snippets can be locally copied and combined into pairs. Consequently, longer DNA strands are formed and information about the target molecules' locations in relation to each other is saved in them.

When the longer DNA strands have been created, this nano-level information about the relative locations of the target molecules can be read out by using modern DNA sequencing technology. In this study, researchers developed an effective computing method that, by using this kind of information, allows reconstruction of accurate images about how the target molecules are distributed across a sample.

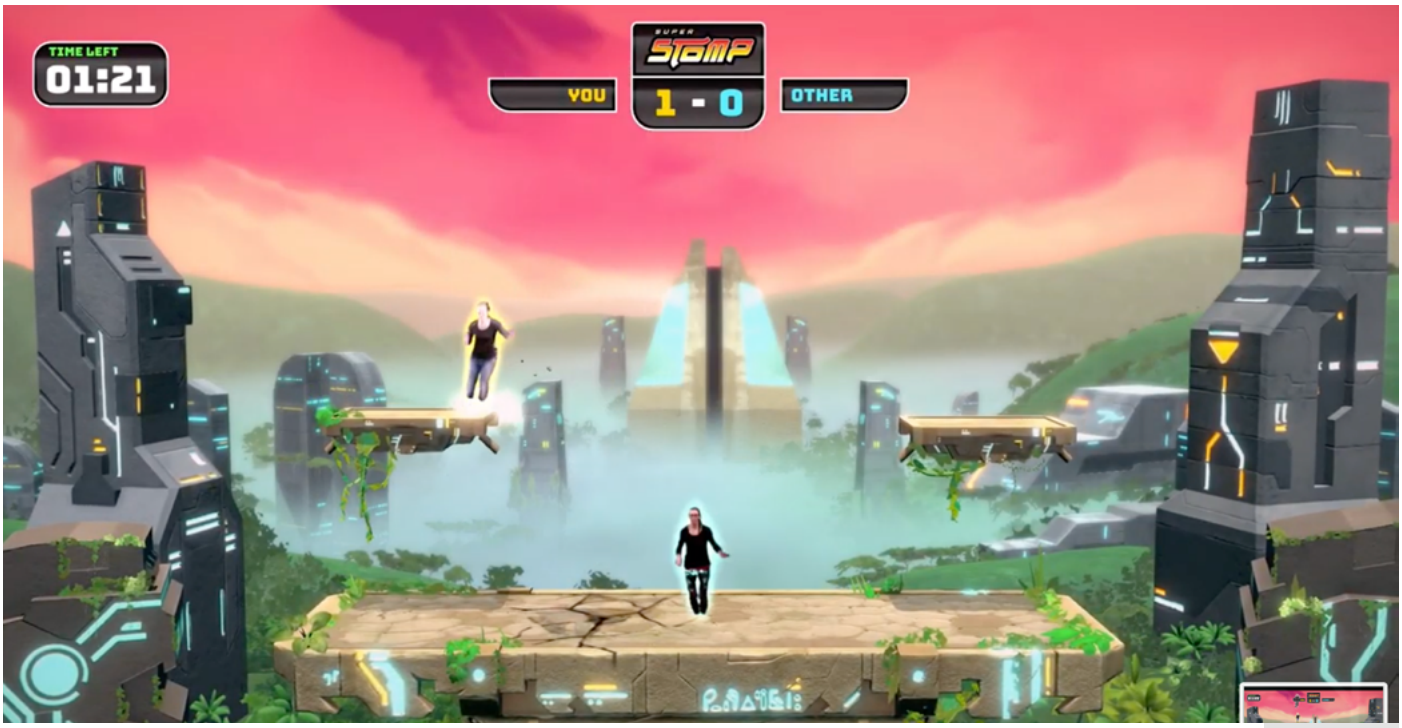
The article was published in the journal PNAS. The Åke Wiberg Foundation, the Knut and Alice Wallenberg Foundation, and the Academy of Finland funded the research.

By Anu Haapala,
Image from the article

Multiplayer bouncing exercise brings extra motivation

The game gives players an empowering experience using custom computer vision, movement exaggeration, and game design techniques.

Research, published: 23.10.2019



Computer-game augmented trampolines motivate people to exercise, according to a new study presented at the CHI PLAY conference. The study was carried out by researchers in Assistant Professor **Perttu Hämäläinen**'s group at Aalto University and CEO Raine Kajastila's team at Valo Motion, a Finnish computer game company with strong ties to the university, and looked at users of Valo Motion's game Super Stomp.

The study explains how the game gives players an empowering experience using custom computer vision, movement exaggeration, and game design techniques. Super Stomp is a game where two players on separate trampolines try and squash each other's avatars, who are moving on a screen that is tracking how they jump in real-life. The game exaggerates the virtual jumps while preserving precise control of the game characters. This can make the player feel like an actual Superhero within the game world.

In their paper the researchers point out that trampolining is a physically demanding task – which brings health benefits for people doing it – but traditional ways of making trampolining more fun, by doing tricks or being on the trampoline with more than one person, is historically how people injure themselves. The game, which allows two people to compete with each other on a screen whist carrying out safe jump styles, therefore encourages exercise safely.

The researchers discovered that the game scores very high on psychological measures of physical activity motivation and enjoyment. In addition, Super Stomp also scored high in a survey that measures engagement with the game and how enjoyable the game was. In short, games like Super Stomp can tick all the boxes for making the player feel motivated to exercise.

The academic paper about Super Stomp will be presented by Dr **Maximus Kaos** at the international CHI PLAY game research conference. CHI PLAY is the international and interdisciplinary conference (by ACM SIGCHI) for researchers and professionals across all areas of play, games and human-computer interaction (HCI). The conference will take place between the 22nd and 25th October 2019 in Barcelona, Spain.

Lauri Lehtonen designed and programmed the game as his Master's thesis.

Games like Super Stomp can tick all the boxes for making the player feel motivated to exercise.

By Tiina Aulanko-Jokirinne,
Image: Screenshot from the SuperStomp

Researchers are importing electricity and internet connections to a Namibian village – required technology can be transported in a pickup

The initiative to be piloted on Independence Day seeks to aid the everyday lives of people in small communities while creating a framework for businesses.

Published: 5.12.2019

From the Finland's Independence Day on, residents of the Namibian village Oniipa will be able to use electricity and the internet, thanks to a solar energy system that is connected to the internet. All this happens, as the Finnish research project Fusion Grid aiming to find alternatives for traditional electricity and network solutions will be piloted for the first time.

Oniipa is a Northern Namibian village of approximately 700 inhabitants, and there are many developing areas like it around the world. The key idea in Fusion Grid is that, instead of building heavy structures, all that is needed for the electricity and internet connections can be transported with, say, a pickup.

'If you buy a sofa from Ikea, you will need a van or pickup to transport it – but not more than that,' says Professor at Aalto University's Department of Computer Science **Marko Nieminen**.

After transportation, the sofa needs to be assembled with the help of simple instructions that are understandable for everyone. The same applies to the telecommunications and electricity connections that are taken to Oniipa: anyone should be able to install them on their own and with low costs.

'The idea is that the system is modular and there are as few attachable parts as possible, which would make it even easier than assemble Ikea furniture,' says Project Manager of Fusion Grid and post-doctoral researcher at LUT University Antti Pinomaa.

Fusion Grid is a joint research project by Aalto University, LUT University, Green Energy Finland and University Properties of Finland, and it is now piloted for the first time. Previously, also Nokia was part of it with its Kuha Mobile Network.

The Finnish company Salo Solar's solar panels are a basic element of the electricity solution taken into Oniipa. The solar panels load the batteries of the system that then store energy for the night. The small solar plant works as a so-called off-grid-microgrid. It provides electrical energy to the people living in a community of a few houses so that they can, for example, charge mobile devices, use a fan, watch the television, and listen to the radio.

The pilot seeks to take into Oniipa a system of 12 solar panels that charges Lithium-ion batteries storing energy for the night. Researchers estimate that this type of a system should provide enough electricity for the everyday life needs in five households. The number of solar panels and batteries can easily be increased: a hundred similar systems could supply electricity for every home in Oniipa, for instance.

"We're not trying to guess what kind of business could be profitable for the locals but rather provide tools and technical platform for it."

The researchers' next plan is to attach Nokia's 4G LTE base station to the solar plant in order to provide better digital services to the residents of Oniipa. The range of the 4G base station is two kilometres, and according to estimates, the system could be used to control the SIM cards of 600 simultaneous users.

'In the test, we get to test our concept in reality. We get to see how much of our guesses have been on point,' Pinomaa says.

Technical readiness for businesses

Fusion Grid relies on the notion that once electricity and telecommunications connections are introduced in small communities of poor countries, they will not only improve the quality of life for local people but also enable a new type of small entrepreneurship to emerge in the area with the aid of digital services. One goal of the pilot is to find out what types of possibilities electricity, the internet, and digital services can bring to these areas.

'We're not trying to guess what kind of business could be profitable for the locals but rather provide the tools and technical platform for it,' Nieminen says.

Creating new employment opportunities is also important for ensuring that there are enough investors for the infrastructure after the actual research project so that similar technology could be introduced in new areas.

'No one will finance something they know will not pay itself back,' Nieminen says. 'For example, national development banks are interested in such investments, but they also want to witness it genuinely improving living conditions and creating a framework for new possibilities.'

Business Finland and the Ministry for Foreign Affairs of Finland have funded the Fusion Grid project, which started in 2018, by 1.5 million euros. The project continues until June 2020. The current pilot provides the researchers a change to collect valuable information about user experiences. The most important results of the project will be achieved during the pilot.

By Anu Haapala

Social media design that seeks to mitigate polarization could increase ideological distance

In a study by Matti Nelimarkka and his colleagues, interviewees brought up the fact that content recommendation models on social media may be poor solutions for reducing polarization in discussions.

Research, published: 11.11.2019

Developers and researchers of social media services have long believed that polarization in discussions can be reduced by designing services that recommend content from perspectives opposite to the users' own views. However, those interviewed in the research by Aalto University and Syracuse University in the US expressed their doubts on the notion. Some even believed that this type of design could, in some cases, increase polarization.

A research article by Aalto's visiting researcher Matti Nelimarkka and his US colleagues was published at the Computer-Supported Cooperative Work and Social Computing (CSCW) Conference on November 9. Researchers interviewed 19 Finnish or American persons, who were either professionals in the political field or ordinary citizens who often discuss politics on social media yet are professionally not affiliated with it.

Researchers presented participants with four different content recommendation models that could be used on Facebook, for example. In the first model, the service recommended users with content that is in conflict with their opinions. The second model encouraged the user to become familiar with such content before posting their own content. In the third model, the user witnessed their friend having shared content that contradicts the user's own opinions. The fourth model showed the user their friends and friends of friends discussing a subject in a way that contradicted the user's own views on the matter. When presenting the different models, researchers asked participants to share their experiences on the models.

Matti Nelimarkka, a visiting researcher, has his background in both political science and human-computer interaction.

The interviewees detected different elements in the models that could even increase political polarization. Participants were most critical of the model recommending articles only presenting views opposite to one's own. The model that encourages the user to rethink before posting content can, according to the interviewees, seem scornful and lead to self-censorship or even anger. Recommendation based on one's friends or acquaintanc-

es of friends, on the other hand, works poorly if the user has a small social network.

The interviewees felt even if a service was designed to mitigate polarization, seeing views opposite to one's own may rather increase ideological distance between individuals. For this reason, services should be planned in a way that they are guaranteed to push people towards appropriate behavior. 'Platforms cannot guide the way people behave but they can, at best, encourage them to engage in more appropriate discussions,' says Nelimarkka.

Seeing someone you know recommend content can motivate opening the link

Participants did find also positive elements in the models. They pointed out that each one could offer people new information and lead to a wider understanding of the phenomenon, and through it, a deeper discussion.

"Opportunities are missed when researchers in other fields fail to utilize things that have been discovered on the HCI side long ago"

'Many noted that this works as a moment of constraint: before posting anything on the service, one can witness multiple different viewpoints and perhaps try to modify their post,' Nelimarkka says.

Many participants believed that once the user perceives someone close to them sharing a piece of news that clashes with their own opinion, motivation to click on the news increases. In situations where people acquire contacts from different life situations, it is common to form a large circle of acquaintances. In fact social media platforms have for years now focused on solving privacy management issues resulting from a large circle of friends.

Focusing on relatively open discussion forums, such as Twitter and Facebook, may however be an outdated approach. According to Nelimarkka, the research also pointed out that political experts in particular have often moved to discuss politics in more closed groups, such as WhatsApp. 'This is even worse for polarization. Many interviewees raised this subject, and it still hasn't been widely covered in literature.'

A weak understanding of other fields may result in several problems

A research review by Nelimarkka was also published at CSCW. The review centers on how democratic decision-making is presented at human-computer interaction (HCI) conferences and how political science and HCI researchers could move toward an improved trading zone.

A poorly functioning collaboration leads to a range of issues. Nelimarkka highlights a study on customer satisfaction measured by smiley face push buttons as an example. These types of research articles, according to Nelimarkka, always begin the same way: Researchers want to support democracy that is based on voting, so they situate buttons in people's everyday surroundings. With these buttons, people would easily provide feedback and get it across.

'None of the papers return to address whether this wish is actually ever carried out,' Nelimarkka says. 'They do report on how many times the buttons have been pushed and how they have been used. Yet research on political participation has taught us that people's actions are distorted. I push those buttons several times, as many times as it takes to get my opinion across better! But someone maybe doesn't dare do this.'

It is probable, then, that not everyone's position is displayed equally in votes, but if the central problems related to participation in political processes are unfamiliar to researchers, this is a viewpoint that is easily overlooked in analyses. Nelimarkka describes the worst-case scenario, where a lack of collaboration and a weak understanding of another field may lead to researchers in one field developing something that has long ago been introduced in another field and proven to not work.

Collaboration leads to higher-quality research

Based on Nelimarkka's review, researchers of both HCI and social sciences still have much to learn from each other. However, collaboration needs to take place under conditions set by both disciplines. Nelimarkka believes that it is necessary to create shared information sharing points, which researchers of politics can use to familiarize themselves with central HCI concepts and methods, and vice versa.

Better collaboration would lead to research that is better conceptualized and detailed in both fields. 'The question is: how do we educate people in a way that enables them to do this? Pursuing several master's degrees is not the answer.'

Nelimarkka himself has a multidisciplinary background. He completed his bachelor and master's degrees at the Faculty of Social Sciences but pursued doctoral studies on human-computer interaction. The reason behind the 'crossover to another field' was the fact that technology was poorly considered at the Faculty of Social Sciences at that time. 'Towards the end of my doctoral thesis, I began working on his literature review and realized I'd come up with everything I want to do: combine these two areas.'

Now Nelimarkka is a visiting researcher at Aalto's Department of Computer Science. Since technology is present everywhere these days, he points out, HCI can be used to study practically anything. City bikes, for example, are a part of HCI, as they collect data on people. They can be researched as not only information technology but also as a sociological or political phenomenon.

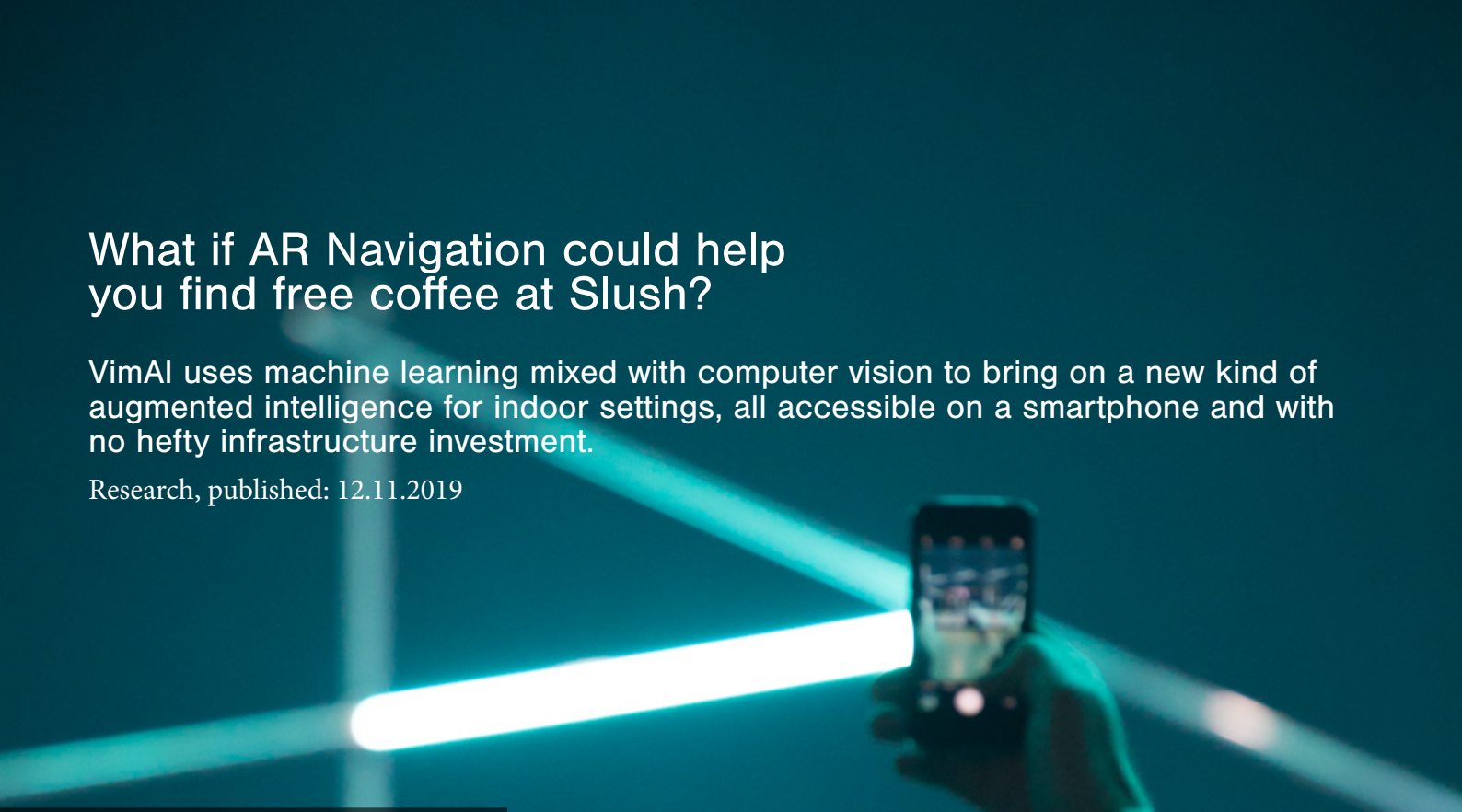
'For me, that's quite a few opportunities missed when researchers in other fields fail to utilize things that have been discovered on the HCI side long ago. On the other hand, HCI researchers sometimes ignore the niche understanding of other fields.'

By Anu Haapala,
Photo Matti Ahlgren

What if AR Navigation could help you find free coffee at Slush?

VimAI uses machine learning mixed with computer vision to bring on a new kind of augmented intelligence for indoor settings, all accessible on a smartphone and with no hefty infrastructure investment.

Research, published: 12.11.2019



VimAI was born from a crowdsourcing research project at Aalto University. As part of the project, the research team investigated if tourist photos from Temppeliaukio church that had been uploaded to Instagram could be utilised. They soon realised that a 3D point cloud model of the church could be created from the photos so the next thing to find out if that model could be used to identify the position of the photographer. This led to the idea that photos taken in a coordinated manner could be used as a positioning tool which subsequently became the VimaAI navigation and location-based augmented reality (AR) app.

In 2016, a team was created for a commercialisation research project at Aalto, which subsequently led to them being recipients of the Business Finland TUTL funding, which enabled them to start an official company.

VimAI CEO, Ismo Olkkonen, says that the company prefers the term augmented intelligence as opposed to augmented reality, 'Even though we could be considered an AR platform, augmented intelligence is a more appropriate term as our solution is meant to enhance human intelligence and play more of an assistive role'.

VimAI comes as two separate mobile apps; one being a scanning tool that can be used to collect visual data from the indoor environments and implement scene understanding, the other being a navigation tool that enables high precision indoor localisation and navigation with dynamic data displayed in different physical locations.

With computer vision and machine learning techniques taking care of the data, the VimAI app only requires the use of commercial devices, like mobile phones, to do the scanning and navigation which negates the need for expensive equipment and infrastructure investment.

While similar products exist on the market, Olkkonen points out that a significant advantage of VimAI solution is its lightness. The positioning is done totally in the phone without the need for computing resources from the cloud, which makes the solution extremely scalable.

VimAI is currently in pilot-phase with several customers, with a focus on providing their product for shopping centres as well as for the industrial and real estate sectors.

By Mark Fletcher,
Photo Matti Ahlgren

VimAI, founded in 2017

Founders: Jiang Dong, Marius Noreikis, Vilen Looga, Antti Ylä-Jääski, Yu Xiao

VimAI has operated so far with bootstrap financing

Company milestones:

May 2019 -VimAI launched its first products and has since made several pilots with customers in Finland.

October 2019 - VimAI made a remarkable deal with a global phone manufacturer.

November 2019 - VimAI got into an agreement with Singapore Airlines to pilot its navigation solution at Changi airport in Singapore.

Website: vim.ai

Turbulent convection at the heart of stellar activity

By combining modern data analysis techniques with stellar structure modelling for main-sequence and giant stars, researchers shed new light on stellar dynamos

Press release, published: 10.3.2020

Different stars can exhibit very different levels of activity. The Sun's coronal mass ejections, flares and sunspots – all signs of solar activity – are rather feeble on an astronomical scale. Other stars are up to ten times more active, for example sporting huge starspots that cover a large portion of their disc. While researchers have long identified the magnetic fields generated in the interior of stars in a dynamo process as drivers of activity, the exact workings of this dynamo are still unclear. A collaboration between researchers at Max Planck Institute for Solar System Research (MPS) and Aalto University searched for an answer by applying the same analysis to a sample of both main sequence and more evolved stars. They find that a common, turbulence-dependent dynamo mechanism plays a crucial role for stellar activity in all stages of stellar evolution. The results are published in next week's issue of Nature Astronomy.

The inside Stars are structured in a layered, onion-like fashion. Stars with temperatures like our sun have cores surrounded by a radiation zone. In this zone, the heat from the core is led outwards by radiation. As the stellar plasma becomes cooler farther away the core, heat moves by plasma flows: hot plasma from within rises to the surface, cools, and sinks down again. This process is called convection. At the same time, the star's rotation, which depends on stellar latitude, introduces sideways movements. Together, both processes twist and twirl magnetic forces to create a star's complex magnetic field, in a dynamo process that is not yet fully understood.

'Unfortunately, we cannot look directly into the Sun and other stars to see these processes in action, but have to resort to more indirect methods,' says Dr. **Jyri Lehtinen** from MPS. In their current study, the researchers compared different stars' activity levels on the one hand, and their rotational and convective properties on the other. The goal was to determine which properties have a strong influence on activity. This can help to understand the specifics of the dynamo process within.

Several models of the stellar dynamo have been proposed in the past, but two main ideas prevail. While one of them puts a greater emphasis on the rotation and assumes only subtle effects of convectional flows, the other depends crucially on turbulent convection. In this type of convection, the hot stellar plasma does not rise to the surface in large-scale, sedate motions, but rather that small-scale vigorous flows dominate.

In order to find evidence for one or the other of the two paradigms, Lehtinen and his colleagues took a look at 224 very different stars. Their sample contained both main-sequence stars, which are in the prime of their life, and older, more evolved giant stars. Typically, both convection and rotational properties of stars change as they age. Compared to main sequence stars, evolved stars exhibit a thicker convection zone often expanding over much of the star's diameter and sometimes superseding the radiation zone completely. This leads to longer turnover times for convective heat transport. At the same time, rotation usually slows down.

For their study, the researchers analyzed a data set obtained at Mount Wilson Observatory in California (USA), which over several years recorded the stars' emissions in wavelengths typical of calcium ions found in the stellar plasma. These emissions are not only correlated with the stars' activity level. Complex data processing also made it possible to infer the stars' rotation periods.

Like the Sun, stars are sometimes dappled with regions of extremely high magnetic field strength, so-called active regions, which are often associated with dark spots on the stars' visible surface. "As a star rotates, these regions come into view and pass out of it leading to a periodic rise and fall in emission brightness", Prof. Dr. **Maarit Käpylä** from Aalto University in Finland –and who also heads the research group Solar and Stellar Dynamos at MPS– explains. However, since stellar emissions can also fluctuate due to other effects, identifying periodic variations – especially over long periods – is tricky.

'Some of the stars we studied show rotation periods of several hundreds of days, and surprisingly still a magnetic activity level similar to the other stars, and remarkably even magnetic cycles like the Sun,' says Dr. Nigul Olspert from MPS, who analyzed the data. The Sun, in comparison, rotates rather briskly with a rotation period of only approximately 25 days at the solar equator. The convective turnover times were calculated by means of stellar structure modelling taking into account each star's mass, chemical composition, and evolutionary stage.

The scientists' analysis shows that a star's activity level does not depend only on its rotation, as had been suggested by other studies based on smaller and more uniform samples including only main sequence stars. Instead, only if convection is accounted for, can the behavior of main-sequence and evolved stars be understood in a unified manner. 'The co-action of rotation and convection determine how active a star is,' Prof. Käpylä summarizes. 'Our results tip the scales in favor of the dynamo mechanism including turbulent convection.'

Written in collaboration with Max Planck Institute for Solar System Research / communications

Designing AI that understands humans' goals better

To make a better smart assistant, we need an AI that understands its user and does not constantly need detailed instructions

Published: 5.12.2019

When researchers design machine learning systems, their goal is typically to automate certain functions. Instead of being fully autonomous, however, most of these systems work together with humans. In order to be truly helpful, they need to understand what goals people have.

Researchers at the Finnish Center for Artificial Intelligence (FCAI) have now taken important steps towards designing AI that understands people.

At first, the researchers taught the AI to build a model of its user - human or machine. Then, they taught it to adapt this model by following the user's actions. In practice, the researchers developed machine learning methods which combine statistics with computation, and then tested the methods in practice and in simulations. They tested the algorithms in simple situations in order to make sure they understand what exactly happens in those situations and report about the events accurately.

