

Introduction to AI and Machine Learning

Exploring the Power of Large Language Models (LLM)

Teacher

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EQF Level

6 - Bachelor

Language of instruction

English

General course description

In this two-week intensive workshop, participants will dive into the fascinating world of Artificial Intelligence (AI) and Machine Learning (ML) with a special focus on Large Language Models (LLMs). Designed for beginner students from diverse backgrounds, this course aims to demystify the complex concepts of AI and ML by providing hands-on experience and real-world applications, particularly in the world of Natural Language Processing (NLP).

Throughout the workshop, students will explore the fundamental principles of AI and ML, learn about data preprocessing techniques, and understand the architecture and functionality of LLMs like BERT and GPT. Participants will engage in practical activities, such as building sentiment analysis models, fine-tuning pre-trained LLMs, and deploying them in various applications, including chatbots and text generation tools.

The course will also cover the ethical considerations and challenges associated with LLMs, providing a comprehensive understanding of both the potential and limitations of these powerful models. By the end of the workshop, students will have a solid foundation in AI and ML, equipped with the skills to apply LLMs to solve real-world problems and create innovative solutions in their respective fields.

This workshop is perfect for those looking to gain practical knowledge and experience in AI and ML, with a particular emphasis on the transformative capabilities of Large Language Models.

Learning outcomes

By the end of this workshop, participants will be able to:

1. Understand Core Concepts
 - a. Describe the fundamental principles of Artificial Intelligence (AI) and Machine Learning (ML), with a special focus on Large Language Models (LLMs).
 - b. Explain the architecture and functionality of prominent LLMs such as BERT and GPT.
2. Preprocess Text Data

- a. Perform text preprocessing tasks including tokenization, stemming, lemmatization, stop-word removal, and vectorization.
 - b. Utilize tools like NLTK and SpaCy to clean and prepare text data for analysis.
3. Apply Machine Learning Techniques to NLP
 - a. Implement supervised learning techniques for Natural Language Processing (NLP) tasks such as sentiment analysis and text classification.
 - b. Fine-tune pre-trained LLMs to perform specific NLP tasks using frameworks like Hugging Face's Transformers library.
4. Develop NLP Applications
 - a. Create and deploy language generation applications, such as chatbots and text generation tools, using LLMs.
 - b. Integrate LLMs into real-world applications, deploying them to cloud services or edge devices.
5. Analyze and Mitigate Ethical Concerns
 - a. Identify and discuss ethical considerations and challenges associated with the use of LLMs, including biases and data privacy issues.
 - b. Develop strategies to mitigate bias in LLMs and promote responsible AI practices.
6. Deploy and Integrate Models
 - a. Demonstrate the process of deploying AI and ML models in industrial environments, focusing on cloud services and edge computing.
 - b. Implement end-to-end solutions that integrate LLMs into various applications, showcasing their real-world relevance and impact.
7. Engage in Hands-on Projects
 - a. Work collaboratively on a final project that applies the learned concepts to solve a real-world problem related to NLP and LLMs.
 - b. Present the project outcomes, demonstrating the practical application and impact of LLMs in an industrial context.

Competence-Based Approach