In the first experiment, they designed an AI teacher for the learning AI.

'This was difficult especially because the learning AI could decide what it wanted to learn,' explains **Samuel Kaski**, the director of FCAI and professor at Aalto University. The researchers noticed that the AI learner achieved better learning results when the teacher understood what information the learner had already learned and adapted its teaching material to suit this particular learner.

In the second experiment, human users were asked to find a particular target word by using an AI-based word-search engine. The engine presents the user one word at a time, and the user then tells it whether the presented word is useful in finding the target word. If the user is looking for the word 'football,' for instance, they are likely to say that the first presented sport-related word is useful, if all the previous words have been related to food.

In the first experiment, they designed an AI teacher for the learning AI

The results of this experiment showed that the AI could help the users in finding the target words faster if it understood that, by responding to the presented words in a certain way, the user wants to direct the AI towards the right words. In other words, the AI took into account the fact that the user is trying to teach it.

According to Professor Kaski, this topic is important, as the interaction between user and AI becomes much easier when the AI understands its user's goals. 'Then the human user does not need to explain in detail anymore what they expect from the AI helper.'

One of the main goals of FCAI is to develop AI that understands humans and is understandable. 'So far, we can build AI systems that understand the users' goals only in very simple situations, which means that designing truly helpful AI assistants calls for a lot of additional work,' Kaski says.

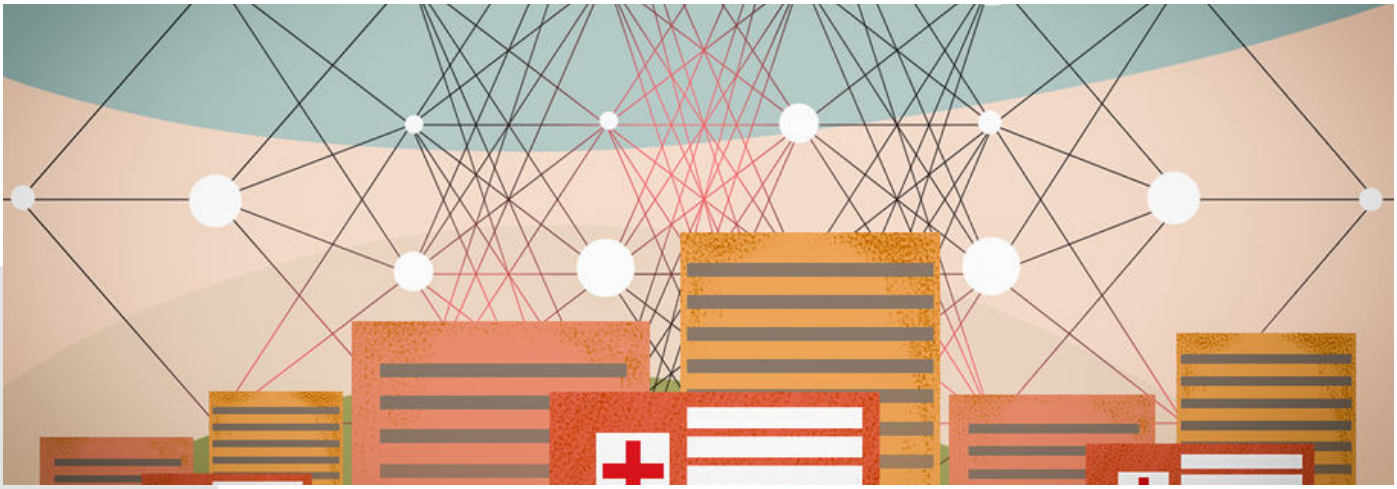
The research article was published at NeurIPS, the world's largest and most prestigious machine learning conference in December 2019.

By Anu Haapala,
Illustration Matti Ahlgren

Neural network for elderly care could save millions

A deep neural network model helps predict healthcare visits by elderly people, with the potential to save millions

Research, published: 13.12.2019



If healthcare providers could accurately predict how their services would be used, they could save large sums of money by not having to allocate funds unnecessarily. Deep learning artificial intelligence models can be good at predicting the future given previous behaviour, and researchers based in Finland have developed one that can predict when and why elderly people will use healthcare services.

Researchers at Aalto University, the University of Helsinki, and the Finnish Institute for Health and Welfare (THL) developed a so-called risk adjustment model to predict how often elderly people seek treatment in a healthcare centre or hospital. The results suggest that the new model is more accurate than traditional regression models commonly used for this task, and can reliably predict how the situation changes over the years.

Risk-adjustment models make use of data from previous years, and are used to allocate healthcare funds in a fair and effective way. These models are already used in countries like Germany, the Netherlands, and the US. However, this is the first proof-of-concept that deep neural networks have the potential to significantly improve the accuracy of such models.

'Without a risk adjustment model, healthcare providers whose patients are ill more often than average people would be treated unfairly,' **Pekka Marttinen**, Assistant Professor at Aalto University says. Elderly people are a good example of such a patient group. The goal of the model is to take these differences between patient groups into account when making funding decisions.

According to **Yogesh Kumar**, the main author of the research article and a doctoral candidate at Aalto University, the results show that deep learning may help design more accurate and reliable risk adjustment models. 'Having an accurate model has the potential to save several millions of dollars,' Kumar points out.

The researchers trained the model by using data from the Register of Primary Health Care Visits of THL. The data consists of out-patient visit information for every Finnish citizen aged 65 or above. The data has been pseudonymized, which means that individual persons can not be identified. This was the first time researchers used this database for training a deep machine learning model.

The results show that training a deep model does not necessarily require an enormous dataset in order to produce reliable results. Instead, the new model worked better than simpler, count-based models even when it made use of only one tenth of all available data. In other words, it provides accurate predictions even with a relatively small dataset, which is a remarkable finding, as acquiring large amounts of medical data is always difficult.

'Our goal is not to put the model developed in this research into practice as such but to integrate features of deep learning models to existing models, combining the best sides of both. In the future, the goal is to make use of these models to support decision-making and allocate funds in a more reasonable way,' explains Marttinen.

The implications of this research are not limited to predicting how often elderly people visit a healthcare centre or hospital. Instead, according to Kumar, the researchers' work can easily be extended in many ways, for example, by focusing only on patient groups diagnosed with diseases that require highly expensive treatments or healthcare centers in specific locations across the country.

The research results were published in the scientific publication series of Proceedings of Machine Learning Research.

By Anu Haapala,
Photo Matti Ahlgren

Computer Science Building at Otaniemi Campus Photo: Matti Ahlgren

Researchers develop new methods for studying materials at the smallest possible scale

Published: 27.2.2020

Scientists around the world are interested in developing new materials to help people live more sustainable and healthy lives, but the quest to produce these materials requires detailed knowledge of the mysterious structures of the molecules they are made from. Designers want to replace wasteful plastic with sustainable plant derived compounds, but this can be a challenge without knowledge of plant compound's molecular structure. A new technique developed at Aalto University should allow researchers to get this essential information.

To achieve this, the researchers combined a common materials analysis technique with artificial intelligence. Atomic Force Microscopy (AFM) uses an incredibly fine needle to measure the size and shape of nanometer sized objects, and can already be used to measure the structure of flat, pancake-like planar molecules. By training an artificial intelligence algorithm on lots of AFM data, scientists can now identify more complex molecules with exciting real-world applications.

The team are now able to take images of a single, 3-dimensional molecules, with enough detail that it is possible to understand the different chemical properties of different parts of the molecule. The work was carried out by researchers at Aalto University, led by Academy Professor **Peter Liljeroth**, and Professors **Adam S. Foster**and **Juho Kannala**; and was recently published in the journal Science Advances.

'The method researchers currently use guesses the structure, simulates AFM images and see if the guess was correct. When there are many possibilities, this is slow and difficult, and in the end one cannot be certain that all possible structures were thought of,' explains Peter Liljeroth.

The researchers used a well understood biomolecule called 1S-camphor, that has a well-known atomic structure and, as a bioproduct of the wood industry, is similar to many of the molecules that other Aalto researchers are interested in for producing sustainable products. Using a combination of machine learning and AFM simulations, Professor Foster's team developed a deep learning system that matches a set of AFM images with their molecular structure. First, the machine learning system was tested on simulated AFM data, analysing various molecules with planar and non-planar geometries. To test that it worked, experimental data was used with exciting results: The AI was able to reliably and rapidly interpret AFM images of complex 3D molecules and say what their chemical properties would be.

Benjamin Alldritt, the first author of the paper explains "This research is exciting because it gives us new ways of understanding materials using current experiments. By combining machine learning with AFM, we can understand images of 3D structures that were unable to before. Additionally, this new method is faster than already existing methods at working out how molecule sits on the surface, and it's quicker and more reliable than human experts for this task."

By Matthew Allinson

Machine learning in chemistry - algorithms help finding minimum energy paths and saddle points more effectively

Published: 8.1.2020

Olli-Pekka Koistinen, doctoral candidate at Aalto University, developed machine learning algorithms based on Gaussian process regression to enhance searches of minimum energy paths and saddle points, and tested how well the algorithms work.

In theoretical chemistry, finding minimum energy paths and saddle points is one of the problems that consume most time and computational resources. The bottleneck of the computation is the accurate evaluation of energy and forces for each atomic configuration, which typically needs to be performed at hundreds of points in the configuration space.

Algorithms utilizing machine learning can reduce the number of observation points and expensive energy evaluations to a fraction of what is required by conventional methods and thus speed up the computation.

Minimum energy paths lie on a potential energy surface that describes the energy of a particular system - a molecule, for example - in terms of particular parameters. Usually these parameters show the locations of the atoms. The local minimum points of the energy surface correspond to the stable states of the system. The minimum energy paths connect these points and describe possible reaction mechanisms.

'As an orienteer, I see this energy surface as a map. The stable atom configurations are shown as depressions on the map, and the minimum energy path is a route between two such depressions. It stays as low as possible all along the way. The highest point of the path is at a saddle point where you can get from one depression into another one staying as low as possible,' Koistinen explains.

Traditionally, researchers have searched for minimum energy paths and saddle points using iterative methods that proceed on an energy surface with small steps. With the help of machine learning and statistical models, previous observations can be utilized to model the energy surface, and the goal can be reached with significantly fewer iterations.

By Anu Haapala

Both physicians and nurses in Finland are dissatisfied with the usability of electronic health record systems

According to a recent study, nurses' and physicians' views on what aspect of the systems should be developed differ from each other.

Research, published: 12.2.2020

Finnish researchers are among the first in the world to have carried out nation-wide survey studies on physicians' and nurses' experiences of using electronic health record (EHR) systems. The study reveals that Finnish physicians and nurses, in general, are dissatisfied with the usability of EHR systems.

In surveys previously carried out in other countries, nurses have been found to be more content with the systems than physicians, but the findings of this study contradicted with those findings. Professor of Practice **Johanna Kaipio** notes that the user experiences of nurses carrying out clinical tasks have previously been studied less than those of physicians.

'As a professional group, physicians are more critical. The views of nurses doing clinical work in terms of development needs may not arise in the same ways as regular physicians'. This may have influenced the general outlook on professional groups' level of satisfaction towards the systems,' Kaipio says.

Finnish physicians and nurses, however, have different views on what is working in current EHR systems and what is not. There is a wide array of EHR systems used in Finland, both in terms of their functions and implementation. Some systems serve the needs of nurses better, while others the needs of physicians.

The study finds that nurses were more satisfied than physicians on how EHR systems support collaboration and information exchange. They also ranked higher how the systems support routine tasks and enable retrieving patient data. Physicians, in turn, were more satisfied than nurses with the technical stability of the systems, learnability of the systems, and systems' support for documenting patient information.

'Nurses consider it important that documenting patient information is fluent, whereas physicians value summaries of patient information provided by the systems needed to support decision-making,' Kaipio sums up.

Development of the systems should take place with consideration to both professional groups. Researchers point in their article that the EHR systems physicians were most satisfied with in terms of usability have been developed in collaboration with physicians.

Kaipio points out that more research on user experiences of EHR systems is needed and the development of the systems influenced this way. The work should also increasingly include system end-users and consider the different use contexts and purposes, along with the potential users.

'There is plenty of room for improvement in the systems, and their implementation reflects the fact that their design has not included an adequate understanding of the work and needs of the end users. Currently, poor usability of the systems results in inefficiency and frustration among physicians and nurses alike.'

Tarja Heponiemi, Research Professor at the Finnish Institute for Health and Welfare, says that 'We could reduce the work burden of people working in healthcare and improve their well-being by investing in well-functioning and user-friendly EHR systems. Offering sufficient orientation and education is also important, especially when we introduce new systems or features.'

The study reported by Aalto University, Satakunta Hospital District, the Finnish Institute for Health and Welfare and Helsinki University Hospital involved 3,013 physicians and 2,560 nurses working in a public healthcare centre or hospital in 2017.

The study has been funded by the Strategic Research Council at the Academy of Finland and the Ministry of Social Affairs and Health. The results were published in International Journal of Medical Informatics.

By Anu Haapala,
Photo Matti Ahlgren

Researchers developed a new solution that brings high quality extended reality to easy-to-use and inexpensive devices

The solution developed at Aalto makes use of distributed computing and offloads the heaviest part of graphics rendering to remote servers

Research, published: 9.3.2020

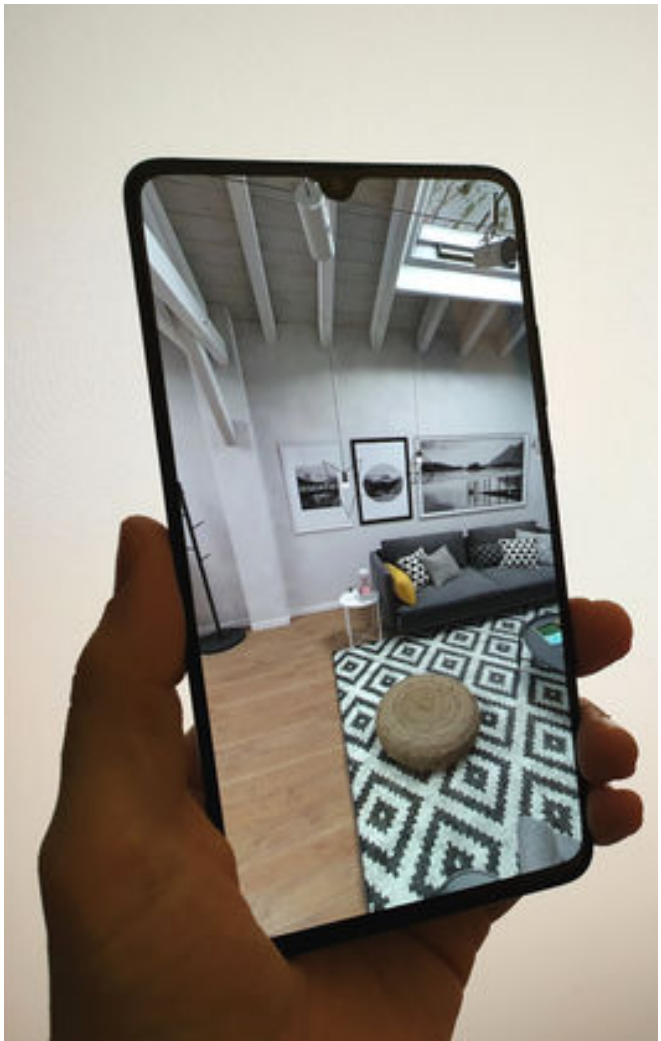
Augmented reality (AR), virtual reality (VR), and mixed reality (MR) technology open new possibilities in several different fields. However, high quality extended reality (XR) applications are computationally heavy in terms of computer graphics, which means that they do not run smoothly on inexpensive and easy-to-use XR devices, such as VR/AR headsets and smart phones, because their GPU computing capacity is limited.

Matti Siekkinen, **Teemu Kämäräinen**, **Olavi Mertanen**, and **Thomas van Gemert** have developed technology that solves this problem. The solution makes use of distributed computing and offloads the heaviest part of graphics rendering to remote servers.

According to the project's Principal Investigator Matti Siekkinen, this type of new technology can benefit experts in education, interactive media or healthcare, among other fields. 'However, the biggest benefits will be achieved in cases in which ease of use and high visual quality of the XR experience are both very important,' Siekkinen explains.

When a part of the computing takes place on remote servers, the XR experience will be of higher quality. However, the use of distributed computing does not come without challenges of its own. Latency, in particular, is such a challenge, and in their solution, the Aalto researchers trust in latency-compensation. 'In addition to distributed computing, we have developed an adaptive solution for latency-compensation, which provides a good user experience even when using a 4G network,' continues Siekkinen.

The biggest benefits will be achieved in cases in which ease of use and high visual quality of the XR experience are both very important



In the 5G networks that are becoming increasingly common, network latency is low, bandwidth is high, and edge computing enables computing at close proximity to the user. All this makes it easier to use the new solution in increasingly complex situations that include a lot of interaction.Furthermore, the need for latency-compensation is reduced when using a 5G network.

Siekkinen says that during their research project they have tested the new solution with several collaborators. One of those collaborators is Elisa, a Finnish company offering telecommunications services, which announced a demo application developed during the collaboration.

One aim of the Aalto computer scientists is to try to find the customers who will gain most benefit from the solution. 'Our goal is to start a company that brings the solution to the market.' says Olavi Mertanen.

The CloudXR project in question is a TUTLI (From Research to Business) project funded by Business Finland and Aalto University that ended at the end of March 2020. The team has focused on exploring potential commercialization paths for XR applications' remote rendering and developing the technology further.

By Anu Haapala,
Photo Teemu Kämäräinen

‘We managed to turn a major risk into a great opportunity’

To make sure the Fusion Grid project could continue, Marko Nieminen travelled to Namibia and drove 1,400 kilometres to transport necessary equipment to the village of Oniipa and make it to KLM’s final flight to Europe

Research, published: 1.4.2020

Marko Nieminen transported equipment needed for the improved pilot. A night guard at a local hotel helped him to move the equipment around.

Since the start of 2018, my research group has collaborated with LUT University, GreenEnergy Finland, Nokia and University Properties of Finland Ltd on the Fusion Grid research project. The goal is to develop light and communal ways of introducing electricity and internet connectivity, along with digital services to those remote areas of developing countries where it would be uneconomic to build heavy traditional electricity and telecommunications solutions.

On Finland’s Independence Day in 2019, we piloted the project for the first time in the Namibian village of Oniipa: the temporary solution enabled five households receiving electricity and internet without a heavy and expensive infrastructure.

In March, the core members of our research group – myself, postdoctoral researchers **Antti Pinomaa** and **Karin Fröhlich** and researcher Iurii Demidov – were meant to travel to Oniipa. We wanted to improve the electric grids and telecommunications networks of the existing pilot, in addition to the local digital service platform. The system introduced in December was built from temporary ‘loan components,’ which were scraped together during the week of the installation. The originally designed components were finally available for use: the control box inverter, batteries and local servers. Everything was supposed to be completed by Namibia’s Independence Day on 21 March.

The aggressive spreading of the coronavirus, however, resulted in a change of plans. A day before the majority of the group was supposed to travel to Namibia, a travel ban was imposed on Finnish universities. It appeared that our research project pilot, which had thus far been carried out successfully, would be left incomplete.

Yet when the travel ban kicked in, I was already in Africa: I had travelled to Dar es Salaam in Tanzania with our Creative Sustainability student group. The study trip that had got off to a promising start came to an unfortunate halt, and our students flew back to Finland. I, however, still had a plane ticket to Namibia and was meant to board a flight home from the country’s capital city Windhoek.

As the Ministry of Foreign Affairs had not yet encouraged travellers to

return to Finland, I travelled to Namibia from Tanzania on 14 March to do what I still could for our project.

On Tuesday 17 March, I drove a pick-up from Windhoek towards Oniipa, where I was transporting the improved equipment needed for the project pilot. At this point, Namibia declared a state of emergency in the country, meaning for instance that the borders would be closed from foreigners. Finnish authorities were now encouraging Finns to return to their home country.

'I won't be able to get a return ticket for the same evening through South Africa anyway,' I thought, knowing that KLM would have a direct flight from Windhoek to Amsterdam the following night. Thus I decided to continue my drive towards Oniipa, which would take approximately five more hours.

In Oniipa, I had about an hour to spend with the local residents. We unloaded the truck and I instructed the locals on how to use to equipment so that we could help them with configuring the batteries and maintain close communication with them via video. This schedule would allow me to get on the KLM flight in time – the company's last flight out of Namibia before the borders closed.

The situation was made especially eventful by the ticket exchange system: when I tried to change my original ticket late in the evening for the following night, the screen kept displaying an error message. Thankfully I was able to find a 'crisis number' for our travel agency, and the customer service provided a reason: there was only one more seat left on the flight, but in a different ticket category – hence the ticket could not be changed online. Perhaps after four and a half seconds of consideration, I replied that the seat could be reserved for me. As I sat on the fully boarded plane on the return trip, I realised how lucky I had been.

I left a smartphone and laptop for the locals in Oniipa so that we could communicate. While I was rushing back to Windhoek, my colleagues Antti

"As I sat on the fully boarded plane on the return trip, I realised how lucky I had been."

Pinomaa and Iurii Demidov from LUT University instructed them remotely from an 'instruction and control centre' built into a laboratory at LUT. They provided guidance on how to switch the batteries, inverter and other equipment, and how they should be connected. The guidance was a great success due to their patience, and I made it to my flight on time.

The residents of Oniipa who took part in the pilot received an improved electricity connection, wireless internet connection and access to digital services as originally planned. We, as researchers, now have even better opportunities to gather empirical data

The preparations for the pilot started in Oniipa in December 2019.

and maintain the system in cooperation with the Oniipa residents, as we work by using a video connection. This real-time video connection introduced on account of the coronavirus appears to be shaping up into a new way of conducting research. It complements our original methods, technical data collection and surveys.

With our entire research group displaying an excellent effort in a tight spot, we were able to turn a major risk into a great opportunity. Together with the residents of Oniipa, we can now continue our research in full. Remote work is now the most current way of working internationally, and it has quickly become a crucial practice in our project. This opens many new and fascinating opportunities, which we are eager to be a part of and develop in the future.

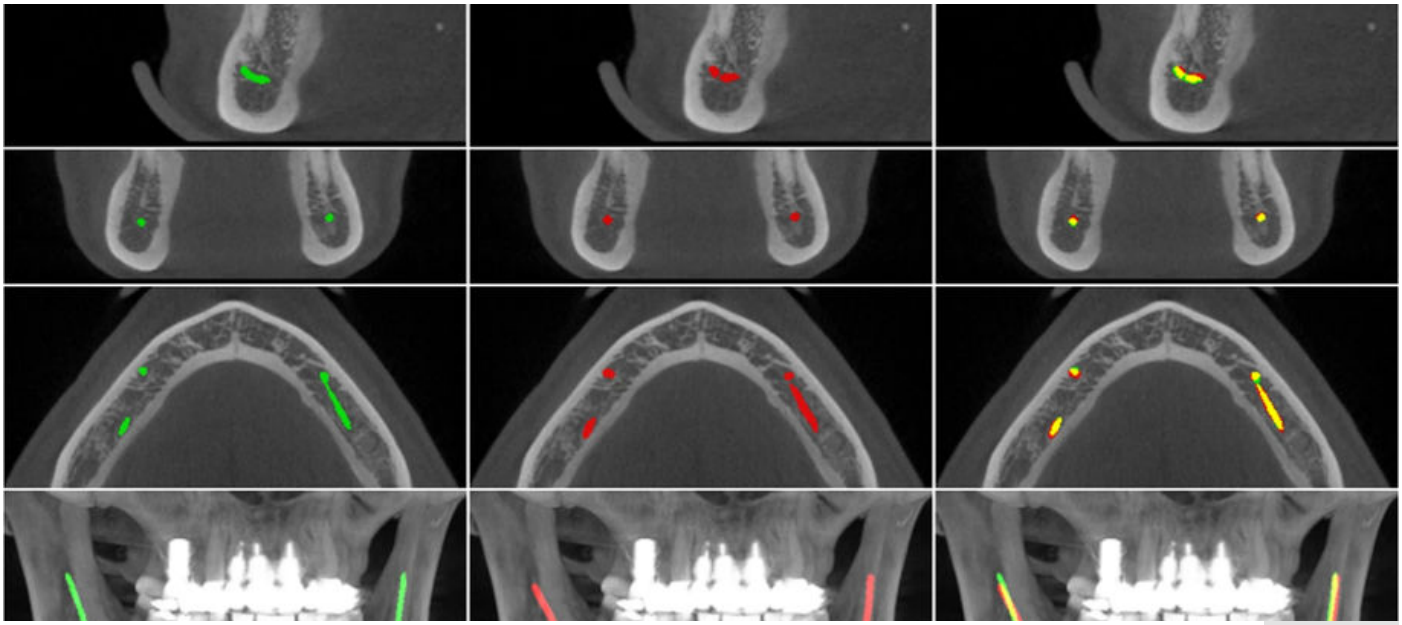
The collaboration in Fusion Grid between LUT, Aalto University and the local piloting community is unique in many ways, and I believe it will bear long-lasting results. We have already noted it time and again that our research and conceptual viewpoints have produced innovative results in a most special way.

By Marko Nieminen,
Photos Fusion Grid

AI makes dentists' work easier – new model helps localise the mandibular canals

Finnish researchers developed a new automatized way to localise the mandibular canals

Research, published: 21.4.2020



Comparison of the model segmentation and the ground truth, from the secondary test data annotations, for a CBCT scan.

In order to plan a dental implant operation and the implant size and position, dentists need to know the exact location of the mandibular canal, a canal located in both sides of the lower jaw that contains the alveolar nerve.

The lower jaw is an anatomically complex structure and medical experts use X-ray and computer tomography (CT) models to detect and diagnose such structures. Typically, dentists and radiologists define the location of the mandibular canals manually from the X-ray or CT scans, which makes the task laborious and time-consuming. That is why an automatized way to do this could make their work and placement of dental implants much easier.

To bring a solution to this problem, researchers at the Finnish Center for Artificial Intelligence FCAI, Tampere University Hospital, Planmeca and the Alan Turing Institute developed a new model that accurately and automatically shows the exact location of mandibular canals. The model is based on training and using deep neural networks. The researchers trained the model by using a dataset consisting of 3D cone beam CT (CBCT) scans.

The model is based on a fully convolutional architecture, which makes it as fast and data-efficient as possible. Based on the research results, this type of a deep learning model can localise the mandibular canals highly accurately. It surpasses the statistical shape models, which have thus far been the best, automatized method to localise the mandibular canals.

In simple cases – when the patient does not have any special conditions, such as osteoporosis – the model is as accurate as a human specialist. Most patients that visit a dentist fall into this category. 'In more complex cases, one may need to adjust the estimate, so we are not yet talking about a fully stand-alone system,' says **Joel Jaskari**, Doctoral Candidate and the first author of the research paper.

Using Artificial Intelligence has another clear advantage, namely the fact that the machine performs the job equally fast and accurately every time. 'The aim of this research work is not, however, to replace radiologists but to make their job faster and more efficient so that they will have time to focus on the most complex cases,' adds Professor **Kimmo Kaski**.

Planmeca, a Finnish company developing, manufacturing and marketing dental equipment, 2D and 3D imaging equipment and software, collaborates with FCAI. The company is currently integrating the presented model into its dedicated software, to be used with Planmeca 3D tomography equipment.

The research results were recently published in the prestigious publication series Nature Scientific Reports.

By Anu Haapala,
Image derived from the research article

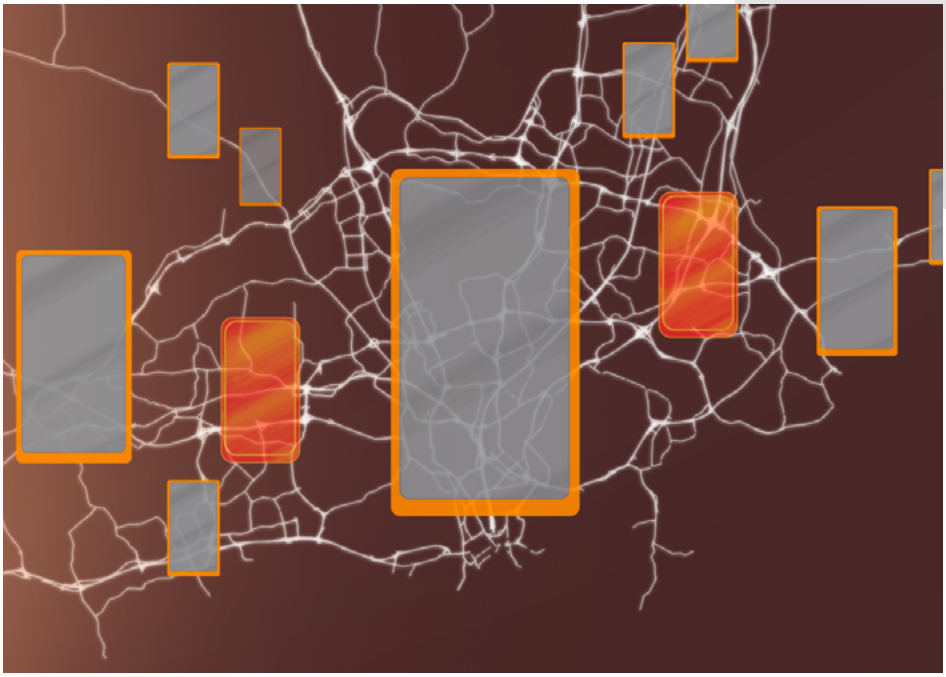
International group of researchers: Mobile phone data should be utilized more to curb the corona pandemic

These types of data could help to curb the spread of the pandemic and to evaluate the effectiveness of restrictions

Research, published: 28.4.2020

Data gathered from mobile devices could help to curb the spread of the corona pandemic and to evaluate the effectiveness of the related restrictions – provided that privacy and anonymization are well taken care of. Decision-makers and authorities should also increase the use of this data in collaboration with researchers, mobile network operators and other instances. Data protection authorities and non-governmental organizations should also be included in the discussion.

This is the message from an international group of researchers, whose research article on the subject was recently published in the recognized Science Advances scientific journal.



"Understanding how people move between cities and areas is also important for the sake of modelling the spread of the epidemic"

The article includes researchers from different fields – including data scientists, network theoreticians and epidemiologists – from several top universities, such as Harvard and Oxford Universities and the Massachusetts Institute of Technology (MIT).

The group includes Professor **Jari Saramäki** from Aalto University in Finland. Saramäki researches social networks and the mathematics of the spreading processes through the utilization of, for instance, anonymized mobile phone data. 'Mobile phones provide information on humans' mobility, among other things: mobile network operators can calculate the number of mobile phones that have moved between two base stations or, for example, between two cities, during some period,' Saramäki states.

This helps to understand the extent to which the recommendations and restrictions on movement are working and how the situation evolves as the restrictions are removed. For this reason, researchers, authorities and companies offering mobile services have begun collaboration in order to evaluate and visualize the effects of the restrictive measures.

'Understanding how people move between cities and areas is also important for the sake of modelling the spread of the epidemic. This can prove greatly useful if mobility restrictions are removed locally or if regional isolation becomes a necessity in the future as well,' Saramäki continues.

On a smaller, urban scale, the data can be used to identify 'hotspots' — times and places where the density of people increases the risk of the disease spreading. More exact location data, collected by e.g. mobile phone operating systems, can reveal how much of their time people spend at home, workplace or elsewhere. Information on how many close contacts people have would be particularly useful for modelling the epidemic, but gathering this type of data is challenging for both technical and privacy reasons.

The opportunities provided by data gathered through mobile devices have not been fully utilized thus far. According to the researchers, one reason is that the authorities rarely have the competence or work force to process such complex data, which requires multidisciplinary expertise to analyse. Companies may also be reluctant to release data from mobile devices, even if it is non-identifiable, aggregated and anonymized. 'Matters of privacy are often at the core of the issue, and solving and addressing them openly should be taken very seriously,' Saramäki says.

By Anu Haapala,
Illustration Matti Ahlgren

Johanna Ylipulli, researcher in Department of Computer Science Photo: Matti Ahlgren

HUMANS OF COMPUTER SCIENCE

Computer Science at Aalto University is more than just coding. Here are stories from our researchers.

Assistant Professor Elisa Mekler: Gaming can help to cope with difficult life situations and improve one's wellbeing

Elisa Mekler found out in her recent study that video games might help people to cope with difficult life situations, which offers a new challenge to game designers

Published: 6.8.2019

Elisa Mekler, a former postdoctoral researcher and manager of the Human-Computer Interaction (HCI) research group at the University of Basel, started working as an assistant professor at the Computer Science Department in August 2019.

Mekler is famous for her research on gamification and motivation, but having her background in psychology, in Basel she was the only senior person in her workplace focusing on human-computer interaction. At Aalto, things will be different, which she finds exciting. 'Aalto University has one of the best reputations in human-computer interaction research in Europe. It was always one of my aspirations to join a department with a really established and strong HCI presence.'

In her work, Mekler studies video games, motivation, and user experience. In particular, she has focused on what motivational and emotional processes relate to user experience and gaming. She has researched, for instance, under which circumstances interactive systems – such as video games – produce emotional and meaningful experiences.

When Mekler studied the motivational processes of gamification for her PhD, there was still little empirical research showing whether gamification has a positive or negative impact on intrinsic motivation. Intuitively, it makes sense that people would play games because they are intrinsically motivated to do so – they find the games inherently interesting. However, an alternative explanation could be that players are actually mainly motivated by extrinsic factors, such as games' reward structures.

Mekler's current conclusion is that things are not black and white; the reasons for playing video games are different for different people. Her studies have therefore triggered a new way of thinking about and approaching the topic. Whether gamification is intrinsically motivating or not, depends on many factors, such as player's personality. 'In hindsight, it might seem obvious but back then it made quite a splash.'

When Mekler worked on her dissertation, testing gamification from a psychological, theoretical perspective by applying motivational theories was novel. 'That was just not done before.'

When struggling with difficult life situations, games offer an easy way to bond with others

Video games have been Mekler's research topic since her doctoral study years, but she has spent time with them for much longer. When Mekler was a child, her favourite hobbies were playing video games and reading.

Although Mekler comes from an academic family – her mother is an ophthalmologist and her father a biochemist who now does his second PhD in mathematics – she did not enjoy going to school as a child. When she thought that 12 years of school seemed like an eternity, her mother consoled her by saying that she will like university. 'Back then, I did not believe her, but she was right for some reason,' says Mekler now, laughing.

Actually, Mekler finds research intriguing for similar reasons she likes

"It was always one of my aspirations to join a department with a really established and strong HCI presence."

video games. While researchers in a research group may have different roles and focus on different tasks, they all work for the same cause, tackling challenging problems and aiming for the best results, and getting better in what they do along the way.

For many people, games are appealing because of the possibility for the player to become a part of a story and contribute to a mutual goal in the game. These things help to make gaming a meaningful experience. Many people like the challenge provided by games. Mekler says that the older she becomes, the more she enjoys playing very challenging games.

The addictive side of video games has been studied and discussed a lot, but Mekler has also studied its positive effects for people in difficult life situations, such as unemployment, struggles with mental health problems or illnesses, or loss of a loved one. Mekler and her colleague Jo Iacovides, lecturer at the University of York, UK, recently published a study in which they asked people to report difficult times in their life and their gaming habits during that time. Based on the results, playing video games helped many people to cope with the difficult event.

'Playing together or even just discussing about the games with others gave them an easy way to bond with other people. It also ties into games giving them goals. Even though the goal wasn't that important, during the time that people felt they have no real direction in life, they knew that at least they can always try to improve in this or that game, so they kept on returning to it.'

Some participants reported that playing video games helped them rebuild their confidence to tackle real life problems again. Most importantly, games allowed people coping with difficult life experiences to take a break from the negative thoughts and emotions they were going through. 'It was not so much about escaping the real world, but just about taking a break from the worries and grief,' says Mekler.

According to Mekler, some participants found playing almost therapeutic. In order for games to help coping with difficult situations, the results suggest that games should not be too stressful or overwhelming but they should be challenging enough. For the same reason, playing video games may be more helpful than watching television series, for instance. 'We had quite a few people talking about a game called Stardew Valley, where you build your own farm.'

'I think the challenging question is how we could design games that don't keep people in this loop, that signal once the player is doing better and remind them that it's time to go back to the real world.'

Art and game industry culture make Helsinki an exciting place to live

Mekler is going to continue studying topics related to video games and user experience at Aalto. She is interested especially in how people experience AI in, for example, the form of game characters, as people tend to become emotionally attached to such characters. She also aims to continue researching gamification and motivation in particular from the perspective of designing interactions that people find meaningful.

Mekler expects to find new opportunities for collaboration at Aalto. 'There are many excellent researchers and students around here, as well as the educational programme that all focus on human-computer interaction. This is game-changing for me.'

Mekler has just moved to Helsinki, which she sees as an intriguing place to live. Being interested in arts since she was a teenager, Mekler likes both classical and modern art and enjoys visiting exhibitions. 'Helsinki has a very exciting museum and art culture.' As she comes from inland, she finds the proximity of the Baltic Sea exotic.

Moreover, Mekler is excited about the game industry and vibrant game culture in the Helsinki region. 'Basically, I just have to go out of my door into the city and there is so much going on. For me, coming from Switzerland, which has a growing, yet much smaller gaming community, it's almost crazy how much exciting stuff is going on here,' says Mekler referring to the number of game events in the region.

By Anu Haapala,
Photo Matti Ahlgren

Elisa Mekler, Assistant Professor

Education: PhD in Cognitive Psychology, University of Basel

Comes from Basel, Switzerland

Lives in Helsinki

The greatest professional accomplishment: Establishing a games research group in Basel from ground up with a successful record of accomplishment at leading human-computer interaction conferences (e.g., Best Papers and Honourable Mentions at ACM CHI and CHI PLAY).

Is also a

Yogi. 'In school, I hated sports and even now I wouldn't say I like sports, but I've been practicing yoga for about ten years now. I don't always like it while I am practicing, but still I do like doing it several times a week.'

Former member of an acting group.'I consider myself the typical, quite nerdy researcher, but in Switzerland, I was member of a French-speaking acting group.'

Fan of medieval Japanese literature. 'Unfortunately, I didn't get to bring many books with me to Helsinki yet, but I did bring one of my favourites – The Pillow Book by Sei Shonagon. It's a quite clever description of courtly life in medieval Japan, but still feels modern.'

‘If you feel like an idiot every time you use a service, it isn’t very motivating’

Sari Kujala helped Kone improve its elevators and Fiskars make better axes. Now, she works as a deputy director in the DigiIN project that aims to ensure that digital services will not increase social exclusion.

Published: 20.8.2019

When user experience became a hot topic among product developers and researchers at the beginning of the millennium, **Sari Kujala** understood that having a user-friendly service is not enough. Instead, a service use should also be pleasant and rewarding to use. ‘If you feel like an idiot every time you use a service, it isn’t very motivating,’ says Kujala.

Kujala, who works as a research fellow, has spent the last twenty years studying how human points of view can be taken into account when designing new products and services. Traditionally, developers focused on creating a first impression that increases product sales. Another important aspect, however, is that the client would actually use the product for a long time.

“If people just try out a service and then stop using it, we will not reach health benefits.”

Kujala has, for example, helped Kone design better elevators and interviewed users of Fiskars axes, noticing that companies can support long-term user experience even when it comes to pure consumer goods, such as axes. This can be achieved by sharing information about product usage and maintenance online.

She now works as a deputy director for the DigiIN project. The project raised funding more than 600,000 euros from the Strategic Research Council at the Academy of Finland in June 2019. DigiIN is a joint project of Aalto University, National Institute for Health and Welfare, University of Helsinki, University of Jyväskylä, Laurea University of Applied Sciences, and Age Institute.

Researcher despite dyslexia

Motivation and rewards are crucial in different types of activities, as without them, one is less likely to work hard to achieve certain goals. Kujala’s first-grade teacher managed to save Kujala’s motivation to learn new things; the teacher helped to discover that Kujala has dyslexia. ‘When I was already a grown-up, I found out that my first-grade teacher in Tampere was a psychologist, which led to the fact that she knew an exceptional amount about dyslexia.’

As Kujala found out about her dyslexia at an early stage, it didn’t have a negative impact on her learning at school. Instead, she saw how psychological research can be applied in practice. After upper secondary school she decided to apply to study psychology at the University of Helsinki, and during her

studies dyslexia only made learning of Latin names of brain regions somewhat difficult.

Many people with dyslexia find out about their diagnosis much later when they have already started suffering from learning difficulties. 'In that sense, I was lucky.'

As a psychology student, Kujala was interested in human behaviour, but never very keen on mental health work and she decided to pursue a career in research instead. She started her career at the University of Helsinki but, soon, she transferred to the Helsinki University of Technology where she did her doctoral studies in human-computer interaction and defended her doctoral dissertation in 2002.

As a researcher, Kujala enjoys the fact that she has freedom and room for creativity. 'It is rewarding to not just do something but instead come up with new ideas and develop new kinds of thoughts.'

Although Kujala spent five years as a professor of psychology at the Tampere University of Technology, Aalto University and its predecessor have been her workplaces for nearly two decades. 'I've had good cooperation with **Marjo Kauppinen** (Professor of Practice in Software Engineering). We've worked on how users' needs should be taken into account in software development,' explains Kujala.

"I was slightly frustrated as a research psychologist. I studied cognitive psychology that is very theoretical basic research. It felt really good to be able to put knowledge about humans into practice."

Take users along to design new services

In Finland, an enormous number of new digital health and welfare services will be launched in the coming years. If researchers and developers ignore users' needs, the good intentions of improving the availability of services. DigiIN project researchers want to ensure that this does not happen.

The idea for the project was born during a previous project called COPE For COPE, researchers did a questionnaire for social welfare and healthcare professionals and they found out that only about 30% of the professionals thought that their clients are able and willing to use new digital services. Moreover, the patients who participated in the project were worried about older people's abilities to use such new services.

According to Kujala, designers and researchers still tend to forget to take users into consideration when they are designing new services. At the moment, professionals typically write information about illnesses for different patient groups, which often makes them difficult to read for normal people.

What is central in DigiIN is to understand what types of problems groups like elderly people and immigrants experience when they are using online services and take them along to test the new services and contents.

The researchers want to make sure that the new services facilitate professionals' work and help to keep it meaningful, but also that they are useful and pleasant for non-professionals to use. This is important just for economic reasons. 'As a state, we invest millions of euros in them,' reminds Kujala.

Focusing on the long-term usability is crucial in health care too. She says that health care expenses in Finland have almost doubled in the 21st century due to factors like aging. 'If people just try out a service and then stop using it, we will not reach health benefits. I am interested in how we can motivate people to use these services.'

By Anu Haapala,
Photo Matti Ahlgren

Sari Kujala, Research Fellow

Education: PhD in Human-Computer Interaction, Helsinki University of Technology

Lives in Espoo

Comes from Pielisjärvi, Finland (current Lieksa)

Funding from the Strategic Research Council at the Academy of Finland for COPE and DigiIN projects

The greatest professional achievement: Worked as a professor of psychology at Tampere University of Technology in 2011–2016

Is also a

Fish-eating vegan. 'Thanks to my 23-year-old son who encouraged me, I've become vegan. Leaving meat out of my diet was easy, because I had been eating mainly vegetarian food even before and I still eat fish. Cheese was the most difficult thing as good vegan cheese does not exist.'

Hiker. 'My husband is crazy about Norway, so we often travel there. We have visited different places all the way from the Arctic Ocean to south of Norway. For Finns, mountains are fascinating.'

Biologist in her soul. 'I like nature a lot. Birds, plant biology, and human biology are my hobbies.'

Understanding the past helps train future engineers

Saara Matala, Doctor of Technology and historian, studied last spring the role of Nokia engineers in the development of mobile platform security. The results serve to remind that technology does not develop in a vacuum; it involves interaction with surrounding society.

Published: 3.9.2019

After the Secure Systems research group at the Department of Computer Science decided to study the role of Finnish engineers in the development of mobile security, especially the Trusted Execution Environment (TEE), the research group leader, Professor N. Asokan, hired Saara Matala. Shortly before, she had received a doctorate degree from the Department of Mechanical Engineering, and she was a historian to boot.

The goal of the study was to gain insight into the security solutions of current mobile appliances and to recognize the factors affecting their development and acceptance. For this, Matala and doctoral candidate Thomas Nyman interviewed veteran Nokia executives, researchers and information security experts.

According to Matala, Nokia's role in the development of mobile security is a good example of how vast technological methods come about. In the very beginning, systems are easy to modify, and the role of an individual engineer in the development of a solution can be decisive. But as systems develop further, grow and are standardized, it becomes ever more difficult to make profound changes.

Should engineers now develop cellular phone security technology from scratch, they could end up in a very different place than their colleagues a few decades ago because for example the price of components has dropped. 'But certain basic choices were made in the early 21st century, and they still dictate the framework and elbow room for today's decisions,' Matala says.

"Understanding of society makes for better engineers better equipped to solve the elaborate problems ahead."

In the course of her study, Matala was surprised to learn how differently companies viewed security in the heyday of Nokia cellular phones compared with today. Now, the importance of security is a given, but back then, it was

difficult to market. Engineers took to referring to it as an enabler. 'Instead of talking about security, they called it technology that enables better SIM locks or management of digital rights. These arguments worked to push new technology into phones.'

Humanists must understand technology, and engineers must understand humanity

Technology never develops in a vacuum. It is influenced by the surrounding society as well as the economy and political regulation. On the other hand, for example information security technology has profoundly influenced the development of pieces central to the current mobile industry, such as payment services and third party applications.

According to Matala, technology holds such a pivotal role in both engendering and solving social problems that it cannot be left to the engineers; also social scientists must gain insight.

Matala finds it equally important that tertiary engineer training approach technology from a social development angle for at least worth one study credit. 'It won't do that people just talk within their own coterie and have no understanding of what anybody else is doing.'

In Finland, it is fairly unusual for a historian to be working in a technological university. The world's leading technological university, Massachusetts Institute of Technology (MIT), incorporated social sciences as part of its engineer training already after World War II. The advent of atom bombs made it clear that humanity had, for the first time ever, the technological potential to destroy Earth. Engineering students had to recognize the responsibility that followed from this capability.

Historical research can add to the understanding of the long-term effects of technology and industrial policy. Matala believes that the better grasp people have of social matters, the better decisions they make. 'My personal mission is to spread the word that a well-rounded understanding of society makes for better engineers better equipped to solve the elaborate problems ahead.'

'Research is like treasure hunting'

Already as a schoolgirl, Matala was intrigued by both history and mathematics. Historians endeavor to understand vast entities and mathematicians to solve vast problems systematically. 'Graduating from high school, everybody wants to save the world, but also understand it. The latter was my reason for wanting to study history.'

Matala discovered her passion for research while preparing her Master's dissertation in History. 'I was sitting in the Bank of Finland archives, pouring over dusty folders. It was so much fun! It made me happy in a special way, like nothing I had experienced up to then.'

What was fascinating was access to the original source, the chance to challenge generally accepted truths on how historical events had unfolded. For example, although it is generally believed that trade between Finland and the Soviet Union imploded because the Soviet Union toppled, archival research shows that the bilateral trade arrangement was coming apart before the U.S.S.R. did. 'Research is a little bit like treasure hunting; you never know what you will find, but you always find something. The suspense is what makes it interesting.'

Until now a project researcher at the department of computer science, Matala will move to Norway in September for post-doctoral research at the Norwegian University of Science and Technology (NTNU). She will study the migration from fossil fuels to biofuels, and the implications of such vast, systemic changes.

'As long as research is meaningful, I would like to pursue it, but I don't see research as something that excludes other career options. Research training enables many other careers, too.'

By Anu Haapala,
Photo Matti Ahlgren

Saara Matala, Project Researcher

Education: D.Sc. (Tech.) (Mechanical Engineering), M.P.S. (Political History)

Awards and scholarships: Fulbright scholarship for researcher exchange in the U.S.A.

Resides in Helsinki

Born in Karkkila, Finland

Greatest professional achievement: Awarded best Novice Presenter at an international conference on history of technology. 'Even though it was a very small recognition in the scale of the world, it made me feel for the first time that I had something to say, and that if you apply yourself, you can improve. I rehearsed my presentation an awful lot and was glad I didn't faint midway through. With that presentation, I took home the prize.'

Is also a

a self-described mediocre but avid alto violinist. 'I took up the violin at a very young age. I have played with Teekkarispeksi and the Polytechnic Orchestra. It's more about playing together than aiming at a professional level.'

eager to sleep more nights in a tent than in a bed in the summer. 'This summer, I have for example gone trekking, bicycled to the Arctic Sea and gone kayaking.'

a climber. 'I have always climbed up trees. The last few years, I have been systematic about it, and climb not only trees but also walls.'

”Machine learning excited me before I knew it was a thing”

Arno Solin received funds allocated to young researchers in the summer of 2019. Solin is excited about machine learning, as it offers a way to both delve deep into theory and solve real-life problems.

Published: 17.9.2019

Dr. **Arno Solin**, Assistant Professor, stores a plastic bag full of electronic gadgets in his office wardrobe, since a student of his needed equipment for building a robot. Part of them have come a long way. “My father bought this soldering iron. I was too little to be in school at the time, or just barely in elementary school,” Solin says and laughs.

Already as a child, Solin was interested in technology, physics and mathematics. At home, he would build robots and spaceships. The son of academicians, he saw first hand the life of researchers -- and wanted to become one himself. ‘After high school, I almost chose Political History as my major. But then I figured it would be easier to have history as a hobby than statistics and mathematics.’

It is Solin’s job to study machine learning, which is an application of artificial intelligence: the machine learns based on experience without being further programmed by humans. Machine learning makes use of e.g. statistics. In June, the Academy of Finland granted the research project led by Solin funding allocated to the new generation of researchers. Researchers make use of statistical machine learning and the development of machine vision in their project entity.

Solin finds machine learning fascinating, as you get to combine theory with solutions to tangible problems.

“There’s no point in being an ace researcher, if you are not able to communicate your findings to others”

He concentrates on probability modeling: How do you model uncertainties? How does machine learning deduce results from new data? How can you help machines reach sensible deductions in the here and now? ‘I think I was interested in machine learning already before I knew it was a thing.’

In the Academy-funded project, researchers concentrate on sensing, comprehending and describing the environment via machine vision methods. These functions are a challenge in the development of any autonomous or augmented reality system, especially when the surrounding conditions are uncertain.

According to Solin, the project has the potential to develop methods that could solve many a practical problem. It is this potential that fascinates him. New research results could help develop e.g. the functionalities of smartphones. Computation, especially, can be used to make them work better, to use the current data more efficiently. Smartphone cameras could become better for shooting at night, or provide better depth of field without bigger, better and more expensive sensors.

‘Existing sensors, existing smartphones can improve and have more to offer simply by being able to arrive at conclusions more effectively from

information detected by the device,' Solin sums it up.

New knowledge can be applied to many other things. For example depth estimation can help create video games, or devices for the visually impaired to better grasp their surroundings. The research is mostly pure research in nature, but provides reliable and efficient methods for the needs of other disciplines. Through collaboration, they have been adapted in medicine and the evaluation of urban air quality.

The researcher must know how to communicate

Dr. Solin, Assistant Professor since 2018, is the co-author of a textbook in stochastic differential calculus together with Simo Särkkä, Professor of Electrical Engineering. Solin has taught several courses at Aalto University as well as AI 101 at the open university.

Solin laughs when he claims his motives for sharing knowledge are partly self-interested. 'Explaining to others, I learn myself. When you have to explain things from different angles, in different ways and afresh, you get a different take familiar things.'

Solin considers teaching and conveying your own particular expertise to others as an essential part of a researcher's work. It supports research and also raises new generations to study and apply what they have learned. Already as a child, at the Waldorf School of his native Turku, he learned to present things visually and with clarity, and to hold presentations. He got used to going to some trouble to make things clear to his audience. 'That is something I think should be valued more. There's no point in being an ace researcher, if you are not able to communicate your findings to others.'

The Waldorf School has strongly shaped the kind of adult and researcher Solin has grown up to be. In his opinion, the pedagogy supports the pupil's personal growth. Studies advance in the pupil's terms. Group sizes are small, which enables more personal tuition. The school encourages self-expression and social interaction. 'Wherever you end up in working life, some kind of social skills and a capability to work together with people are needed.'

Solin hears people are amazed at how many international partners he has. He puts it down to his proclivity to work with other people. 'Maybe it comes through, and then others like to work with me, too.'

'In Finland, you get a solid basic education'

The high school guidance counselor never breathed a word about the then Helsinki University of Technology, but in his final year, Solin met a student from there at a housewarming party. The student suggested Solin, who was interested in physics and mathematics, send an application to study Technical Physics and Mathematics there.

This encounter stuck to Solin's mind. He did apply and was accepted, but still during his national service, he went through the options: should I stay or should I go? 'It was a very pragmatic choice: If you wish to remain in Finland, you surely get a solid basic education. Which is very true.'

A young man, Solin was into jogging and played competitive badminton. Nowadays, a family man, his hobbies are linked to his work. Other projects have had to go. 'I like to build, experiment and code things. My wife considers them work, I see them as pleasure. It's a very thin line: if you wish to apply algorithms in the automation of the family home, is that work or play?'

What's left is spent largely with the children, but there, too, you can pursue your own interests. 'After a years-long hiatus, I have rediscovered legos! My daughter plays with Duplo legos and my son with little legos. I sit in between and monitor that the pieces don't go into the mouth...'

By Anu Haapala,
Photo Matti Ahlgren

Arno Solin, Assistant Professor

Education: D.Sc. (Tech.) Aalto University

Awards: Mathematical Contest in Modeling (2010, 'Meritorious winner', together with Eric Malmi and Jussi Sainio), Kaggle Schizophrenia Classification Challenge (2014), Aalto Data Science Hackathon (2015, 'Best hack in the category Smart Cities', together with Eric Malmi Jaakko Luttinen), ISIF Jean-Pierre Le Cadre Best Paper Award (2018, together with Manon Kok)

Funding and scholarships: Finnish Foundation for Tehnology Promotion incentive grant (2014), the Academy of Finland post-doctoral researcher funding (2017): "Sequential inference for real-time probabilistic modelling", Business Finland's New Business from Research Ideas funding (2018), the Academy of Finland's project funding (2019): "Shallow models meet deep vision"

Lives in Helsinki

Hails from Turku

Greatest professional achievement: Raising awareness of the multiple uses of probabilistic models and solving real problems with them

Is also a

A Swedish-speaking Finn. "I use Finnish a lot, but speak Swedish to e.g. my children."

Colorblind. "My students have learned the hard way: I can't tell apart the color of lines. In certain things, I gladly surrender decision-making to others, be it visualizing things or what color furniture we should get."

Good with his hands. "In the summer, I usually relax fixing something at our summer place. This time, I puttied and painted the old windows."

When physician and AI work together, the patient benefits

Doctoral student Iiris Sundin learned in her studies that a machine learning model could make use of a physician's silent knowledge which usually is never written down. This kind of model predicts best how a given patient will react to specific treatment.

Published: 15.10.2019

Artificial Intelligence opens up new avenues into for example health care, but its potential is as of now not fully put to use. There are many reasons, but the most important one became clear to **Iiris Sundin** as she was starting her doctoral studies on machine learning: machine and Man must learn to work together.

'When I acquainted myself with the research of my advisor, Professor Samuel Kaski, on user modeling where the machine tries to understand the human, I realized the huge potential. Co-operation can mean other things than the human operating Excel or passively staring at projections on the screen,' says Sundin, a doctoral researcher.

Sundin's research combines Medicine and technology and many other interests of hers. She has also always wanted to work at something that benefits other people. On the other hand, she was interested in mathematics and programming.

"I realized that researching was such great fun that I rather do more of the same."

The role of AI and machine learning in health care is researched a lot. Sundin's point of view is unique in having the machine make use of the doctor's knowledge to define the best possible care for the patient.

There are uncertainties in the world that must factor in when decisions are taken

Physicians have vast quantities of knowledge that is never written down and that is impossible to feed directly into a learning algorithm. Sundin and her colleagues have found out just how the machine could make use of such knowledge in, for example, figuring out the efficacy of a given type of medication.

Sundin and her colleagues have at their disposal, for instance, data on gene specimens collected from cancerous cells, courtesy of FIMM, Institute for Molecular Medicine Finland. Researchers took a look at the mutations in the specimens and tried to predict which cancer medicine would work best for each patient.

It is crucial to remember that there are always uncertainties in the world, and thus, also a physician's knowledge of the effect of different mutations can be uncertain. The machine learning model devised by the research group takes this into account. The results show including expert knowledge in machine learning models and empha-

sizing data improve prognoses on how a given patient will react to a particular treatment.

So the model developed by researchers depicts realistically how sure people are of the different properties of real matters. 'I would that such thinking were more common: we don't just discuss the average person, we acknowledge there are differences, and take it into account when reaching decisions. That way, things can be modeled in a more useful manner.'

The researcher gets to tell something new about the world

Even though Sundin was fond of mathematics already as a child, and it comes naturally to her to see the world via mathematical thinking, art held a big role in her life, especially when she was young.

As a schoolgirl, she played the piano, sang in a choir, read books and attended art school. Now, she is into yoga, air acrobatics and camping. A researcher can be interested in many things, and creativity, for example, helps at work, too. 'When you e.g. make posters for a conference, it is very useful if you can do some of the visual elements yourself.'

The antics of engineering students were something Sundin grew up with. Both her parents graduated from the Helsinki University of Technology, and the family always celebrated First of May with parents' college pals. All the adults sported the traditional tassel caps of engineering students. So engineering studies came naturally. 'The degree of an engineer is really well-rounded and offers a good start. You can choose to be a researcher, industrial work or pretty much anything.'

Sundin completed her Master's in Automation and System Technology. Although she never fancied herself a researcher, her interest in it was kindled when she was working on her dissertation. Sundin was modeling the properties of a drop of fluid on different surfaces.

Research offered a way to bring received mathematical ways of thinking and skills into the real world, and to tell something about that world. 'I realized it was such great fun that I rather do more of the same.'

'You succeed at work if you are open'

Sundin says she sometimes imagined researchers worked alone in their chambers. That is no longer the case, anyway. 'You succeed better at work is you are open, socially adept and like to travel to conferences and network with the people there.'

It is crucial for a doctoral student to possess the wish and motivation to understand things. The point of further studies is to delve into one fairly narrow area of learning very profoundly, something which can be demanding. Therefore, it is important to have tenacity and the ability to stick to it. 'It is needed, if you want to make it to the end.'

Even though Sundin has hitherto worked in basic research, she feels the methods developed need to be taken to a practical level, once the foundation laid by basic research is robust enough.

In the future, she hopes to apply what she has learned and continue work for the benefit of people and also the environment. 'I hope to work at some Finnish institute doing research that help Finland make smarter decisions when it comes to the environment.'

Iiris Sundin, Doctoral Student

Education: Master of Science, Aalto University

Was born in Espoo

Lives in Espoo

Personal scholarships for doctor's dissertation from the Jenny and Antti Wihuri Foundation, the Alfred Kordelin Foundation and the Emil Aaltonen Foundation

Greatest professional achievement: The latest publication of the research group. "We worked with researchers from Johns Hopkins University, and I had a pivotal role in this cooperation. It is challenging to work with people all the way on the other side of the Atlantic, but the research succeeded so well the results were made public in one of the most renowned conferences in the field. This would never have happened had I not been really firm and believed in myself, and if the professor had not backed me the way he did."

Is also a

A bird person. "I have four cockatiels and a whole room dedicated just for them at home. I love birds above all! They can fly, the aerodynamic contour of their plumage is beautiful and even single feathers are exquisite. Birds are cute and strong. When I was a child, we had zebra finches until I was five."

Fond of old ships. "At a conference I attended in California, the Queen Mary, an Atlantic-crosser from the 1940s, was listed as one of the conference hotels. Its cabins had been made into hotel rooms. The hotel was old and not quite tip top. I thought it was beyond cool to get to stay there: it felt a little like crossing the Atlantic by ship."

An amateur aquarelle painter. "I paint with watercolors, especially cards for weddings, farewell parties and graduation parties. People are often surprised to hear I painted them myself. I guess I have improved, even though I haven't applied myself systematically since eighth grade. However, I only paint if there's a particular reason, so I don't have a collection of aquarelles of my own."

By Anu Haapala,
Photo Matti Ahlgren

A “lifelong interest in coding” is not a requirement for seeking a career in technology

Johanna Kaipio, Professor of Practice, ventured onto the path of technology as a result of an interest in psychology, mathematical subjects and medicine in upper secondary school. Now, as a researcher of health and social care information systems, Kaipio brings these elements together.

Published: 29.10.2019

In the fall of 2007, **Johanna Kaipio** – then Viitanen – was watching the Finnish TV programme 45 minuuttia (“45 minutes”), when she had an idea that would change the course of her career. The episode in question dealt with the shortcomings of electronic health record systems used in hospitals. ‘I thought then that if the systems are so difficult to use, perhaps I could research them,’ Kaipio says.

Kaipio has researched IT systems in healthcare for a decade now. In addition to academia, she has been involved in two extensive client and patient information system procurement processes. In September, she started working as a Professor of Practice at Aalto University’s Department of Computer Science.

Kaipio is interested in health and social care information systems because developing them through technical expertise is a way to help clients and patients in the healthcare and social welfare field. ‘I enjoy working with people from different backgrounds, such as physicians, nurses, and social care workers. It is a meeting point where the best new ideas and insights come together.’

When Kaipio was a child, her father (a Master of Science in Technology) and mother (kindergarten teacher) nudged her towards mathematical subjects. In addition to mathematics, her interests in upper secondary school also included psychology. It was this combination that led her to apply for the Department of Electrical and Communications Engineering at Helsinki University of Technology. ‘In my studies, I was able to apply my knowledge of both psychology and mathematics. User-centred design and usability are a natural continuation of this interest.’

Technology is present in all fields. Psychology and cognitive science are prime examples of where it can be seen. Kaipio emphasises that there are several different angles for approaching technology.

The industry could do with more female students. Currently, women make up less than a third of students in the field of technology. In computer science, the distribution is even more unbalanced. Kaipio would like to tell girls and young women that students in the field do not need to be ready experts or even particularly technology oriented. ‘A lifelong interest in coding is not a requirement for seeking a career in technology. Being enthusiastic about new things and interested in working with technology and information systems go a long way.’

Developing a single solution for various work environments is challenging

According to Kaipio, healthcare information systems have evolved in the last ten years, though there is still much be done. ‘Finland is a forerunner in many aspects, such as the utilisation of advantaged IT systems’ functionalities and health information exchange at the national level. This is often overlooked, as we are so critical of our own work.’

Particular critique has been directed at the Apotti project, which Kaipio also worked on during 2013–2015. The system was first introduced at Peijas hospital in the Hospital District of Helsinki and Uusimaa (HUS) in November 2018. Its use is now being expanded within HUS and the metropolitan area municipalities gradually until the end of 2020.

Although the project is considered costly and has been criticised, Kaipio reminds that Apotti is a pioneer project. It is the first in the world to combine social and healthcare information in the same system, while also factoring in the field’s evolving landscape.

Social welfare and healthcare as a field is more complex than many, involving e.g. several legal and interoperability requirements around information management and security. Procurement processes are often long, which makes it difficult to predict all that is needed for the IT system to work upon implementation.

It is not until recent years that usability has become a focus area in healthcare information systems in Finland. Current systems have become outdated and they have reached the end of their development cycle.

According to Kaipio, the aim of finding one solution to fit for the needs of both primary and specialised healthcare is a particular challenge. Different contexts of work and fields of specialisation may have very different

requirements towards IT systems as well as procedures of work.

From an end-users' perspective, an ideal healthcare information system would be intuitive and easy to use, yet adaptable for use in different contexts. 'A major challenge in current systems is that all functions are visible to all users, regardless of which ones are actually needed and being used. The systems are inflexible and do not support employees' routine tasks. Rather, they require employees to adjust, and on the system's terms.'

Yet Kaipio believes that it should not simply be a discussion of good or bad systems. How different organisations use these systems is also an important factor. 'Looking at it from the outside, it may be difficult to grasp just how much work practices are affected by the collaboration and division of tasks between different groups of professions, for example.'

In fact, the procurement of new IT systems and the development of new work practices and processes are closely linked. They should go hand in hand, with the operational change included as a key part in the deployment stage. It is important that during the implementation, end-users become familiar with the new ways of work and how the IT system is used. Otherwise, the desired benefits will never be realised.

A university background alone would make me less equipped to understand real-world problems

What makes the field of healthcare so special and different from others? This was a question asked by a participant at an event, where Kaipio was presenting the results of a national survey on physicians' experiences on their health information systems. The commentator believed that usability problems were simply a result of bad design and compared the IT systems to cashier systems at stores.

For Kaipio, the comment demonstrates just how difficult it is for even researchers in the field of technology to apprehend the complexity of the healthcare field. 'It is a complicated and critical operating environment that deals with patients' lives and safety. This is not something that can be compared to a cashier system used in stores.'

As a Professor of Practice, Kaipio hopes to be able to spread this knowledge. A Professor of Practice combines expertise and knowledge acquired both in academia and practical work. 'A university background alone would make understanding practical, real-world challenges – which the research in my field is strongly based on – more difficult.'

In addition to healthcare information systems, Kaipio wishes to shed more light on social welfare, where the processing of client information and providing the professionals an up-to-date overview of the client's situation is crucial. She hopes to expand her research into social care information systems.

'Today, it should be a fundamental requirement that the IT systems provide the end-users the information they need and support their routine work tasks. For example, the systems should provide a summary view of the client's overall services and guide the social care workers in decision-making process.'

According to Kaipio, current IT systems in social care require a lot of tips and tricks, and information must be retrieved from different screens in the system. 'Modern technology should enable these tasks easily. Yet developing successful solutions requires an understanding of not only social welfare processes, legislation and work practices, but also usability.'

By Anu Haapala,
Photo Matti Ahlgren

Johanna Kaipio, Professor of Practice

Education: Doctor of Science (Technology) from Aalto University

Born in Pirkkala

Lives in Jyväskylä

Awards and grants: Grant awarded by KAUTE Foundation for a researcher exchange in Canada in 2015, grants awarded by the Finnish Work Environment Fund and Instrumentarium Science Foundation for the finalisation of the doctoral thesis, SoberIT's Researcher of the Year 2011 award, best article award at the research days organized by the Finnish Social and Health Informatics Association in 2015, 2017 and 2018.

Greatest professional achievement: Getting ahead on the research path and area of my choosing. "I have managed to tackle many steps, and there is still plenty of years to do more. I suppose I have always let my interests lead the way, leaping towards new things with an open mind."

Has also

Started playing ice hockey as an adult. "I have frequented Tappara's games ever since I was a child. I was encouraged to try ice hockey myself as an adult when a mothers' team was set up in Kirkkonummi in 2012. I was hooked immediately. On ice, the focus is totally on practicing together with like-minded ladies."

An affinity for lakes and her summer house. "I need a place to wind down, spend time on my own or with my family, put my boots and listen to the waves and do some fishing. The house in the countryside is my lifeline. It is where I also wrote a great deal of my doctoral thesis."

Dreamt about being a physician. "If I had not applied to the University of Technology after upper secondary, med school would have been an alternative worth pursuing. Luckily, I have been able to adjust my research focus according to my own wishes. Another career path has not even occurred to me."

“Mathematics is a bridge between different disciplines”

Psychology, medicine and philosophy are some of the subjects that Silja Sormunen has studied. That is why Complex Systems, part of Life Science Technologies programme, felt like just the thing she had been looking for. She is also in the Doctoral Track programme.

Published: 5.11.2019

Silja Sormunen has an interest in many things. So many in fact that she managed to study psychology, medicine, philosophy, comparative literature and aesthetics before her master’s studies at Aalto University.

‘Through my philosophy studies, I got more into mathematics and physics. This got me thinking that it might be interesting to study something more mathematical. After all, mathematics is a bridge between different disciplines,’ Sormunen says.

For her master’s studies, she wanted to find a programme where she could combine different interest areas while learning something new. She was browsing through master’s programmes at Aalto University when she came across the field of Complex Systems in the multidisciplinary Life Science Technologies programme. ’It felt like just the thing I had been looking for.’

“Everything you study leaves you with an understanding and viewpoints that can be used in different ways.”

Now Sormunen is in her second year of studies in the programme. The Life Science Technologies programme focuses on biomedical research, offering six different major subjects for students to choose from.

Sormunen’s major subject of Complex Systems focuses on complex networks and the studies also include network science, statistics, mathematics and programming. The objective of the studies is to provide students with a strong computational and theoretical understanding of how complex systems – say, e.g. the human brain or biological or social systems – work. The studies can either have a focus on the theory of systems or data science.

The understanding of complex systems acquired in the master’s studies can later be applied to several different fields, such as neuroscience and social networks. ‘I think it’s wonder-

ful that the same tools can be used for very different projects. I am currently involved in a joint project on immunology together with the University of Helsinki's Faculty of Medicine.'

Professor Jari Saramäki heads research on Aalto's side. Researchers are looking into how, for example, the T-cells necessary for the immune system are different in diabetics and in healthy controls as well as the types of processes through which T-cell receptors are produced in the thymus.

Different minor subjects and voluntary studies can also be included in the master's degree. Sormunen is studying a minor subject called Systems and Operations Research at the Department of Mathematics and Systems Analysis.

"Different disciplines have very different ways of defining the types of questions that can and should be asked, and the answers that can be considered acceptable."

Finding new insights in everything

Sormunen's interest towards different things became apparent in school. She was particularly fond of mother tongue and writing, mathematics, languages and history. Then again, no subject really felt like a constraint, either. 'I enjoyed almost every subject and studied practically everything I could get my hands on.'

Music was an important hobby already as a child. 'I play the violin and piano and still do classical singing rather actively. I also read a lot.'

Sormunen's parents have always encouraged and supported her to study what feels right for her. ''m sure many others would have already applied some pressure on me to decide on what it is I want,' Sormunen says and laughs.

'Everything you study leaves you with an understanding and viewpoints that can be used in different ways.'

Sormunen has found it interesting to see the different ways in which questions of the brain, for example, are approached in the fields of psychology, philosophy, medicine, and network science. 'Different disciplines have very different ways of defining the types of questions that can and should be asked, and the answers that can be considered acceptable.'

The doctoral track combines master-level and doctoral studies

Research was an area Sormunen found interesting already in upper secondary school. She is currently in the doctoral track programme, which combines master's studies with doctoral studies.

In the programme, studies are tailored in such a way that they support doctoral studies. Students gain research experience as early as the first semester. 'First, students become research assistants in different research groups. Gradually they start choosing their own topic and shaping it into a diploma thesis and doctoral thesis.'

In addition to Saramäki's project, Sormunen has worked in Assistant Professor Mikko Kivelä's group where she researched human mobility and social networks with the help of Wi-Fi data.

Sormunen is planning to graduate as a Master of Science in Technology in 2020. She hopes to find herself as a postdoctoral researcher at the university in a few years. 'It has been a nice and safe, long-term task to work on my master's and doctoral thesis at Aalto University. Previously, I have worked on so many things that the programme and location have been different almost every year.'

Sormunen's favourite things at Aalto University include her pleasant research group and the green, harmonious campus area near the water. 'Walking to the Laajalahti birdwatching tower is one of the things I enjoy doing.'

By Anu Haapala,
Photo Matti Ahlgren

Silja Sormunen, MSc student and research assistant

Education: BA in psychology (University of Helsinki), pre-clinical studies in medicine (Uppsala University), bachelor-level studies in philosophy completed except for thesis (University of Helsinki)

From Helsinki

Lives in Helsinki

Greatest study-related achievement: "I have boldly tried a range of different subjects and been able to combine these different areas of interest."

Has also

An interest in operas. "I like Puccini, La Bohème in particular."

A friendship with trees. "I have always been very fond of trees. In different cities, I often look for a tree that I can climb and study on. In Uppsala, I had a certain tree for doing my homework assignments. I haven't yet found a tree in Aalto's surroundings, but I'll keep looking."

Dreamt of being a bass singer, confectioner and farmer as a child. "Although all bass singers are men, I held on to this dream for a long time. Even before the age of ten, I was a fan of the great opera singer Jaakko Ryhänen. As a confectioner, I could have made some fine creations. Baking was an activity I enjoyed as a child, and still do. The farmer thing is a reflection of my desire to be out and about in nature. My grandparents grew up in the countryside and their stories have been passed on to me."

“Researchers should compete with Netflix, Spotify and YouTube”

According to master’s student Ali Salloum, researchers have an obligation to get young people excited about science.

Published: 12.11.2019

When **Ali Salloum** went to upper secondary school in Helsinki, he participated in a national writing competition in which his essay received an honourable mention. The panellists of the competition were determined that Salloum will be the future **Eero Heinäluoma**, a Finnish veteran politician and former chairperson of the Social Democratic Party.

Salloum, who studies in the Life Science Technologies Master’s Programme and works as a research assistant, has always been interested in politics and social issues. When he was still in school, he was a member of Vantaa Youth Council for several years, also working as its chairperson.

However, now Salloum finds the memory of panellists comparing him to Heinäluoma a bit amusing. Becoming a politician is no longer his dream, rather he has understood that there are myriad ways to influence on societal phenomena, and research is one possibility to do so.

‘I feel that researchers have an obligation and responsibility to influence on things because we are so privileged. We have had time, resources, skills, and even luck to get to the core of our expertise,’ says Salloum.

Born in the mid-nineties when mobile phones started becoming increasingly popular, Salloum has been living in the era of internet and social media. In his childhood, Finnish teens and young adults were using the first social media platforms, such as MySpace and IRC-galleria (a Finnish platform for sharing and commenting on photos, initially created for IRC users but later adopted by a much wider audience).

According to Salloum, the academic world should discuss more about how science communication can reach young people and get them excited about research. ‘Researchers, academia, and education should compete with Netflix, Spotify, and YouTube.’

Researchers can easily share content online and popularize it in different channels including blog posts. Salloum however thinks that real influence calls for, for example, YouTubers creating videos on science, research articles, and study results in an understandable way.

Such YouTube channels exist already, and one good example is a channel called Veritasium. The man behind Veritasium is **Derek Muller**, a Canadian Doctor of Philosophy in Physics, who talks about science and education in his videos. Veritasium has over six million subscribers, but no names come to Salloum’s mind when asked if he could come up with a similar Finnish YouTube channel.

Many researchers are active users of Twitter, but according to Salloum, there are better social media channels for popularizing science than Twitter. In addition to academics, many politicians and journalists use Twitter on daily or weekly basis. ‘On Twitter, you’re inside a bubble, and the content doesn’t reach a wider audience.’

Simple equations are insufficient for modelling complex phenomena

Last spring, Salloum who works in the research group of Assistant Professor **Mikko Kivelä** was working on the ELEBOT project ordered by the Finnish Ministry of Justice. He studied bots on Twitter and their attempts to influence the Finnish parliamentary election and the European Parliament elections.

For the assignment, Salloum and his fellow research assistant Tuomas Takko gathered data from Twitter before and during both elections. The final report of the project was published in the beginning of July. Based on the research findings, bots’ attempts to influence elections in Finland were minimal and their tweets received only little attention from Finland’s Twitter users.

Salloum has always been interested in research and he found this research

topic important and meaningful. 'For the first time ever, I got to make use of those engineering tools, use of which I've learned during my years at the university, for a societal phenomenon. That was very interesting.'

Another aspect he found exciting was the chance to participate in a research project from scratch. Unlike in many examples used on university courses, the data gathered from the real world was imperfect and causal relationships less straight forward.

Salloum's parents live in Vantaa, a neighbouring town of Helsinki, and therefore Aalto University was a natural choice for him after upper secondary school. Aalto is the only technical university in the Finnish Capital Region and, as Salloum says, the best one in Finland. 'Aalto has a great brand. It is well known in Finland and abroad.'

Salloum majors in Complex Systems, a discipline that literally focuses on researching complex systems. Students in this major learn use of data processing tools, mathematics, and modelling complex phenomena in general. In the future, they can make use of these skills in many fields. 'Simple equations or trivial models are no longer enough. You need to know machine learning and chaos theory in order to model complex phenomena and break them into smaller pieces.'

Interest in internationality and performing

Salloum's mother is a midwife and his father a mechanic and they have always appreciated education, encouraging their children to study. 'If my Mum didn't know how to help me with my homework, she took me to our neighbour. Then, she asked the neighbours whether they could help. She always wanted to ensure that I find the right answers to my questions.'

In school, Salloum enjoyed especially mathematics and mother tongue education. He also liked to perform, which encouraged him to join a theatre club as a kid, study expression skills in secondary school, and act as a compere in school events.

All this experience helps him now in the academic world. His friends at the university know that, when their study group needs to give a presentation, Ali is ready to speak in front of an audience. When Mikko Kivelä asked whether Salloum would like to come along with him to the Ministry of Justice and present the results of ELEBOT project, he was surprised – he thought it was obvious that he would be there.

'I have learned to perform since a little kid and practice on stage, which has endured to this day. I'm very confident when performing.'

During his bachelor's studies, Salloum spent one semester as an exchange student in Singapore, and in spring 2020, he will move to Lisbon for the same reason. In the future, he would love to live in another Nordic country and work in, for example, education export as a link between Finland and another country.

Social issues are still close to Salloum's heart and he hopes to inspire people to think and understand, how much there is to learn and how few things are simple. He believes that the humankind needs to have good tools to explore the world, in order to take another step forward.

For that to happen, everyone needs to understand causal relationships, socio-economic factors, and complexity of different phenomena. In practice, some kind of knowledge of mathematical and logical reasoning skills are essential. When a person, group, or a nation works in a certain way, one needs to understand what types of socio-economic factors lie behind.

Moreover, it is crucial to acknowledge that one can always learn more about any matter. Science helps in all this. 'I feel sad that some people are so cynical, have given up on the world, and think that the world can't be fixed. I'm fully against such way of thinking.'

By Anu Haapala,
Photo Matti Ahlgren

Ali Salloum, Master's Student and Research Assistant

Education: Bachelor of Science (Bioinformation Technology) from Aalto University; aims to graduate with a Master's Degree in Life Science Technologies in 2021

Awards: In upper secondary school, the first price in Generation €uro Students' Awards where the Grand Price took Salloum and his school friends to visit the European Central Bank in Frankfurt. In addition, he received a stipend in mathematics and gained success in writing and speech competitions.

Lives in Helsinki

Comes from Turku, Finland

The greatest professional achievement: Gaining confidence to explain even difficult technical things to others. 'I want to improve in that and learn new presentation skills.'

Is also

A former theatre and chess club member. 'I get excited easily. I believe that all kinds of hobbies and club activities and the possibility to try out different things is beneficial.'

Bilingual. 'My strongest language is Finnish, but I speak Arabic almost as well as Finnish. My Dad comes from Lebanon and my Mum from Palestine. They have always spoken Arabic to me, and I will be forever grateful for that. It's so valuable and enriching.'

Diving enthusiast. 'I find it cool to get to know a completely new world in the seas. I have had the chance to admire the underwater world in the South China Sea, the Adriatic Sea, and the Andaman Sea.'

An ‘info student’ can teach crowdfunding to entrepreneurs in slums and coding to secondary pupils

In her diploma work, Niina Arvila studied how awareness of crowdfunding and the skills it requires could be spread among entrepreneurs of small communities in poor countries. Alongside her studies, Arvila has arranged a coding club to adolescents and works as a UX Designer at technology event Slush.

Published: 19.11.2019

Design of digital services. Influence of socio-cultural factors. The relationship between humans and technology. These are things that **Niina Arvila** combined in her diploma work as part of the Fusion Grid research project. ‘I’m particularly interested in how cultures influence the introduction of technologies and why an application that works well in Finland may not feel logical to someone in a different culture,’ says Arvila.

Fusion Grid is a joint research project of Aalto University, Lappeenranta-Lahti University of Technology, Nokia, Green Energy Finland and The University Properties of Finland. Aalto’s representatives include Arvila, Professor at the Department of Computer Science **Marko Nieminen**, doctoral candidate **Pietari Keskinen** and Visiting Researcher **Karin Fröhlich**.

Arvila, who joined the project in autumn 2018, is an ‘infolainen’, i.e. ‘info student’, meaning that she has studied in the Information Network degree programme. She majored in User-Centred Design.

Her work has focused on researching the possibilities that electricity and the internet offer small business owners in poor countries. The topic of the diploma work has been narrowed down to how entrepreneurs of such communities can be taught about crowdfunding campaign skills and how their awareness of crowdfunding possibilities could be increased.

During the project, Arvila arranged, for example, a training week on crowdfunding in Namibia together with a local university. Participants were small business owners, who live in slums. ‘Generally, they are faced with the problem of acquiring initial capital for their businesses, since the majority of their finances are spent on daily living costs. Especially for those who live in the more secluded areas or the slums, obtaining a loan from the bank is challenging.’

The goal of the project was to spread information on crowdfunding to a group of entrepreneurs in the area, so that they might pass this information on further. The results reveal that the training week is an excellent way to increase awareness of crowdfunding in a short amount of time, but not a very lasting solution in the long run.

‘Learning new operating models is challenging, and therefore studying should be supported even after the training week. In the future, it would be good to explore how this training could be maintained with digital learning materials, for example.’

Reaching Aalto after gap years and economics studies

Arvila did not begin her studies at Aalto until four years after graduating from upper secondary. She was ‘good at everything,’ but not particularly excited about any specific subject. In upper secondary, she studied extended mathematics, which advanced faster than regular advanced mathematics. Yet Arvila did not receive the best grades as a student and her teacher made her believe that she would not be admitted to study a technical subject at Aalto. As such, she never even applied.

After two gap years, Arvila began to study economics at the University of Helsinki. It was interesting, though at the same time, she longed for a more concrete approach. She ultimately convinced herself to send an appli-

cation to Aalto's Information Networks degree programme, which had a human angle on technology that she found particularly appealing – and was admitted to the programme.

At Aalto, Arvila has been especially keen on the possibility of being made a course assistant and summer-season research assistant early on in her studies. Starting students are provided with plenty of support for coding. There is also an abundance of group works, enabling student to develop their collaboration and performance skills, much-needed assets in working life. 'Group works teach us how to work with different people, become committed in things and take responsibility within a group while experimenting with different roles.'

Arvila discovered her interest in the subject of her diploma work as a result of a six-month study exchange in

"Especially for those who live in the more secluded areas or the slums, obtaining a loan from the bank is challenging."

Namibia. Fusion Grid has provided an opportunity to do things that genuinely help those in need. 'You can really see something possibly making a difference in someone's life.'

'At Slush, I've discovered that everyone doesn't understand what I'm talking about'

Alongside her studies, Arvila has also worked at technology and growth event Slush. The event has been arranged in Helsinki every autumn since 2008. During this time, it has transformed from a gathering of 300 people to the world's leading start-up event that sees 25,000 participants annually.

Arvila is a UX Designer in Slush's product team. The work has balanced her life as a student busy with a diploma work while teaching her a great deal on teamwork, for example. Some of Arvila's colleagues are self-taught coders, while others possess educational backgrounds entirely different from hers.

'At Info, everyone thinks with a similar thought pattern: each understands the basics of user-centred design and is interested in it. At Slush, I've discovered that everyone doesn't understand what I'm talking about or have the same starting premises for thinking as I do.'

For two years, Arvila also taught coding for secondary pupils. The after-school coding club was arranged for pupils once a week. 'I loved seeing how excited they were about the training how they used their free time to be a part of it.'

In fact, the popularity was so great that when the coding school was on a summer break in summer 2018, making the secondary pupils somewhat unhappy, Arvila had the pupils complete the Aalto University's Open University course on Python. She contacted the course's professor and acquired funding from Aalto Junior to cover the costs of the pupils' studies.

'I've always been good at teaching and explaining things to other people. I was the person who explained math assignments to friends. My teachings got through to them better than the teacher's.'

After graduation, Arvila would be interested in working with product development while helping other people and the world. 'I'd like to work in a project that sought to develop applications for those in need, for instance. There are quite a few several interesting apps related to e.g. mental health these days.'

By Anu Haapala,
Photo Matti Ahlgren

Niina Arvila, MSc Student and Master's Thesis Worker

Education: Bachelor of Social Sciences (Economics) from the University of Helsinki and Bachelor of Science in Technology (Information Networks) from Aalto University

Lives in Otaniemi

Born in Helsinki

Greatest professional achievement: My entire academic path. 'I'm pretty proud of the fact that I've graduated from the University of Helsinki as well as Aalto University – both are high-level educational establishments. I've succeeded very well in my studies and been able to work on different projects, even publish articles before graduating.'

Is also

Began playing football as an adult. 'I had always wanted to be able to play football, something that's always played at cabin trips and recreational events. Pietari (Keskinen) encouraged me to join football club HJK's football school. Sometimes it's still awful to go there, as I'm not very good, but it's an invitation to surpass myself every week.'

Travelled from Beijing to Moscow by train via Mongolia and Siberia. 'My friends and I did the Trans-Siberian trip in the summer: we first flew to Beijing, where we hopped on a train to Mongolia. The trip continued to Lake Baikal and then Moscow. We would stay on the train for up to four hours at most. No internet or telephone service at all – definitely one the most relaxing experiences of my life!'

Learnt to sail last summer. 'Last spring, I was a bit easily led and decided to buy a small, old sailing boat together with my friends. I had only sailed once, so becoming a sailboat owner also meant having to learn sailing. Owning a boat has been fun: you learn something new every day and get to do things with your hands, such as varnishing and cleaning old surfaces.'

‘The ethical issues in Artificial Intelligence are a hot topic all around at the moment’

Master’s student Nagadivya Balasubramaniam, originally from India, enjoys the fact that at Aalto students get enough time to learn things profoundly. For her thesis, Balasubramaniam studied ethics of AI – and soon she will continue her Aalto career by starting her doctoral studies.

Published: 26.11.2019

A few years ago **Nagadivya Balasubramaniam** had just completed her bachelor’s degree and started working in India, at a software consultancy company. However, after just three months the work started to feel routine-like and repetitive. ‘It was not a place I belonged to,’ Balasubramaniam says sitting in Helsinki, four years later.

That feeling sparked the need to look for a master’s degree program. Balasubramaniam was particularly interested in UX – user experience – design and service design. ‘When we talk about UX and service design, it requires you to talk to people. It’s not the kind of work you can do just sitting in a cubicle.’

She wanted to study engineering that combined the human aspect as well. After looking for study opportunities, Balasubramaniam noticed there weren’t many universities offering specialized courses in service design engineering. Nordic countries were among the few providing such courses.

Balasubramaniam applied to Sweden and Finland to study, and ended up choosing studies in software engineeringat Aalto University with a specialization in service design engineering. She has just submitted her thesis ‘Using the ethical guidelines of AI for defining quality requirements’ after having studied in Finland for three years, and the graduation looms ahead in December.

During her master’s studies, Balasubramaniam has been part of PREAGO, a research group supervised by Professor of Practice **Marjo Kauppinen**. She has been working in a project developing an e-learning application for healthcare professionals to tackle cross-cultural communication issues and in another project focusing on ethics relating to artificial intelligence, the topic in which she focuses in her master’s thesis.

‘The ethical issues in artificial intelligence are a hot topic all around at the moment, especially the autonomous decision-making systems,’ Balasubramaniam explains.

Balasubramaniam has now been offered an opportunity to continue her career at Aalto as a doctoral candidate – an offer she gladly accepted.

Companies recognize the impact of AI

When starting her thesis Balasubramaniam knew of an existing AI ethics challenge organized by the Ministry of Economic Affairs in Finland. Balasubramaniam and other research team members interviewed management-level people from 3–4 big companies in Finland participating in the challenge.

“AI is like a black box. Nobody really knows what’s happening inside. But companies are taking a step forward to comprehend what’s inside.”

The participating companies are developing their own ethical guidelines for utilizing AI as part of the challenge.

Balasubramaniam and the other team members expected companies to find the ethical guidelines boring, but that hypothesis changed quickly. ‘After the interviews we noticed that the companies are really considering these ethical issues and they want to

address them and build proper guidelines.'

However, many of them do not yet have a proper way to implement the guidelines. As they can be rather vague, the connection between the ethical guidelines and an individual project is often hard to see.

One significant thing Balasubramaniam learnt was that in Finland transparency is highly important. 'The companies here don't want to cheat the customers or just collect user data and use it for other purposes than what they claim to collect it for. Their intentions were good and they seem to want to earn the users' trust by being open and transparent with them.'

Another important observation was that the companies are thinking about the purpose and influence that the AI technologies will cause. 'AI is like a black box. Nobody really knows what's happening inside. But companies are taking a step forward to comprehend what's inside this black box,' Balasubramaniam says.

According to her, companies want the designers, developers and other experts to know why the machine is suggesting a specific recommendation as well as to measure the impact made by the AI solution. 'They want to make sure the impact is positive – not just for the end user but on a broader society level as well.'

With the doctoral studies, the project team members are aiming to include more companies to the research project and take the interviews to a deeper level.

'The kind of learning experience everyone should have'

Looking back Balasubramaniam feels studying at Aalto University has been extremely flexible without the pressure to select particular courses or collect credits.

'Back in India we had to complete eight courses in a semester. Here I had the flexibility and I completed the courses with a slower pace. It was a good thing; I feel like I learned the topics profoundly. I think that's the kind of learning experience everyone should have,' Balasubramaniam says.

Balasubramaniam also praises the professors for being very helpful and friendly. 'If you have any difficulties, they're there to help. For example, when I joined, Marjo Kauppinen told us that her office door is always open and you can come and ask whatever questions you have.' Balasubramaniam took a few opportunities to meet her professor to talk about her course selection.

Balasubramaniam underscores that the professors seemed to be interested in the students also on a human level, asking how they are doing and are they adapting to Finland.

Aalto University also gets positive feedback for the university's cross-disciplinary approach. 'I was positively surprised about the cross-disciplinary projects and teaching at Aalto University. I worked with people who are business students – and their perception is totally different! It was eye opening for me.'

Studying at Aalto has also facilitated a new kind of social life. Balasubramaniam now has friends from Turkey, Italy, Mexico, and the Nordics. 'I never thought I'd be able to mingle easily with people from other cultures. I'm glad I've managed to make good friends whilst in Finland.'

As Balasubramaniam does not drink alcohol, she has attended less the student parties – but has organized a lot of dinners and get-togethers at home instead. 'I love to cook, and I cook a lot. I've managed to get all the ingredients that I'd need for my Indian cooking here from the various Asian shops.'

Having lived in Finland for some years, Balasubramaniam has started to appreciate the quietness and the space. When visiting home in India, the constant noise irritates her. 'I'm so used to the quietness and people not poking you. In India when going anywhere, it's usually pretty noisy. And I'm used to the punctuality of Finland.'

By Anu Haapala,
Photo Matti Ahlgren

Nagadivya Balasubramaniam, MSc student and doctoral candidate

Education: Bachelor of Technology in Information Technology (Anna University, India). Completing Master of Science (in Tech.) degree at Aalto University in December 2019.

Lives in: Espoo

Hails from: Coimbatore, India

The greatest professional achievement: The completed master's degree and a conference paper

Has also

Partaken stage dramas in the form of scriptwriting & acting. 'I've been doing stage dramas since the school days and written dialogs for a couple of big dramas. Here at Aalto we created a concept video explaining how an application works and we enacted it.'

Followed cricket since the age of five. 'I have skipped classes to be able to watch the team I support play. In India, cricket is like a religion and a bonding factor. It's something we talk about when we get together, over lunch and over dinner.'

Travelled in 11 European countries since the beginning of studies at Aalto University. 'I had never traveled in foreign countries before I arrived in Finland, but I did a lot of research about the Nordics and spoke to my brother who lives in Sweden – so I knew what I was getting myself into when it comes to climate etc. So the culture shock wasn't heavy at all.'

How to achieve digital equality in smart cities

Who we design digital devices and apps for can unintentionally exclude some users, a process referred to as 'digital inequality'

Published: 26.11.2019

Johanna Ylipulli has started as a postdoctoral researcher in Aalto University's Information Networks programme, which combines social science expertise and a human-centred vision with engineering education.

'Technology should be studied from different perspectives, such as psychology or anthropology. Complex problems like climate change cannot be solved without a multidisciplinary approach'

Ylipulli studies how we can avoid digital inequality in smart cities. Digital inequality refers to three separate issues. Firstly, how people's opportunities to own or access different digital devices and apps differ. Secondly, the differences in people's skills in how to use the devices and applications. Finally, there can be differences in people's understanding of the deeper role technology plays in society.

'Inequality manifests itself not only among people, but also in power relations between people, large companies or institutions. For example, social media companies or government organisations like cities can collect, analyse and utilise their user's data.'

According to Ylipulli, it is important to consider who smart cities are being developed for, as people have different interests. Older people are considered reluctant to adopt and use new technologies, but at the same time, applications are designed primarily for young adults.

Ylipulli has already studied digital inequalities by interviewing experts responsible for digital development and digitalisation in Helsinki and the City of Espoo. In her new work, she will also have access to the user's perspective. One method she is using will be including a comprehensive question sets in an upcoming city service survey in Espoo,.

'Technology is often designed using a self-centred approach. Designers assume that everyone else is interested in the same things as they are.'

Similarly, when the majority of technology is designed by men, the male point of view is strongly visible.

'For example, car crash test dummies have long been made according to men's measurements. The tests have been designed to protect men's bodies. Many safety products, such as respirator masks, can also be too big for women. The same principle applies to digital technology, but the differences are more subtle and relate to content, for example.'

Virtual forest

Ylipulli is also studying the role of libraries as enablers for technological opportunities. Libraries made the Internet accessible to everyone in the 1990s. Libraries still have a role to play in increasing citizens' technological knowledge and educating citizens to be more critical of technology.

Ylipulli started a library collaboration in Oulu, where she designed a virtual reality application using participatory design methods in collaboration with computer scientists and the city library.

'The app includes a virtual environment similar to the library's real-world environment, but also an elevator that is able to take the user to three different fantasy worlds. In these fantasy worlds you can get recommendations for books, move objects, or write together.'

Ylipulli is now taking library cooperation to a new level in Helsinki, where an application that can be used by all libraries is being developed. The theme is a virtual forest.

"A forest is perceived as a calming and highly Finnish theme, and the virtual forest fascinates people. This is a long-term open source development project that libraries can develop further in the future.'

A woman in the world of science

Ylipulli is one of 15 scientists interviewed for the book Tiedenaisia: suomalaisia tutkimuksen ytimessä (Female scientists - Finns at the heart of research), which was published this year. The book introduces the interviewees' and their career paths.

'Women have to work much harder than men for their expertise to be taken seriously. Women are also not so easily seen as experts or leaders. This is reflected at superficial levels, such as where women have to pay more attention to their appearance in order to look like experts.'

However, women want to be considered primary as experts, not as women. At the same time, fields of technology need female role models.

'The IT sector in Finland still is still a very male-dominated field. This is a cultural phenomenon, and in some other countries more women work in the information technology industry.'

By Tiina Aulanko-Jokirinne,
Photo Matti Ahlgren

Machines to make sense of our health

Making use of artificial intelligence methods for personalised medicine.

Research, published: 26.8.2019

Samuel Kaski, Professor of Computer Science:

My research focuses on machine learning algorithms, which are powerful AI tools that benefit many areas in our day-to-day lives. They power things like automatic text translation, face recognition in pictures, and voice assistants like Siri and Alexa. There's hope that soon these powerful computer-driven predictions will be put to work in hospitals assisting clinicians in making diagnoses a method commonly referred to as personalised medicine. If we can make a deep learning algorithm that can spot your face in a busy crowd, can we detect when you're getting ill and identify how to best treat you?

Cancer samples make up one successful example. Using algorithms, we've been able to find out what information is relevant in datasets, and in their dependencies. These tools improve prognoses of what kinds of therapies are effective for each patient, based on a specific tissue sample.

However, one of the main challenges we face in this task is data quantity. Successful deep learning methods current require huge datasets to train on. Before a computer can detect a face in a picture, it needs to see thousands of photos of faces and more of things without faces before it can tell them apart. For patient data, though, the datasets we have to train with are much smaller. For some rare diseases there will only be information on a handful of cases we need to develop new methods that can provide the great predictive power of deep learning algorithms, but with much less training data. To create algorithms that would mean a computer could monitor your own health, the dataset available shrinks even further to only one person: you! My research group is working on designing new approaches better suited to smaller data sets.

"Using algorithms, we've been able to find out what information is relevant in datasets, and in their dependencies."

As well as being able to handle smaller amounts of data, we need to be able to make algorithms explain what they do. When your smartphone's keyboard suggests a word to you based on what you typed, you don't really think about how it reached that suggestion. However, if Siri started suggesting that you need to take expensive medication with side effects, or undergo a risky operation with a long recovery time, you'll definitely want to know why it this suggestion. I co-supervise a group that is looking to develop AI methods that can explain how they have reached their conclusions, which will greatly help integrate the strength of new artificial intelligence tools into existing healthcare infrastructure.

These problems are not unique to health applications for artificial intelligence. The best way that we can develop AI for a full range of advanced applications is by building expert communities that can work on different aspects in close collaboration. I am the director of the Finnish Center for Artificial Intelligence (FCAI), a joint initiative by Aalto University, Helsinki University and VTT. Our slogan is that we create 'Real AI for Real People in the Real World' and our work on developing new AI methods for personalized medicine is an example of this. FCAI brings together engineers and scientists with expertise and experience across a number of fields to develop the next generation of AI together and use it to solve society's grand challenges.

Photo: Aleksi Poutanen

‘Aalto is a safe place for building your skills and confidence’

Linh Nguyen wanted to obtain a degree with good job prospects and that is why she decided to study Data Science at Aalto University.

Published: 7.1.2020

When **Linh Nguyen** went to high school in Vietnam, she enjoyed studying mathematics and probabilities. But at the same time, she was also very interested in social sciences, and on her spare time she did, for example, volunteer work with her friends.

Before starting her Data Science studies at Aalto University, Linh had already lived in Finland for a couple of years, as she studied information technology, business and web development elsewhere. Therefore, she was already working as a Web Developer when she started her studies at Aalto.

‘In order to develop good and maintainable software, you need to have a very good foundation. That’s why I had been looking for Data Science courses in Helsinki, and that’s when Aalto opened the Bachelor’s Program in Data Science,’ Linh tells us now.

She finds it important to break the stereotype according to which all coders are men, and encourage more women to study technology and data science. She points out that, in some schools, girls are still discouraged to study science – back in school, that was her experience, too.

‘All my female friends in the Data Science program do really well, and at Aalto, no one will tell you that you cannot do it. Instead, they really value your points and input – it’s a really safe place to build your skills and confidence.’

‘As a data scientist, you have the power’

When Linh decided to apply to study at Aalto, she thought it would be important to obtain a degree with good job prospects. The English program in Data Science seemed like a good choice.

Now, Linh is a second-year student and happy with the choice she made. The program has provided her with valuable tools that help her in her current job as a Web Developer. She also enjoys studying at Aalto where people are always ready to help each other.

‘The professors and teaching assistants here are willing to listen to students. They encourage you to give feedback on courses, and you actually see that they make changes based on it.’

Linh lives on-campus in Otaniemi. ‘Living in Otaniemi is the kind of an experience that every Aalto student should get. The student life here is great! It’s convenient to go to school, but there are also a lot of clubs and activities that welcome everyone.’

Her plan is to start working on her Bachelor’s Project in fall 2020. She would like to work on a project focusing on either social networks or some type of a biological or medical application – and she is still very keen on working for a better society.

‘As a data scientist, you have the power because you know technology and math. Data science can help to tackle many societal problems, for example. You can use it to recognize fake news and polarized content but also to solve many other problems.’ After obtaining her Bachelor’s Degree, Linh wants to continue her studies in a Master’s Program.

Helsinki is safe and ideal for traveling in Europe

Linh thinks that Helsinki is a perfect place for studying in Europe. ‘When you live in the Helsinki region, you can easily access other places in Europe, but at the same time, you live in a very well-functioning society which you always feel safe in and which isn’t too busy.’

She says she has recommended studies at Aalto, and in Finland, for her relatives and friends who are still in high school. ‘This is a really good university, but you need to do well on the SATs to get in. If you get really high points, you may even get a scholarship.’

If Linh moves away from Finland in some point, she will surely miss the nature and the forests. ‘Many people think that nature is present everywhere in Europe, but in many places that is not true. But in Finland, you can just walk out of the city center and you’re already in the forest.’

Linh Nguyen, BSc student in Data Science

Will graduate with a Bachelor of Science (in Tech.) in 2021

Lives in Otaniemi

Comes from Bac Ninh, Vietnam

Greatest study-related accomplishment: Linh and her friend won a sustainability challenge at Junction 2019 (a hackathon organized in Helsinki) with a project called ‘Ecof.ai - Find pareto-optimal cost and emissions tradeoff for conference locations from flight data.’

By Anu Haapala,
Photo Matti Ahlgren

‘If you study data science, you won’t limit your choice of career in the future’

Before starting her Data Science studies at Aalto, Angeline Jayanegara obtained a diploma in fashion design.

Published: 14.1.2020

When **Angeline Jayanegara** was in school, she loved drawing and dreamt about becoming a fashion designer. After high school, her passion for fashion saw her move from her home country Indonesia to Singapore, to study fashion design. But after graduation, she decided to study more and a completely new field, Data Science, at Aalto University in Finland.

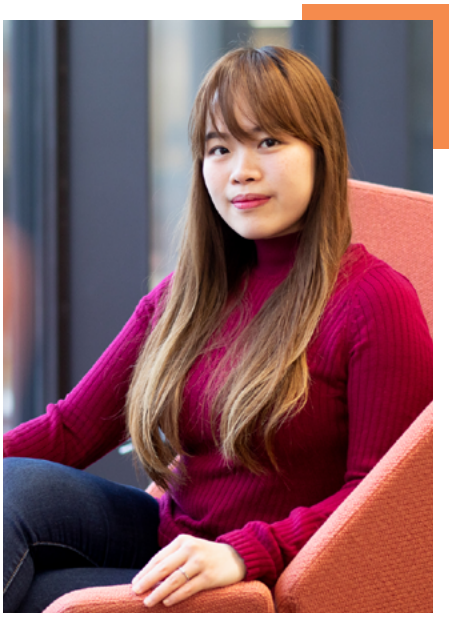
Already as a school kid, Angeline liked mathematics, and in high school, she represented her school in the International Mathematical Olympiad. ‘I like solving problems. Finding solutions to them makes me feel good.’

Now, she is a second-year student in the Aalto University’s Bachelor Program in Data Science. The Aalto data science students obtain the required skills to solve real-world problems using algorithm design, machine learning, artificial intelligence, statistical inference, operations research, and optimization.

Data science is a multidisciplinary field that focuses on the study of scientific methods used to extract knowledge from data and build models that cope with complex problems. It employs techniques and theories drawn from the broad areas of mathematics, statistics, information sciences, and computer science.

Next year when Angeline will start working on her Bachelor’s Project, she hopes to find a project in which she could use data to study fashion or color trends, for example. In the future, she would like to work as a data scientist in the fashion industry. ‘Nowadays, we can find data everywhere, so if you study data science, you won’t limit your choice of career in the future. You can extract data in any field.’

She wants to do also her Master’s at Aalto, in the Master’s Program in Machine Learning, Data Science and Artificial Intelligence. ‘It will give me the best foundation to work in data science. The world becomes more and more digitalized and almost an infinite amount of data will be available in the future.’



Finland is a worry-free country for students

During the first one and half years of her studies, Angeline has learned a lot about programming and mathematics. What she likes about Aalto in particular, is the support provided by the teaching staff and fellow students. The free help center Laskutupa helps students taking any mathematics courses at Aalto University. Students can also get additional help for studying programming.

Many types of activities take place on the Otaniemi campus and the facilities for studying are good, too. ‘When you want to study, you can go to any library. The environment is a big plus to me,’ Angeline explains.

Because the university is very international, one can easily make friends with people from across the globe and of different ages. That helps in building your network, Angeline points out.

Initially, she wanted to study in Finland because she had heard that Finland has one of the best education systems in the world and is a safe country to live in. After living in Finland for a couple of years, she still thinks that way.

‘I would recommend studying in Finland because it’s a safe country for teenagers and students, and people are honest. You don’t need to worry as much as in some other countries.’

Angeline currently lives in Helsinki, which means that she frequently travels from Helsinki to Espoo where the Aalto University campus locates. ‘I really like the public transport here. It is very easy to commute to any place in Helsinki, Espoo, or Vantaa.’

If she moved away from Finland, she would miss picking berries and mushrooms in the Finnish forests. The Everyman’s Right guarantees that anyone can do so free of charge. ‘I would also miss the snow and the northern lights in Lapland, and the environment that allows me to be freely who I am.’

Angeline Jayanegara, BSc student in Data Science

Education: Diploma in Fashion Design from the Nanyang Academy of Fine Arts (Singapore), will graduate with a Bachelor of Science (in Tech.) from Aalto University in 2021

Lives in Helsinki

Comes from Lombok, Indonesia

Greatest study-related achievements: Tuition grant for studying fashion design in Singapore, participation in the Mathematical Olympiad in high school, success in poem and drawing competitions.

By Anu Haapala,
Photo Matti Ahlgren

Janne Lindqvist: You can't help if you stay in the ivory tower

This sociable professor of computer science knows how to forge his own path and trusts his instinctive curiosity towards different research topics.

Published: 11.1.2020

I'm interested in the science of security, the science about security engineering. Security engineering is a very popular subject, and bold claims about security are made far too easily. For example, e-mail encryption methods sometimes have such major shortcomings that it would be better to talk of slightly less insecure options rather than secure ones.

My group and I have studied whether top-tier publications about authentication systems, such as passwords and facial recognition, are comparable. The answer is no – there are no common practices in the performance reporting, and as such the results are not often comparable.

Another interesting work we did was about usage-based car insurance, which is available in the United States and some other countries. Many companies monitor driver behaviour using GPS technology. However, some companies claim that their equipment measures only speed and, therefore, they do not know where the driver has been during the day. We showed that, based on the speed and a starting location, the companies could work out the movements of their customers – in other words, the claims of better privacy were unfounded.

How did you become a research scientist?

In the beginning of my Master's studies, I thought I'd become the best programmer in the world. I worked in companies in the field and we also founded a company, but just programming turned out not to be my thing.

When I then started working as a teaching assistant in Helsinki University of Technology, I realised that I could really help students. I found it hugely satisfying – with my experience, I could actually be useful to others. I also realised that research can be done in a really practical way: picking

out the problems of real life and solving them with the help of science.

After my doctoral dissertation, I went to work as a postdoctoral researcher at Carnegie Mellon University. Because I wanted to do more human-centered research, I focused on human-computer interaction – which I didn't know anything about. As a research scientist, I have never wanted to look at things from just one angle or just the particular perspective of my own field.

What have been the highlights of your career?

There have been many, and they have been very varied. Top-tier publications and progress along my career path as a professor, both in the United States and here at Aalto, have been very significant things. One unquestionable highlight was receiving the prestigious National Science Foundation CAREER Award. At a workshop for the application for the award, we were urged to be as ambitious as possible and I combined themes that interest me, ranging from cognitive processes to security engineering.

Another very memorable achievement was the application that we created for a township of New Jersey in the aftermath of Hurricane Sandy. The application enabled residents to report any dangerous trees and other risks to utility companies. Once the danger spots are clearly and undeniably pointed out, the utilities companies cannot retrospectively claim that it did not know about them – and it is therefore worthwhile for them to do something about it before the next hurricane comes. For our work together with the township we received the Sustainable Jersey Creation & Innovation Award. The application was not technically demanding and did not produce top publications, but it showed once again how important it is to do this work in interaction with people and society, and not just look down at the world from the ivory tower.

What is required from a research scientist?

Scientists who achieve good results believe in what they are doing even when no one else does. I have great confidence in the feeling that there is something interesting and worth exploring here. It always takes time, and one must put up with moments of despair – and get through them and carry on.

Independence is one of the best and most challenging aspects of the scientist's work. Nobody's is going to come and say what you should do and how you should do it. Or if they do, you can decide how seriously you take their advice. Good interaction skills are also helpful. I'm a social guy, I like to bounce ideas around with colleagues and my students. It also doesn't do any harm to have a good sense of humour. Often our work is not, after all, a matter of life and death.

By Minna Hölttä,
Photo Kalle Kataila

Juha Siivola encourages researchers to innovate and think of ways to commercialise their work

‘In addition to having a long-term academic goal, it would be good to think about possible short-term results,’ says Siivola, who works as an innovation advisor

Published: 14.2.2020

When Juha Siivola began work at Aalto University after a long career in industry, his objective was clear. He wanted to help develop ideas, technological solutions, products and companies from academic research. These will advance the Finnish society and help maintain Finland’s competitiveness, and Aalto is an ideal environment for such activities.

Siivola, who graduated as Master of Science in Technology in the late 1990s, worked in the industrial business a couple of decades before moving to his current role as an innovation advisor at Aalto University School of Science. He gained experience in, for example, international software and product development at Nokia, Symbian and Digia, along with several smaller companies and startup-typed projects.

Siivola believes his experience will prove useful when the ideas stemming from the work of Aalto’s researchers is commercialised.

The academic world often focuses on the academic merits of the research alone. Siivola wants to encourage researchers to innovate and consider the commercial possibilities related to their work. These should be considered monthly. ‘In addition to having a long-term academic goal, it would be good to think about possible short-term results,’ Siivola says.

It is also useful to look into the types of research being carried out at other departments and institutes of higher education. Several successful innovations and inventions are based on cross-disciplinary collaboration, and opportunities for collaborating at Aalto are good.

‘When considering, for instance, the field of information technology, it is good to keep in mind that software are always tied to e.g. equipment solutions and the manufacturing of material. Considering the technical impact of, say, algorithms when they are applied to a different branch of industry, is beneficial.’

Aalto provides a safe environment for experimenting with commercialisation

Siivola and his colleagues are in charge of the School of Science’s IPR, i.e. intellectual property rights and transferring them. Practically, this deals with patents and control over them. A research and innovation service team helps supporters in refining invention ideas and applying for patents. The application process is a long one, lasting even three to five years.

‘This involves a lot of analyses and commentaries on patent texts and reacting to interlocutory decisions. It also involves strategic decisions on e.g. which technology sector and geographical area the patent should be directed at.’ Siivola is also involved in technology transfers – AI solutions will be increasingly seen in all industrial sectors in the future.

The team of research and innovation services focuses on commercialisation as well. Once research projects produce something with commercial potential, Siivola and his colleagues consult the researchers and help develop business ideas and business logic.

The goal is to help create a solid foundation for a company starting its journey at Aalto. ‘We want to provide the best tools we can and be involved during the entire development project. One successful tool is the Research to Business funding (formerly TUTLI) offered by Business Finland. This makes the commercialisation and research project last from one to two years.’

Siivola hopes to be able to help researchers find ideas and a basis for commercialisation. He encourages contacting research and innovation services on a very light basis. Ideas about invention or business ideas can be sent through the innovation team website. It does not have to be a fully refined idea, and all kinds of initiatives are welcome. ‘An innovation a day keeps the moss away,’ Siivola states.

The university is a good environment to start advancing your own invention or innovation. In the corporate world, the invention always belongs to the employer’s, but at the university, the practice is beneficial for inventors. An invention made at the Open University, for example, belongs to person who makes it. ‘Aalto offers a safe environment for experimenting with commercialisation and business thinking,’ Siivola says.

By Anu Haapala,
Photo Matti Ahlgren

Many practical issues are related to questions of theory – this steered Jara Uitto's interest towards theoretical computer science

Even though theoretical computer science is – as its name suggests – theoretical, its connection to real-life questions is easy to draw, says Assistant Professor Jara Uitto

Published: 28.1.2020

Assistant Professor Jara Uitto did not always know that he would become an academic. When completing his bachelor's thesis on computer science at the University of Helsinki, his instructor Jukka Suomela familiarized him with theoretical computer science and distributed online algorithms in particular. Although questions of computer science are theoretical by definition, drawing can help to perceive them.

Uitto noticed that drawing pictures made research on distributed algorithms more approachable and that it does not require superhuman abilities to understand research questions of this kind; you simply need to go the extra mile. Now he works as a professional researcher of theoretical questions related to communication networks, i.e. networks attached to several computers.

Uitto noticed that drawing pictures made research on distributed algorithms more approachable.

Uitto brings up a couple of practical issues he can direct theoretical questions on in his work.

The Skype caller wants the video image and sound to be of good quality, and for these to be efficiently conveyed to the other party of the conversation. Someone needs to design how these work on the iron and software level, along with the related theoretical questions.

Huge data clusters of major corporations, in turn, keep churning numbers at a steady phase. 'Someone has to work out how it happens. I'm also thinking about such a computing theory in my work,' says Uitto.

Unofficial meetings help in networking

Uitto's did his basic studies at the University of Helsinki and now works as an Assistant Professor at Aalto University, but in between he spent eight

years in Switzerland. He worked on his doctoral thesis at ETH Zürich, which was followed by a year in the industry and two years as a postdoc researcher.

During his postdoc years, he built extensive networks in the field. Mohsen Ghaffari, who headed Uitto's research

"Aalto is a university of just the right calibre."

group, started as a professor at the time when Uitto began his own work. The professor often invited guests for a visit, allowing Uitto to get acquainted with new people and to network with them.

Arranging networking opportunities, particularly for new employees, is important. 'Any unofficial activities should work well. Parties by invitation always include a great number of people, but don't make it easy to look for individual people, especially when there's only so much time.'

Uitto finds meetings with a maximum of ten people in the same space to work best: in this group, they go over matters pertaining to the research. 'If you can drink mulled wine or beer, or eat pizza – which does in fact work best – it must be a good way to create contacts.'

'Childcare is arranged better here'

Uitto who started working at Aalto in October 2019 does not consider himself to be 'particularly patriotic,' nor did he feel any notable home sickness when in Switzerland. He applied for work around the world. The return to Finland took place, when an offer received from Aalto topped almost all other offers as a whole. 'Aalto is a university of just the right caliber. Here I can continue with the same level of academia while surrounded by high-level students and personnel.'

Of course, the typical Finnish balance between work and leisure somewhat tipped the scales, along with personal reasons. 'I have two children whose grandmother lives here. This made the decision easier. Jukka (Suomela) who researches similar topics is here, and so are my relatives. Helsinki is also not 12 hours away from Europe by plane.'

Adjusting to the change, apart from the bad weather, has been smooth. Everyday life for the family of small children is now easier than before. 'In Switzerland, childcare is nearly ten times as costly as here, and we weren't able to place both our children in full-time day care. Here people can take their children to the same place every day, allowing the children to spend time with the same, familiar faces.'

Uitto's children are multilingual, but in Switzerland their German came more naturally than Finnish. 'I became slightly worried that language could be an issue. But my older child, now four, began to speak fluent Finnish within two weeks.'

Uitto points out that the perks offered by employers to those with families arriving from abroad may be an important incentive when it comes to selecting a work offer. In Finland, day care has been arranged well, but it also means literal day care: the child has to be taken to care and always picked up at the same time. This is sometimes not a great fit for an academic's working rhythm. Those moving from abroad often do not have a support network in the new country to help with childcare.

'It would be convenient if, for example, the university would be able to arrange some afternoon activities, especially for smaller children. It wouldn't need to be every night, but every now and then.'

By Anu Haapala,
Photo Matti Ahlgren

Jara Uitto, Assistant Professor

Education: Doctor of Science from ETH Zürich

Lives in Helsinki

Born in Kerava

Greatest professional achievement: Developing a solution for a problem that had long been on his mind. During his master's studies, Uitto became interested in a game where the cops and robbers moved by turns from one node of the network to the next, with the cops winning when they reach the same node as the bandit. This involved a research problem: if the game includes one robber and two cops, how many rounds do the cops need in the worst-case scenario in order to catch the robber? 'While it was an interesting question, solving it seemed unlikely. In 2017, we did manage to find a solution together with my co-writers! The result was published in a well-known conference, which also secured visibility for it.'

Has also

A bouldering hobby. 'In Switzerland, climbing was somewhat mandatory. I became immediately hooked on bouldering. I had never imagined it would be as cool as it is.'

Been an enthusiastic StarCraft II player. 'As a young boy, computer games were a big thing for me. When I moved to Switzerland, another researcher who also enjoyed playing started in my research group. We ended up playing StarCraft together. Later as I started a family, we began to arrange weekly meetings. My friends would come over and we would make food and play as a group.'

Many characteristics untypical of a Finn, according to his friends. 'They say I'm too extroverted! I'm an open person, but the downside is that I may also talk too much sometimes. However, breaking the ice comes naturally for me and I am able to make new friends easily.'

Eero Hyvönen introduces masses of data to humanists – and everyone else

Data from the 'sampos' developed by Hyvönen and his colleagues are open to everyone, and they facilitate the work of historians, for example

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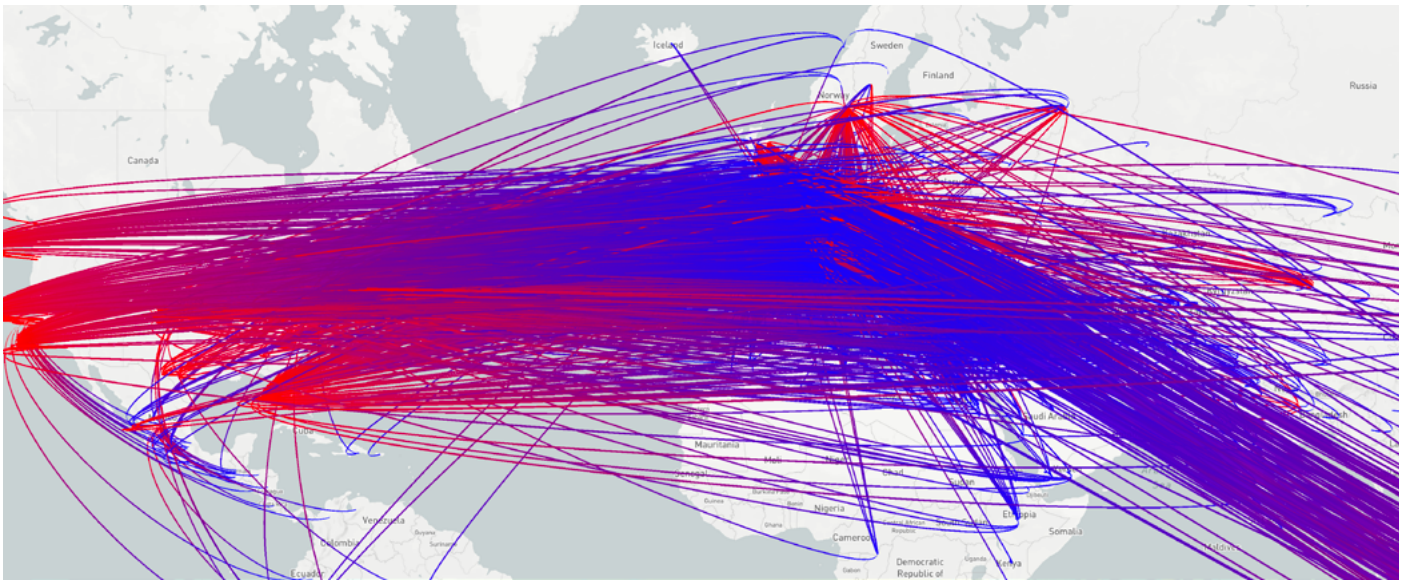


Looking for the latest book tips or information on a relative who fell in the Winter War? Out to find the life's story of a famous Finn? Or are you perhaps a historian interested in the mobility of medieval texts globally?

Eero Hyvönen, Professor at Aalto University and Director of Helsinki Centre for Digital Humanities (HELDIG), and his Semantic Computing Research Group (SeCo) has made it significantly easier to search for such information. Hyvönen is known as the person behind the sampos.

Using the sampos, anyone can search information on a range of subjects – ranging from Finnish fiction, soldiers who fell during World War II and the life and close circle of famous Finns.

Sampos combine data picked from different databases. They can also be used to visualise and analyse the data. 'At some point, we realised that the sampo makes for a rather good brand. I believe we have twelve different sampos at the moment, with more on the way,' Hyvönen states.

BookSampo and WarSampo have gained the most popularity

Sampos facilitate the works of humanists, as they provide access to data-analytical tools without requiring in-depth IT skills. According to Hyvönen, sampos have resulted in several humanists taking an interest in technology.

Hyvönen highlights that all sampos are open: the data and the applications based on this data can be used

"The network includes 120 million connections between different pieces of data"

by anyone and in any manner of their choosing. Several sampos have been of interest to researchers, as revealed by the number of users.

BookSampo, which combines all the works of fiction from Finland's public libraries, was used by a total of two million people last year. It is currently maintained by public libraries, which update the database whenever they acquire new works of fiction.

The second-most popular of the sampos is the WarSampo, which has received international awards and attracted over 630,000 users since 2015. It combines data related to the Winter War and Continuation War from different war history sources. 'We know of all the approximately 95,000 Finns who passed in World War II and thousands of other known soldiers, based on materials from the National Archives. The linked data also includes thousands of military units, tens of thousands of war diaries, 160,000 authentic photographs from the Finnish Defence Forces, historical maps and so much more,' Hyvönen describes.

The user can, for example, look for information on a relative who died as a soldier in World War II. This appears to be the most common reason why people have been enthusiastic about getting to know WarSampo. 'The system automatically reconstructs the soldiers' warpath or war story.'

BiographySampo reveals even surprising connections between famous Finns

Perhaps the most versatile of all the sampos is the BiographySampo. It contains over 13,000 biographies on famous Finns from the Finnish Literature Society, complemented by sixteen other sources, such as BookSampo and WarSampo. BiographySampo has seen over 29,000 visitors.

When developing the BiographySampo, researchers created a gigantic semantic network from biographical texts with the help of artificial intelligence. The network includes 120 million connections between different pieces of data. The service can be used to research the biographical events of different people on maps and in time, along with their movements, networks and connections. BiographySampo easily displays, for example, a renowned person's relatives, which parts of the world they have influenced in and how.

In the portal, you can also conduct language analysis and explore the extent of certain words being associated with different people. 'It reveals, for example, that biographies about female Members of Parliament use a large number of the words "child" or "family," whereas family matters are rarely brought up in connection with corresponding male Members of Parliament.'

Some connections between different people may even be confusing. 'Looking, for example, at the egocentric network of **Tapio Rautavaara**, you can see that he has a direct connection to academic and poet **Aale Tynni** – which seems a little peculiar. However, BiographySampo reveals that they both won a gold medal in the London Olympics: Aale Tynni as the winner of lyric works, which was an Olympic title at the time.'

The latest sampo reveals how medieval texts may have circulated the world during the centuries

The latest newcomer in the Sampo series is Mapping Manuscript Migrations (MMM). Published in Washington DC at the end of January 2020, it has proven useful to historians in particular.

MMM combines over 200,000 hand-written documents from the Middle Ages and the Renaissance period, along with 900,000 related events. The documents have been compiled from three massive sources: the famous Bodleian Library at the University of Oxford, the Schoenberg Institute in the US and the French research institute IRHT.

'We gathered information from these different organisations to make the manuscripts easier to research. These are internationally circulating manuscripts and the same ones are mentioned in different databases. In this project, data from the different databases were combined in order to provide a global view.'

The service can be used to find out, for instance, when a certain manuscript has been made and by whom. It includes also over 2,000 copies of the documents by the ancient Greek philosopher Aristotle, made in the Middle Ages. Since many of the texts are copies, their contents may deviate from the original.

'For instance, the adventures of Marco Polo come in many different versions. A new copyist or publisher wanting to make business may have added a few funny anecdotes,' Hyvönen says and laughs.

One idea behind the new sampo was to make visible in the portal's map view how the documents have circulated globally. User-friendly data analysis tools have been integrated into this one as well, and they can be used without any additional learning. 'If the researcher is not satisfied with our visualisations and wants to use, say, another map programme, they may select an interesting cluster of data and download it as a spreadsheet.'

A bit over a month after the MMM had been published, it had attracted a total of approximately 1,500 users. Considering that it is directed at researchers of medieval manuscripts in particular, the amount is quite high.

Do you have a historical background, considering your devotion to these subjects? 'I do find history interesting, of course, and I've always admired the multidisciplinary work of Renaissance people, but I am a graduate of Helsinki University of Technology,' Hyvönen says.

He considers the subject appropriate for semantic research. 'Even though we're not professional historians, we are able to understand these things at a general level, which makes this an understandable research theme. A more in-depth understanding on the projects comes from the humanist researchers who are involved. Collaborating with the Helsinki Centre for Digital Humanities at the University of Helsinki's Faculty of the Arts is an important part of our work.'

By Anu Haapala,
Image: Screenshot from MMM

The sampos that are being developed:

AcademySampo, which holds detailed information on the 28,000 people who received academic education in Finland during 1640–1899

FindSampo, which is developed from archaeological findings data from the Finnish Heritage Agency and the National Museum of Finland

LawSampo, which is created by researchers in collaboration with the Finnish Ministry of Justice and Edita Publishing, publishes central and Finnish legal cases as an intelligent semantic portal

ParliamentSampo is based on materials from the parliament and is developed for the purposes of researching political culture within the DIGIHUM programme of the Academy of Finland

HistorySampo addresses Finnish history and utilises, for exampe, the timeline data of Suomen humanistiverkko Agricola ('Finnish Network of Humanists – Agricola')

Eero Hyvönen reveals that there is an open infrastructure linking the different sampos in the making. 'You might call it **SampoSampo**.'

Nitin Sawhney: In designing technologies for a complex world, how do we engage the social and political?

Nitin Sawhney explores the role of human-centered research and design, beyond the traditional boundaries of computer science, in transforming civic action

Published: 19.5.2020

Professor of Practice **Nitin Sawhney** and his partner moved to Helsinki from New York in the midst of an emerging global pandemic, as countries began closing their borders and Aalto University shifted to remote work and teaching.

Despite the exceptional start at Aalto, he seems grateful. 'On every level, we have been so fortunate in this situation, and I can't say enough about how well the Finnish system has functioned for us.' As an academic researcher Sawhney's residence permit was approved in less than 10 days, which normally takes far longer. Having visited Helsinki several times previously, he had an opportunity to get to know many of his faculty colleagues at Aalto.

This made the physically-distanced interactions with colleagues over Zoom this spring far less awkward for Sawhney. 'I already feel very connected to the Aalto community and I know there will be many more opportunities to continue building this network now that I'm here,' he adds.

Computer science combined with media and arts

Crisis was part of Sawhney's life even as a child when his family was forced to leave Tehran, Iran in the midst of a revolution in the late 1970s to move back to New Delhi, India, where he was born. Returning to live in the Middle East and across the U.S. for most of his life clearly shaped Sawhney's worldview. 'When you're around and grow up in these places, you recognize the world is a complicated place and that technology has a crucial role, but we need to take many social and political aspects into account.'

Sawhney trained in computer science and engineering but has gained experience in media, documentary film, design, arts, and activism. He completed his doctoral studies at the Massachusetts Institute of Technology (MIT), while conducting research at the MIT Media Lab in speech interaction, wearable computing, and distributed design collaboration.

After finishing his PhD, Sawhney co-founded Akaza Research, a software startup to develop open source platforms for clinical data repositories. He later led new product development for Cytel Inc., on statistical simulation tools to support adaptive clinical trials. 'Working in industry I tried to promote open access principles, interoperability standards and novel business models to support partnerships for public biomedical research, but the pace of such innovations and practices can take a very long time to be adopted,' he says.

The transdisciplinary ethos and international orientation made Aalto an attractive option

Sawhney has collaborated with artists, activists and social scientists which greatly challenged his perspective. 'I realized that my own sensibility has been transformed by engaging with seemingly intractable problems in society in somewhat unexpected ways. Arts, design, humanities, and political activism can be integral to how we as computer scientists make sense of and act in the world,' he adds.

This is what led Sawhney to take up a faculty position at The New School in New York in 2011 and collaborate with colleagues across disciplines in social science research and at the Parsons School of Design. In all his work, Sawhney engaged the design of collaborative digital platforms with participatory action research among communities in crisis or contested spaces.

The transdisciplinary ethos and an international orientation are also what drew Sawhney to join Aalto University where science, engineering, arts

and design are more easily infused in people's work. 'I want to explore things that the Nordics have done well, particularly in terms of participatory design, social equity and sustainability. Obviously, Finland has also been an important research and technology hub since the days of Nokia.'

Sawhney also had a more personal link to Aalto. While at MIT, he advised the PhD thesis of **Teemu Leinonen** who is now an Associate Professor of New Media Design and Learning at Aalto. 'We kept in touch over the years. When I was thinking about Aalto, Teemu was very encouraging; he invited me to stay at his home and was able to connect me with the Aalto community informally. That made me feel comfortable at Aalto right away.'

Researchers should collectively seek solutions for the biggest crises for the globe

While Human-Computer Interaction (HCI) remains his core research area in the computer science context, Sawhney plans to expand his prior work in participatory design with children, multi-modal voice-based interaction, and cooperative Human-AI systems in crisis response.

He hopes to push himself and his students to consider how we can contribute to collectively understanding and designing for seemingly intractable problems. 'I feel like climate change, besides this pandemic, is one of the biggest crises for the globe and our future, and if we are not finding a way to collectively address this crisis, I don't know how we are going to be valuable.'

This summer Sawhney teaches online at Aalto, on e.g. his course 'Human-Centred Research and Design in Crisis.' He hopes that students will develop a deeper understanding of how to conduct research and design for technological innovations in complex crisis contexts, while examining their ethical implications. 'The course offers students opportunities to engage industry and organizational partners in the city and elsewhere, but also help the faculty to develop socially engaged curricula that we can expand in future courses.'

Sawhney says he has settled in well in Helsinki, but will miss his life in Brooklyn, New York. 'We lived right by Prospect Park, which is almost like the Central Park of Brooklyn. I would go running in the park almost every day and I was very involved in the community.'

He speaks highly of the vibrant social and cultural atmosphere of Brooklyn, its diverse people, arts exhibitions, community gardens, and activism. 'I imagine these things are also present in Helsinki, so I'm very much looking forward to finding those kinds of eclectic arts spaces, participatory communities, and critical engagement here too.'

By Anu Haapala,
Photo Matti Ahlgren

Nitin Sawhney, Professor of Practice

Education: PhD in Media Arts and Sciences from the Massachusetts Institute of Technology

Lives in Helsinki

Was born in New Delhi, India, but feels at home also in Cambridge, Massachusetts, and Brooklyn, New York

Greatest professional accomplishment: Running a startup company and transforming his dissertation research into a practical context, creating significant public impact. 'It was a key moment for me to leave academia, create a high-risk startup, build a team, and develop open source software platforms with a viable business model to sustain it. The lessons from this experience have shaped how I manage research projects and industry partnerships.'

Greatest non-professional achievement: Establishing Voices Beyond Walls, a program for participatory media, youth training, and community-based research in Palestinian refugee camps. 'It was probably the hardest thing I've done in a non-academic context; each summer for five or six years I led a team of artists, educators and social workers to develop the programs and evaluated their impact. It helped me develop a socially-engaged pedagogical practice.'

Has also

Taken a one-month expedition in the Himalayas. 'I hiked and camped with artists, scholars and writers on a historic pilgrimage route from Nepal to Tibet. It was a very transformative moment to explore this world and the role of sacred in people's lives. Along the way, I recorded the sounds of the landscapes and monks chanting. After the trip, I devised an art installation with a soundscape where people could walk on Himalayan salt.'

Made a documentary film with children in Gaza. 'While working in Gaza, I decided to make a film on the role of kite making and flying on the lives of children. Not having a production crew, I trained a group children on filmmaking and we made the film together. It became such a joyful project, as they captured the lives of other kids in such humorous and authentic ways; all this is reflected in the film, Flying Paper, which has been widely seen.'

Been constantly confused with his namesake, musician Nitin Sawhney. 'He became very popular in the nineties, and I would mistakenly receive his fan mail all the time. But one day he emailed me out of the blue to tell me about his experience. For a concert he was performing with Sting in France, the publicity posters accidently used the wrong person's image. I never received a copy of that poster with me and Sting! But my namesake kept in touch with me and after I finished my documentary in Gaza, he produced the soundtrack for it. When the film premiered in London, audiences were even more confused with the credits.'

Computer Science News

Erkki Oja has been awarded the Frank Rosenblatt Award for his achievements in artificial intelligence research

The huge current boom in artificial intelligence research started just as Professor Oja retired after a decades-long career in the field. His impact and contribution to our understanding of AI is now being recognised by the IEEE.

Awards & Nominations, published: 4.9.2019

Recent developments in artificial intelligence research seem incredible to Professor Erkki Oja, who has been researching neural networks since the 1970s. Back then, there were only a few researchers in this field and their innovations did not lead to much because they could not be tested with large amounts of data. Computers were simply too inefficient.

Now Erkki Oja has been awarded the Frank Rosenblatt Award for his achievements in artificial intelligence research.

'Neural networks have been making a breakthrough in the last ten years. These days papers and magazines have lots of articles about artificial intelligence, machine learning, and neural networks. I am a bit annoyed that I retired just when the artificial intelligence boom started!' Erkki Oja said.

During Oja's career, neural network research was conducted by a small group of people and there wasn't much publicity about it. In the 1980s and 1990s there was a slight increase in interest, but it also faded away. However, the research continued and its popularity persistently grew, resulting in over 50 doctoral graduates from Oja's group. A lot of students also graduated with a Master of Science in Technology degrees.

"I was a little worried about whether all the graduates would find work. But now their particular skills are in high demand,"

'I was a little worried about whether all the graduates would find work. But now their particular skills are in high demand,' said Oja.

One of the grounds for the Frank Rosenblatt Award include the "Oja rule" developed by Erkki Oja in 1982. It is based on a model developed by Frank Rosenblatt in the 1950s, according to which learning is the strengthening of synapses and nerve connections.

'The Oja rule is used in artificial neural networks. However, most of the references now come from brain research,' Oja said.

For example, the Oja rule has been used in the European Union-funded Human Brain Project, which aims to build a model of the brain. Oja's research group also developed independent component analysis, which further improved the Oja rule's algorithm.

Artificial intelligence from a pioneer's point of view

The current artificial intelligence algorithms are basically the same as in the 1980s. On the other hand, computational efficiency and data volumes have increased dramatically. Each problem requires its own artificial intelligence, for example, speech-recognising artificial intelligence cannot recognise images.

According to Erkki Oja, artificial intelligence algorithms should not be blindly relied upon, for example, because they lack morals. In addition, the logic of decision-making is based on the data on which the artificial intelligence has been trained.

'Data may cause distortions. For example, granting of a loan should be based on the applicant's income and housing information, but skin colour may become a decisive factor in decision-making,' Oja said.

From the perspective of digitalisation and automation, artificial intelligence has enormous potential. Likewise, digital human sciences can provide a more accurate idea of what people want and how they think. According to Oja, it is however obvious that this also creates opportunities for abuse.

By Tiina Aulanko-Jokirinne
Photo Matti Ahlgren

Aalto researchers awarded for an article showing that algorithms cannot match more effectively than they do now

Jukka Suomela and his colleagues prove that any method designed to find a matching is either slow or leads to a wrong solution.

Awards & Nominations, published: 19.9.2019

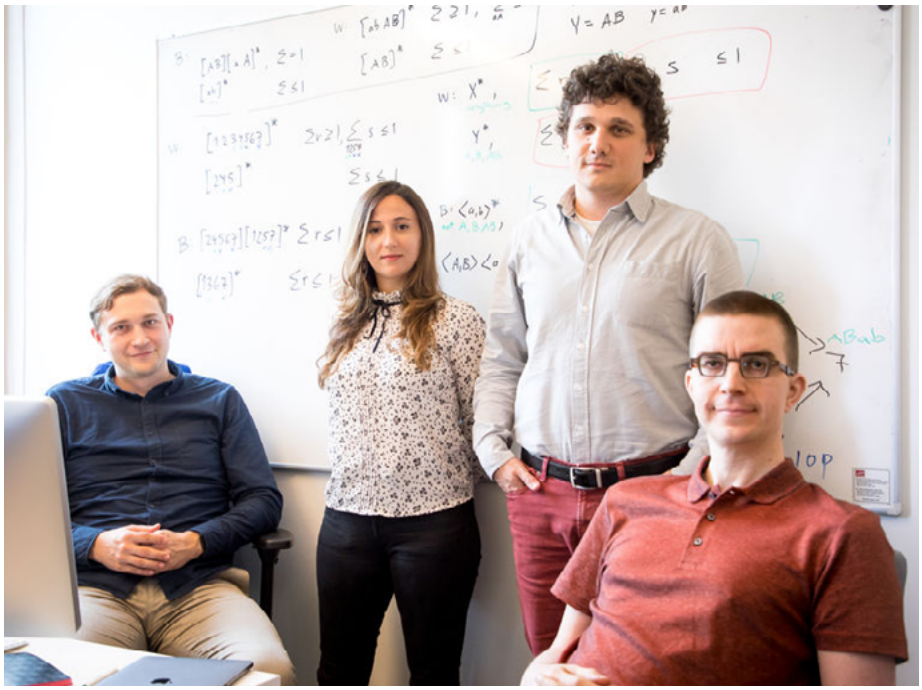
The prestigious conference, Foundations of Computer Science (FOCS) 2019, gave out the Best Paper Award to Assistant Professor **Jukka Suomela** and his colleagues. FOCS is one of the two major conferences in the field of theoretical computer science. The title of the awarded article is Lower bounds for maximal matchings and maximal independent sets.

One of the most fundamental questions in computer science is what types of processes can be automated effectively. In the research project in question, Suomela's group looked at the topic from the perspective of distributed computing, and they wanted to figure out what types of tasks in a network can be solved effectively. 'Matching is an example of such a task,' says Suomela.

The key question about matchings is how far one needs to see from a single node in order to find a pair for it in the network. Suomela and his colleagues showed mathematically that looking at the local neighborhood of the node is insufficient and matching cannot be done more effectively than current algorithms do.

Even though this study is theoretical basic research, the matching problem can be made more understandable by using a simplified situation in which employers need new employees and job seekers need new jobs. In other words, employers need to be matched with the right job seekers.

One way to solve this problem is to use a centralized service that contains information about all job seekers and open vacancies, but the problem of matching can also be solved by using a decentralized, local approach. In the aforementioned example, a job seeker would list all jobs they find interesting and approach them systematically, one by one. Such a method is, however, slow and researchers have long been interested in how effectively algorithms can match.



In their article, Suomela and his colleagues proved that any method aimed for matching is either slow or inevitably leads to a wrong solution. These results indicate that the development of algorithms designed to solve these types of problems has reached a point in which researchers can show that current methods are the best or almost the best possible solutions. 'We managed to set boundaries for how effective methods can exist. We found out, for example, that one method that was developed in 2001 is, in given situations, the best possible approach. It's truly impossible to speed it up.'

"We found out, for example, that one method that was developed in 2001 is, in given situations, the best possible approach. It's truly impossible to speed it up."

Suomela worked together with Aalto University postdoctoral researchers **Alkida Balliu**, **Juho Hirvonen**, **Dennis Olivetti** and **Mikaël Rabie** and postdoctoral researcher **Sebastian Brandt** from ETH Zürich. The Academy of Finland funded their research.

The FOCS Best Paper Award is one of the most appreciated awards in the field of theoretical computer science. 'It's very unlikely that I would receive anything this big for another time in my career. In our field, everyone will speak about maybe five topics this year, and this will be one of them. It means very, very much to me,' says Suomela.

By Anu Haapala,
Photo Matti Ahlgren

New Academy Research Fellows explore the changes in work and society, and how the pandemic may affect them

How state-owned companies and digital inequality will change with the pandemic makes up some of the work of new Academy Research Fellows

Awards & Nominations, published: 15.5.2020

The Research Council for Culture and Society of the Academy of Finland has granted funding to two Aalto Academy Research Fellows for a five-year period of 2020–2025. **Pasi Nevalainen** examines changes in the business operations of state-owned companies. During exceptional situations, the role of state-owned companies gains particular emphasis, such as in the manufacture of essential protective equipment and in decisions granted by the state to support its companies. Johanna Ylipulli studies digital inequality, which also affects remote work and contacts with family and friends during exceptional situations.

"Should a state-owned company maintain a manufacturing capacity that is not worth maintaining under normal circumstances?"

'The project will examine changes in the basic characteristics of economic activities carried out by the state and the significance of government ownership of companies. Should a state-owned company maintain a manufacturing capacity that is not worth maintaining under normal circumstances? A public debate has arisen on matters such as respiratory protective equipment, as its manufacture was moved away from Finland in the past', says Pasi Nevalainen.

Nevalainen analyses long-term changes in the state's business operations in Finland and internationally. It can be questioned to what extent state-owned companies from countries like China are comparable to European or Finnish state-owned companies. Nevalainen also examines the changes from the perspective of history. The significance of state ownership, the way in which companies operate and their environment have changed dramatically over the past few decades, yet general perceptions on the characteristics of the state's business operations are still based on the models of the 20th century.

Recently, the role of the state in the economy seems to have become more pronounced again.

'In a pandemic situation governments are very generous in supporting the activities of state-owned companies, such as airlines. Finland is also dependent on air and transport connections, which affects the decisions', says Pasi Nevalainen.

'We have now seen how the state has intervened in the business operations of different companies. The effects may also be permanent, the longer the exceptional situation continues. Without a clear exit plan, the support systems may take a life of their own. In this case, the state may have to take over failing companies, start new production itself, or form more permanent support schemes.'

Importance of digital skill level

Johanna Ylipulli's research combines cultural and social sciences with information technology research. The first objective is to understand digital inequality particularly in smart urban areas and, in general, in a society that is becoming more digitalised. Ylipulli aims to find out how this inequality could be simultaneously reduced and prevented. Her aim is to produce ideas, concepts and practical applications.

'The situation with coronavirus has emphasised the importance of research, as almost everyone has now relied on accessing the internet. The level of digital competence affects everyday life and access to information, work and how well you can keep in touch with family and friends', says Johanna Ylipulli.

Digital inequality is a complex phenomenon that may be affected by factors such as the economic situation, educational level and gender.

'Age matters, too, but at the same time, there is a lot of variation within the age groups. The project focuses on adults over 65 years of age and young adults. In this respect, the purpose of the study is also to dismantle stereotypes. Older people have not necessarily lost track, and not all young adults are digital natives', says Johanna Ylipulli.

"Older people have not necessarily lost track, and not all young adults are digital natives"

In Finland, Ylipulli will work in cooperation with the cities of Helsinki and Espoo, for example, through the Urban Academy network. The University of Helsinki's INEQ network (Helsinki Inequality Initiative) is also an important partner. Aimed at developing smart cities, the Finest Twins project will gain expertise in social sciences through cooperation with Ylipulli. Plans for researcher visits to Barcelona and Australia are also under way.

By Anu Haapala

Professor Samuel Kaski selected to the Finnish government's Research and Innovation Council

Awards & Nominations, published: 11.10.2019

Academy Professor Samuel Kaski was appointed to the Finnish government's Research and Innovation Council. The new council was elected on October 10.

The Finnish Center for Artificial Intelligence FCAI, directed by Kaski, announced that it is pleased that Finland sees the importance of artificial intelligence and that the Finnish government displays trust in knowledge and research in general.

The Research and Innovation Council is an advisory body chaired by Prime Minister that addresses issues relating to the development of research and innovation policy that supports wellbeing, growth, and competitiveness.

Professor Lauri Malmi receives prestigious, international award for his significant contribution to computer science education

Awards & Nominations, published: 22.11.2019

Lauri Malmi, Professor of Computer Science, received the internationally prestigious SIGCSE Award for Outstanding Contribution to Computer Science Education. This annual award started in 1981, and Edsger Dijkstra from the Netherlands and Donald Knuth from the USA, both world-famous computer scientists, are among previous receivers of the same award.

'This is a great honor, as this award has been previously given to some of the most famous researchers in computer science,' says Professor Malmi.

The SIGCSE Award for Outstanding Contribution to Computer Science Education honors an individual or group in recognition of a significant contribution to computer science education. Their contribution may take many forms, such as innovating teaching methods, textbook authorship, or development of new teaching tools. The contribution should have had long lasting impact on, and made a significant difference in, computing education.

Malmi receives the award for his leadership in building the international computing education research community, and raising the profile and quality of computing education research and research training.

'I have contributed in many ways to the development of the research field and helped to improve the quality of research. Researchers in this area have published a myriad of papers that present new teaching innovations and their experience of those innovations, but we also need in-depth theoretical understanding of learning models and processes, and strong empirical evidence that supports those models and processes.'

Malmi also thanks his colleagues and research group for their work and support. 'Naturally, I haven't been here alone; I've been surrounded by a group of colleagues and many talented doctoral candidates who have showed deep interest in the quality of teaching and related research.'

According to Malmi, the 17 doctoral dissertations that have been completed in the LeTech research group so far have been interesting and motivating part of his work.

Aalto University ranked third best European university in Computer Science

Rankings, published: 4.11.2019

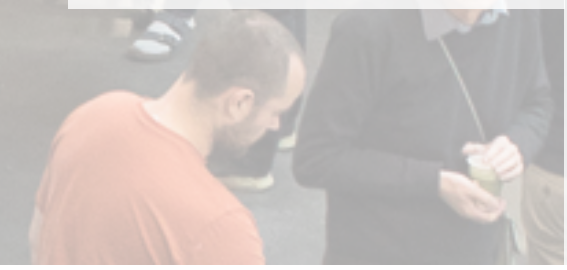
The U.S. News ranked Aalto University the third best European university in Computer Science in the Best Global Universities ranking. The Swiss Federal Institute of Technology Zürich and University College London were the only European universities that succeeded better than Aalto University.

In the whole world, Aalto University's ranking in Computer Science is 33. The Tsinghua University in Beijing was ranked the world's best university in Computer Science. A year ago, the ranking of Aalto University Department of Computer Science was #7 in Europe and #43 in the whole world.

Among the Finnish universities offering Computer Science education, Aalto's ranking was by far the highest. The ranking of the University of Oulu was the second highest in Finland, with the global ranking #113 and the European ranking #30.

The U.S. News Ranking 2020 was published on October 22. The Best Global Universities rankings are based on Web of Science data and InCites metrics. According to the U.S. News, their methodology weighs factors that measure a university's global and regional research reputation and academic research performance.

For the overall rankings, this includes bibliometric indicators such as publications, citations and international collaboration. Each subject ranking has its own methodology based on academic research performance and reputation in that specific area.



20 years of HIIT: 'A track record of outstanding research and success in project funding'

Rankings, published: 15.11.2019

In November 2019, the Helsinki Institute for Information Technology celebrated its 20 years anniversary. The Helsinki Institute for Information Technology HIIT is a joint research institute of Aalto University and the University of Helsinki for basic and applied research on information technology.

In the celebrations, the past and present HIIT directors gave a retrospect of information technology research during the past 20 years and envisioned what the future will bring.

Aalto University President **Ilkka Niemelä** reminded that HIIT is an important link between IT industry and universities. He emphasized that HIIT has always had a multidisciplinary take on research and mentioned, that many research projects have been carried out together with e.g. sociologists and lawyers. 'HIIT has a track record of outstanding research and success in project funding, and I hope to see equally impressive results during its next 20 years.'

The rector of the University of Helsinki **Jari Niemelä** emphasized the importance of collaboration of the two universities, for which HIIT was founded in the first place. 'Aalto University is our main partner in cooperation. Together we are stronger in international competition.'

Professor **Martti Mäntylä**, the first director of HIIT reminded the audience that HIIT was founded at a time when ICT sector started to rapidly grow. 'We needed to create bigger units in order to attract international talents. Those were fun times!'

During the early years, HIIT wanted to strengthen the computer science research carried out at the University of Helsinki and enhance linking theory with practice. 'HIIT also increased mobility between the two collaborating universities,' said **Heikki Mannila**, President of the Academy of Finland.

Professor emeritus **Esko Ukkonen** led HIIT from 2004 to 2008. 'HIIT has been an intensive research environment and acted as a professor school of a kind. Now it is a platform for independent research programmes. During the past 20 years, we have experienced changes both in universities and their funding and also in the industry. The research carried out in our field is now more important than ever.'

'If we put our resources together we will do better in the international competition' was the idea behind HIIT, according to Professor **Petri Myllymäki**, current HIIT director. He pointed out that organisations do not produce results, people do. 'HIIT is a competence centre but it is also a community in the metropolitan area, and its success has been brought on by its people.'

Janne Lindqvist is the first person in Finland to receive a Mozilla Research Grant – supports making the internet a better place

Funding News, published: 23.1.2020

Janne Lindqvist, Associate Professor, was the first research scientist in Finland to receive the Mozilla Foundation's international research grant. Unlike most traditional research grants, the Mozilla Foundation awards researchers with unrestricted gifts, which makes them highly competitive. The Mozilla Foundation provides research grants to universities, labs and research-focused registered non-profits.

Lindqvist received funding for a project in which researchers aim to understand user experience of people who stream videos online. At Rutgers University where he worked before Aalto his research group noticed that nearly all methods used to evaluate video streaming were based on the outdated assumption according to which people watch videos in one place and on a big screen.

However, these days a large number of videos are viewed on a mobile device, using a wireless or mobile data connection. 'A lot of research has been conducted with short video clips. Statistics show, however, that when we use mobile devices for viewing videos, the length of clips is much longer than in those previous studies. We are interested in how the user experience differs when people stream videos using a mobile device and how the wireless connection influences the video quality in comparison to a fixed network,' Professor Lindqvist explains.

Societal impact plays a role

Lindqvist points out that wireless internet connections always come with some types of issues. Globally, the Finnish well-functioning, fast, and unlimited mobile data connections are unusual. Lindqvist is interested in how user experience can be improved when the internet connection comes with limitations. 'Finding out these sorts of things may have an impact on education or any other field in which viewing videos may be beneficial.'

Such a societal impact plays an important role when the Mozilla Foundation makes research grant decisions. As the developer of Firefox browser, it is also interested in how viewing experience can be improved when the user is watching a video in the browser.

Lindqvist's research group has studied how issues in the online traffic influence the video quality and user experience. The group did this by creating an online environment with artificial but realistic network errors. Then, the participants were asked to evaluate the impact of the resulting video impairments.

This time, the researchers want to take their research from the lab to the real world and the internet. They are going to collect data from an internet browser and ask participants to evaluate their user experience.

Aalto receives EUR 3.5 million funding for ICT research

Funding News, published: 6.9.2019

The Academy of Finland has granted funding for projects within the ICT 2023 programme. A total of EUR 3.5 million was granted to 12 Aalto University researchers. The total sum of funding applied was EUR 45.7 million and the funding granted amounts to EUR 9.25 million. Aalto's share of the funding granted came to 38 percent.

The research, development and innovation programme ICT 2023 is jointly coordinated and funded by the Academy of Finland and Business Finland. The aim of the programme is to further improve scientific expertise in computer science and to promote the extensive application of ICT.

The funded projects belong to three thematic calls and Aalto researchers received funding within all of them.

Innovation, Business and Sustainability in and with Software

Projects SASSE (**Matti Rossi**) and CryptoProSAT (**Chris Brzuska**)

Autonomous Everything

Projects REPEAT (**Juho Kannala**), ULTRA (**Riku Jäntti, Claudio Roncoli**), B-REAL (leader **Ville Kyrki**, **Samuel Kaski**, **Harri Lähdesmäki**), and **Antti Oulasvirta**'s and Quan Zhou's research projects

Programmable World and Advanced Software Techniques

Projects FIT (**Samuel Kaski**) and PARADIST (leader **Simo Särkkä**, **Jukka Suomela**).

FIT project studies the Internet of Things

Academy Professor **Samuel Kaski** from Aalto University forms a research consortium with Professor **Pan Hui** from the University of Helsinki and Associate Professor Antti Honkela from the University of Helsinki. Their aim is to resolve key challenges of the Internet of Things (IoT). The objective is to provide an easy-to-use modelling framework that is scalable, enables the use of powerful probabilistic models to account for complex dependencies in the data, and has a strong, built-in privacy protection. The solution is to be demonstrated with prototype applications on an IoT platform. The currently ongoing revolution in machine learning and artificial intelligence is largely driven by the wide availability of data. The rapidly developing IoT is intimately connected to this process: advanced machine learning methods improve IoT, which drives further progress by providing large amounts of new data. The project is a part of the Academy flagship Finnish Center for Artificial Intelligence, led by Samuel Kaski.

Five MSc students awarded for health-related theses

Awards & Nominations, published: 6.9.2019

The Life Science Technologies Master's Program at Aalto University awarded five master's students for their excellent dissertations completed in academic year 2018–2019. The winners were announced in September 2019.

According to Associate Professor **Alexander Frey**, Vice Director of the master's program, the results produced in the awarded research projects were of very high quality and they will affect future research in the relevant fields.

The thesis award amounts to 500 euros per student. Alko donated money for the awards to support development of health and well-being technology. With the help of this donation, Life Science Technologies program will award students for their excellent theses for three years.

Alko's donation links to The Polytech Sobriety Association's humorous attempt from last year to empty the Alko shop in Otaniemi. Due to this attempt, a client of Alko contacted the company and asked whether Alko could sponsor life science technology master's students. Alko saw this initiative as a very positive one because one of its most important roles in the society is to promote responsible alcohol use. 'We are very happy about the donation by Alko, which helps Aalto University in recognizing student achievement and excellence in the field of Life Science Technologies,' says professor **Juho Rousu**, director of the programme.

The Master's Thesis Award is an incentive for students to write outstanding theses in the field of life science technologies and well-being as well as to highlight their findings to the society. The theses are evaluated based on a two-stage selection process, and fellow students from the program's committee select the award winners.

The nominated awardees and the titles of their thesis are:

Henriikka Vekuri. Patient induced pluripotent stem cell-derived neurons as a model for a mitochondrial encephalopathy.

Roni Hytönen. Dual-energy computed tomography in radiation treatment planning.

Pauliina Hirvi. Generating head models for diffuse optical tomography of the child brain.

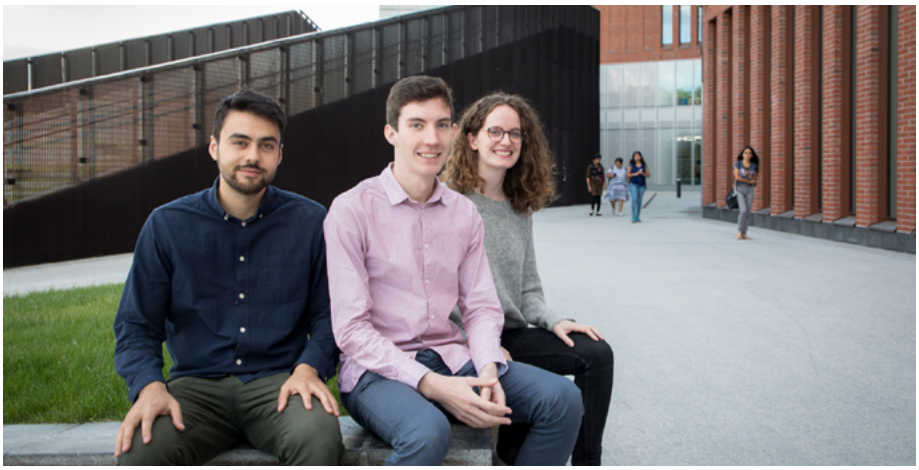
Iris Hakaste. Förster resonance energy transfer analysis of a dynamic DNA origami nanocapsule.

Heli Julkunen. Predictive modeling of anticancer efficacy of drug combinations using factorization machines.

Summer internship in Finland: research experience, great work-life balance, and dips in the sea

Three master's students from Paris spent their summer in Helsinki working as research interns. Aalto University has a long history together with Télecom Paris, one of the best European institutions in machine learning.

Studies, published: 30.8.2019



A research internship abroad comes with many benefits, both professionally and personally. **Jane Douat**, **Luc Motteand** and **Antoine Moulin** from Télecom Paris – one of the world's best institutions teaching computer science – spent their summer at Aalto University doing a research internship.

Moulin, Douat, and Motte have all studied applied mathematics and machine learning, among other subjects. Moulin and Douat have one year of their master's studies left, whereas Motte will graduate after his final internship, two months of which he did at Aalto.

During the summer, Moulin and Motte worked on algorithms, trying to understand how existing algorithms work and how to improve them. Douat worked on two different research projects. In both of them, experiments were designed to test how existing methods work on datasets and the results of these experiments were compared to those achieved by using more common methods.

Aalto has a long history together with Télecom Paris and with the research group of Professor **Florence D' Alché-Buc** in particular, says Professor **Juho Rousu** who supervised all three interns this summer. Students at Télecom can come to study or do their internship or master's thesis at Aalto, and similarly, students at Aalto can do a part of their studies at Télecom.

In the best-case scenario, even doctoral studies in which the doctoral student has one supervisor at both universities are an option. Motte's research was supervised by both Rousu and D' Alché-Buc and their aim is to continue his work in doctoral studies. Both professors will work as Motte's supervisors.

"Collaboration with top-level partners is a win-win situation to both parties. Together we can conduct research of higher quality"

'Télecom is one of the best European institutions in machine learning. Collaboration with top-level partners is a win-win situation to both parties. Together we can conduct research of higher quality,' says Rousu.

Enriching experiences

Télecom is an interesting exchange destination to Aalto computer science students. Antoine Moulin says that at Télecom, students can study computer science and applied mathematics, but the course catalogue covers also other subjects, such as economy, philosophy, and even personal development. 'It's not only about studying computer science but there's also a possibility to earn some broader knowledge.'

According to him, Télecom is a very international institution where exchange students can meet people from all around the world. Students can take part in many extracurricular activities, such as French or English theatre, a music association, and associations focusing on sustainable development or entrepreneurship.

Changing environment from Paris to Helsinki was an enriching experience to Moulin as it allowed him to learn a new culture and a new city as well as to improve his English skills. 'Personally, I learned a lot because this was my first research experience and also my first international experience.'

Luc Motte and Jane Douat were happy with the good working conditions and the fact that everything was well organized and worked out as promised. 'There's a great work-life balance. It seems important in Finnish companies, in general, to take care of employees,' says Douat.

Thanks to the balance between work and personal life, the three research interns found time to enjoy the summer months as well. They all liked the nature and water that is present 'everywhere.' One of the most memorable events was Kallio Block Party, a free music festival organized every August in the streets of the vibrant Kallio area in Helsinki. 'I also loved saunas and jumping into the sea' adds Douat.

By Anu Haapala,
Photo Matti Ahlgren

Upper secondary school students become professors on Day of the Girl

An initiative between Aalto University and Otaniemi Upper Secondary School gives students the possibility to draw attention to technology- and society-related topics that they see as important.

Studies, published: 11.10.2019

What does a 16-year-old upper secondary school student do when she becomes a professor at Aalto University? This is something we found out on October 11, International Day of the Girl, when a student group from Otaniemi Upper Secondary School stepped into the shoes of **Risto Sarvas**'s, a Professor of Practice.

Sarvas is the Director of the Information Networks Programme and influencing teaching and public discussions about technology's role in society is an important part of his job. This initiative gave this power to first-year students at upper secondary school for one day.

During the Day of the Girl, the student group spoke to information networks students in their guild room; had lunch together with Jouko Lampinen, the School of Science Dean; and gave speeches at Science Center Heureka's event for comprehensive school pupils.

For Aalto University, this is one opportunity to make technology field more familiar to young people and girls and young women in particular.

Girls feel pressure on social media

The Otaniemi Upper Secondary School students prepared for the day in small groups together with Sarvas and **Ulla Helenius-Aro**, a literature and Finnish language teacher. During their preparations, they spoke about how girls' life looks like these days.

Technology and societal themes were at the core of the speeches the students gave on the Day of the Girl, but each small group got to decide what exactly they want to bring up. **Ella Kimanen** and **Lumi Borgers**, two of the students taking part, wanted to focus on social media because it strongly influences the lives of young people – whether one likes it or not.

'Social media treats girls, boys and different kinds of people in different ways. How people behave in the social media differs from how they act in school, for instance" says Kimanen.

They point out that on social media, people can say anything they want to anyone they want. Girls in particular feel the pressure to act and look a certain way. According to Kimanen,

"Social media treats girls, boys and different kinds of people in different ways"

'In the real life, nobody comes to judge you and say that you look horrible today. But in the social media, that's something you can say.'

Borgers hopes that her group's speech shows what it feels like for young people.

Diversity is important for the technology field

Siiri Niemi, also a student at Otaniemi Upper Secondary School, wanted to talk about equality. 'Even though people often say that in Finland everything's already fine, social standards and stereotypes are still really strong,' Niemi says.

Stereotypes and different ways of treating people have for its part influence on, for example, decisions about where and what one decides to study.

The field of technology is still very male-dominated. In Finland, about 70% of technology students are male, and among computer science students, the proportion is as a high as 80%.

According to Risto Sarvas, in many fields having technical skills means that one can also hold more power. If mainly men have this kind of knowledge and skills, the power distributes unequally between men and women. That is why it is important to ensure that a more diverse group of people holds this type of knowledge and expertise.

Diversity is also a key factor in developing new technologies. Sarvas thinks that 'It breaks ossified attitudes and blows away dusty stereotypes.'

Siiri Niemi wishes that upper secondary school students would receive more information about different kinds of study options. According to her, every student in her school knows about medical school, law school, and business school, but it would be important to hear about all other available options, too, and get more advice on how to prepare for future work life. 'We have been told that about a half of us will end up in professions that haven't even been invented yet,' remarks Niemi.

By Anu Haapala,
Photo Matti Ahlgren

How Open Data changes the world? Conference gathered over 600 people to discuss this topic in Otaniemi

RDA Plenary Meeting participants discussed how data changes the world.

Events & Conferences, published: 30.10.2019

The three-day plenary meeting of the Research Data Alliance (RDA) brought 620 experts of different fields to discuss Open Data and practices related to it. The central theme of the conference was how Open Data changes the way we work and make decisions as well as how data can fulfil all the expectations set to it. At the outset, the organisers expected about 500 participants to the plenary, but this target was by far exceeded.

This was the first time the RDA Plenary Meeting was organised in Finland. The event was organised jointly by the CSC – IT Center for Science Ltd, Aalto University, the University of Helsinki, the Finnish Meteorological Institute, the Federation of Finnish Learned Societies, and the RDA Europe 4.0 project. The organisers on the Aalto University side were Professor **Pekka Orponen**; **Ella Bingham**, the Head of Research Services; and **Anne Sunikka**, the Head of Open Science and ACRIS, together with their support teams.

'Currently, one important theme in the RDA plenary workgroups is how to bring good data management practices to the everyday research culture through accessible services, researcher education and support, and merit recognition policies,' said Professor Orponen.

At the conference, he was particularly interested in a research funding agencies' group session on how to compile an overview of the status of open data collections in their area by using, for instance, computerised data management plans.

Another session he found interesting was organised by a group working on indicators for assessing a dataset's compliance with the FAIR data principles. The abbreviation comes from the words findable, accessible, interoperable, and reusable, and the FAIR principles provide a "gold standard" on the quality of open data management .

Plenary speaker Hillary Hanahoe, RDA Secretary

Education plays a key role

Pilvi Torsti (State Secretary at the Ministry of Economic Affairs and Employment), **Alexander Törnroth** (leader at Finland's AI Accelerator initiative), **Eva Mendez** (Chair of EC's European Open Science Policy Platform advisory board), and **George Strawn** (Director of the Board on Research Data and Information at the National Academies of Sciences, Engineering, and Medicine in the US) were the panelists at the plenary meeting's panel.

Torsti said that data changes the world because currently humans create more data than before; we have plenty of storage capacity for it, and different kinds of tools that can be used to analyse it. Törnroth pointed out that companies have increasing expertise in terms of how they can make use of data.

However, a big problem is the bad quality of data. Torsti used a water metaphor: in some situations, data – like water – can be useless, but when it is used for the right purpose, and at the right moment, it can be very useful.

The panellists reminded their audience of one focal quality of data; data can be shared with others, and open access does not mean that the data owner would need to give up their own data.

Torsti also brought up the role of education in changing the world. Eva Mendez said that she agrees with her and reminded her audience that being a digital native does not mean that you are fluent with technology – as access to books does not mean that a little child can read.

EU invests in data-driven research

The speakers of the opening session on Wednesday were Andreas Veispak (Head of Unit eInfrastructure and Science Cloud, EC DG CNECT), **Hilary Hanahoe** (RDA Secretary General), **Heikki Mannila** (President, Academy of Finland), and **Tuuli Toivonen** (Associate Professor, University of Helsinki).

Veispak spoke about priorities in the development of the European Digital Single Market. He mentioned that the EuroHPC project and the LUMI supercomputer are good examples of public investments that significantly support European digitalisation.

EuroHPC creates new opportunities for developing skills, conducting top research, and developing data-driven business. Veispak said that transparency and the rule of law are Europe's strengths.

The EU invests in data-driven research also through the European Open Science Cloud (EOSC), an ambitious programme of the EU to provide a virtual environment with open and seamless services for storage, management, analysis and re-use of research data, across borders and scientific disciplines by federating existing scientific data infrastructures. It is currently dispersed across disciplines and the EU member states.

By Anu Haapala,
Photo Matti Ahlgren

GAN-mirror by Andrzej Pisarek and Prof. Jaakko Lehtinen

Matti Ahlgren

Huawei and F-Secure donate to Aalto information security students - attracts excellent students to Finland

Studies, published: 19.12.2019

The technology company Huawei and information security company F-Secure have continued supporting The Helsinki-Aalto Centre for Information Security (HAIC) in 2020 by making a donation to HAIC. HAIC is a joint initiative by Aalto University and the University of Helsinki, established in 2016, that aims to ensure excellence in the Finnish information security research and education.

According to Mikko Terho, VP Technology Planning and Site Manager from Huawei Technologies Oy (Finland), Aalto University and the University of Helsinki have been doing well in producing qualified security experts, which is important to sustain research and development in the field of platform and cloud security. 'HAIC programme essentially is a key enabler to achieve this goal.'

F-Secure has sponsored HAIC for three years and Huawei for two years, supporting the master-level students studying information security. 'Huawei has seen the collaboration mutually beneficial. It has also enabled better recruitments for Huawei. We have also hosted several good interns and thesis workers, which has strengthened and supported our in-house knowledge in several topics,' Terho continued.

Jyrki Tulokas, CTO at F-Secure, said that F-Secure continues supporting the HAIC initiative and also providing Master's thesis work and internship opportunities for security students, as it recognizes the growing need for top-notch skills in cyber security at the company and in Finland. 'Collaboration with HAIC is an integral part of our joint research and education activities with Aalto University and the University of Helsinki, which we hope to expand further in the coming years,' Tulokas stated.

Professor N. Asokan, the founding director of HAIC who stepped down from his position in 2019, mentioned that supporting student scholarships through gifts is a relatively new concept in Finland. 'I am gratified that our industry partners like Huawei and F-Secure have consistently supported HAIC from its inception,' he says.

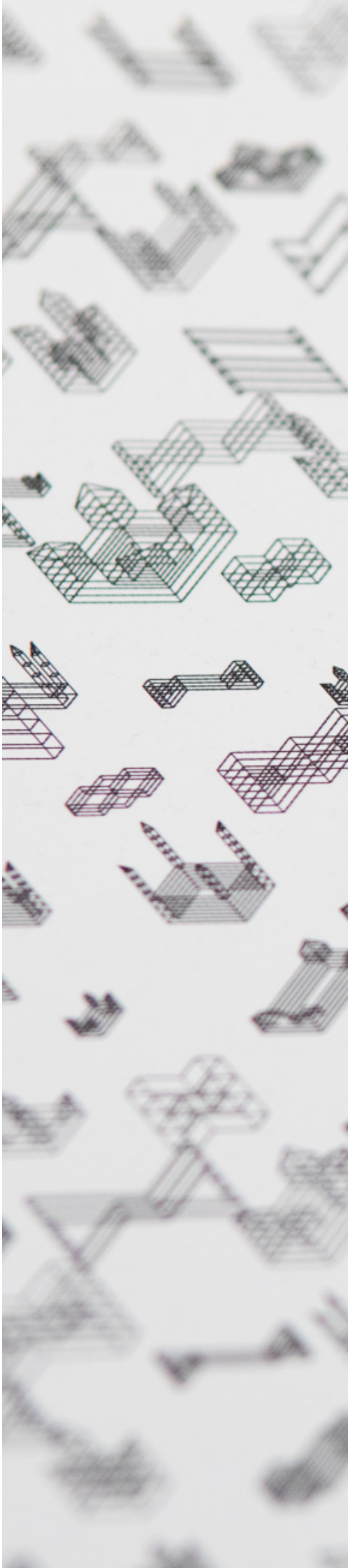
Professor N. Asokan pointed out that the higher education landscape is changing around the world. He thinks we need more industry partners in Finland to step up with this kind of support to ensure that Finland continues its track record of producing top-notch information security experts.

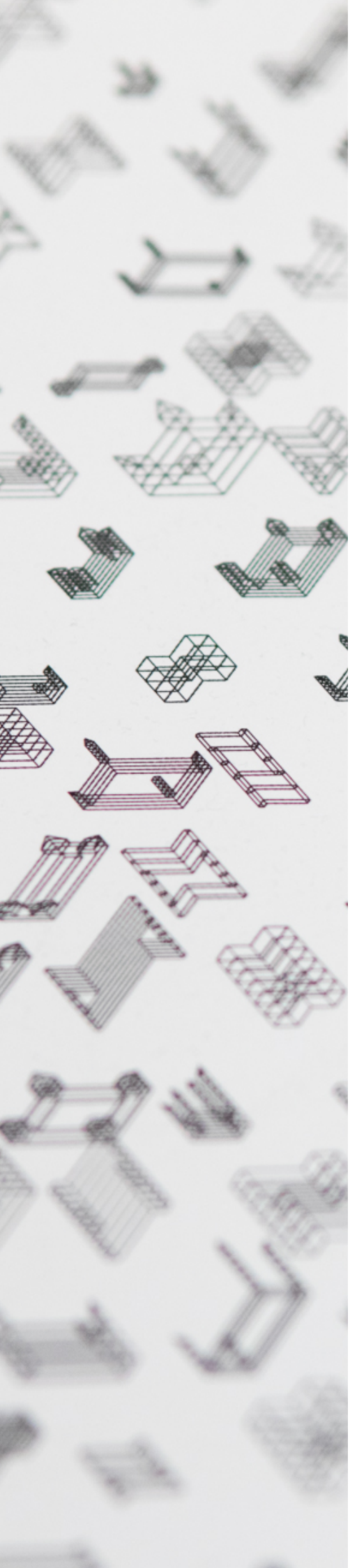
'I am grateful for Huawei and F-Secure for the continued support for computer science education in Finland. I am also honoured to continue the legacy of N. Asokan and move HAIC to a new decade when I start at Aalto in January 2020,' said Professor Janne Lindqvist, the current director of HAIC.

The donations go towards scholarships for Master's students, the goal of which is to attract the best international candidates to the area of information security that has an acute and growing need for new professionals. In 2020, HAIC will offer scholarships for several new students whose earlier academic success shows great promise.

The scholars receive generous financial aid in the form of a living cost scholarship, and a tuition fee waiver if they come from outside the EU/EEA. The scholars need to be admitted in either the Security and Cloud Computing majorat Aalto University's Master's Programme in Computer, Communication and Information Sciences or SECCLO – Master's Programme in Security and Cloud Computing (Erasmus Mundus).

By Anu Haapala





Online events, outdoor activities, and sense of community – this is how computer science and 'info' students will celebrate Wappu

Studies, published: 29.4.2020

Aleksi Lallukka, computer science student and publicist of Tietokilta:
'In Wappu 2020, I am going to follow virtual events and stay in touch with my friends and people close to me; I may even travel to a cabin. I would have never thought of spending Wappu as a student anywhere else but in Otaniemi, but we're living in extraordinary times.

Events that I won't miss include Fuksispeksit, the May Day Madness, and putting on the cap, which will top off the evening of 30 April. I'm pretty sure that I will also take part in some type of a May 1 picnic. Tietokilta won't have any special events of its own, but I believe that members can get into the festive spirit by visiting the remote guild room.

Walpurgis Night is a holiday on which we celebrate sense of community and togetherness, so the best way to get into the spirit is to stay in contact with others, in one way or another. You can have fun also remotely, and as one cliché says, Wappu is a state of mind. My concrete tips are to listen to the Radiodiodi spring radio and check out the versatile selection of Wappu events by OUBS Live. I believe they will help to lift your mood.'

'This year I will put my cap on physically alone at home, but mentally together with everyone else'

"This year I will put my cap on physically alone at home, but mentally together with everyone else"

Atte Makkonen, information networks student and publicist of Athene Guild:
'The Walpurgis celebrations of Athene include all kinds of events, even though this year Wappu will be different than all of those that have taken place in previous years. Many events will still take place, but they have been adapted so that they can be organized online.

We started the Wappu of Athene by publishing the traditional Wappukukka, a virtual Wappu calendar. On each April day, we publish something new with the aim to cheer people at Athene and Aalto up. Also, the traditional Wappukukka Qkkachat helped to create the festive spirit on Monday before May 1; this was a 24-hour-long chat program that took place online. Members of Athene have also held their remote sittnings, and on the last week of April, we will participate together in many events, such as the virtual Crowning of Havis Amanda.

This Wappu, I will be staring at my computer screen a lot, and in order to keep some balance, we should remember to go outdoors as well and enjoy the amazing spring weather! I'm going to eat Vappu food, wear clothes that are associated with Vappu, and decorate my apartment accordingly. These little things help to get into the right mood.

This year, I will put my cap on physically alone at home, but mentally together with everyone else. Even though this Vappu will be different than any previous Vappu, I believe it will be a memorable one!'

By Anu Haapala

Young programmers competed at Aalto – competitions help improve one's programming skills and can even open the doors to university

Studies, published: 13.2.2020

The finals of the Finnish Olympiad in Informatics 2020 took place at Aalto University on Sunday February 9. **Roope Salmi**, a student at Otaniemi Upper Secondary School, won the competition. He has performed well at the Olympiad also in the previous years. Henrik Aalto from Munkkiniemi School came in second and **Unto Karila** from Tapiola Upper Secondary School came third in the competition.

The best three competitors received monetary awards, whereas the top ten competitors can directly apply to study technology or a mathematical or scientific field at several Finnish universities. The Finnish team for the international programming contests, the Baltic Olympiad in Informatics (BOI) and the International Olympiad in Informatics (IOI), will be formed of the Finnish Olympiad contests.

Jukka Suomela, Assistant Professor at Aalto University Department of Computer Science, has been one of the organizers for this event for years. This year, he took responsibility of arranging the event together with Heikki Hyyrö from Tampere University, Antti Laaksonen from the University of Helsinki, and several volunteers, some of whom are students at Aalto.

Suomela noted that universities highly value successful participation in programming contests because making contest assignments develops not only one's programming but also their mathematical and logical reasoning skills. 'These days, all of those skills are helpful in technology and science.'

Successful participation in the contest is a great starting point for university studies, and eventually also for a career as a top coder in the software industry or as a theoretical computer scientist in the academia. 'Good performance in the contest looks good on CV and helps to stand out,' Suomela summed up.

The Finnish Olympiad in Informatics is intended for all comprehensive school and upper secondary school students who know how to program.

All of us are exposed to information manipulation - Welcome to follow open lectures and learn what that means

Studies, published: 6.3.2020

The lecturers of the Degree Programme in Information Networks organized the course on information manipulation ('Manipulaation perusteet informaatioverkostoissa') for the first time in spring 2019 when it also ended up in the Finnish news. This year's course was designed together with National Defence University, and the lecturer in charge **Vesa Kantola** and professor of practice **Risto Sarvas** wanted to welcome everyone to follow the open lectures. Even though the course was taught in Finnish, some guest lectures were given in English.

'The only effective way to fight against informational influence is to have as broad general knowledge as possible and think critically about things happening around us and the sources we receive information from. Our aim at this course is to create and develop such critical thinking together,' said Vesa Kantola.

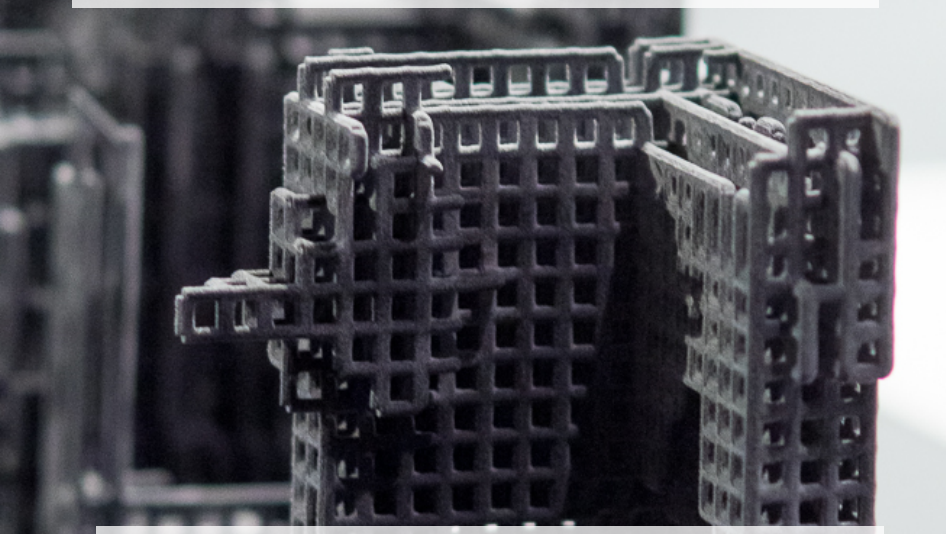
According to Risto Sarvas, the course is important because informational influence reaches the whole society from the civil service to individual citizens. 'How we are influenced as a state, often happens through our citizens. Unlike the traditional cyber-attacks online, informational influence is an everyday thing and we don't necessarily even notice it.'

Those parties that want to influence average people use the same digital channels in which we spend time and read the news every day. 'That is why it's extremely important that all of us understand the tools, channels and methods of information manipulation. We cannot technically prevent malicious information manipulation, so the only effective way is to make sure that people are aware of it and understand what happens around them,' Sarvas continues.

The list of guest speakers was impressive with names such as **Jessikka Aro**, a well-known journalist and author, and **Mikko Hyppönen**, an information security expert from F-Secure.

How ecological is AI? How can you compose with a neural network? Come to AI exhibition to find out!

Events & Conferences, published: 19.11.2019



Aalto Digi Platform and FCAI hosted a science and art exhibition that took its visitors to a journey in the world of Artificial Intelligence. The Connecting the Dots exhibition, which took place at Aalto University's campus, aimed to increase our understanding about the history of AI, the current state of art, and what the future holds.

'AI is already part of our everyday life, but what we can do with it and how it works is still quite a mystery to most people. With this exhibition, we hope to give answers to questions they may have,' said **Saara Halmetoja**, the exhibition coordinator from Aalto Digi Platform.

The exhibition was suitable for people of all ages. Visitors could step into a sound environment in which they can control the surrounding voices with their movements; compete against AI in a music game; and compose together with a neural network, among other activities.

The exhibition dived into the core of AI research. Visitors saw how a machine learns to classify and predict things, as well as how it forms sounds, pictures, text, and molecules. The exhibition presented robotics and showed how AI adapts to real-world situations.

Connecting the Dots discussed the history and ecological aspects of AI. While AI can help the clothing industry in getting rid of textile waste, artificial neural networks – mimicking human brain's neural networks – consume enormous amounts of energy.

The exhibition brought together the diverse fields of Aalto University from natural sciences, technology, and architecture to design and arts. The scientists, artists, and students behind the exhibition come from diverse backgrounds; some of them are 'pure' AI researchers, while others use AI tools in their scientific or artistic work.

According to Halmetoja, 'if only certain types of people take part in discussions about AI, we will end up designing discriminatory technology. Therefore, we need to make sure that everyone in the society participates in these discussions.'

Helsinki and FCAI will host a new ELLIS unit for top AI research

Research, published:11.12.2019

Finnish Center for Artificial Intelligence FCAI will host one of the new European units of top AI research, as the European Laboratory for Learning and Intelligent Systems will establish one of its first units in Finland.

ELLIS is a pan-European effort initiated in 2018 to secure the excellence of European machine learning research. It aims to ensure that Europe continues to be competitive with big economies, such as the US and China, and benefit from the newest findings of AI research.

With the units, ELLIS wants to strengthen European AI research and collaboration between European researchers.

The unit will be founded in Aalto University and the University of Helsinki and hosted by the Finnish Center for Artificial Intelligence FCAI. **Samuel Kaski**, the Director of FCAI and Academy Professor at Aalto University, sees this as an excellent opportunity to boost basic AI research, which is the basis of all AI-related applications and impact. 'Finland is very strong in AI research, and this new status is one indication of that.'

Professor Kaski believes that the ELLIS unit helps Finland to maintain its position as an attractive destination for top-level international researchers. It also gives current AI researchers in Finland more reasons to stay.

ELLIS aims to offer European researchers outstanding opportunities to carry out their research in Europe, and to nurture the next generation of young researchers in the important field of AI. All ELLIS units will arrange visits and events as well as provide funding for doctoral students in the ELLIS PhD programme.

The other cities selected to host a unit are Alicante, Amsterdam, Copenhagen, Darmstadt, Delft, Freiburg, Linz, Lausanne, Leuven, Oxford, Prague, Saarbrücken, Tel Aviv, Tübingen, Vienna, and Zürich.

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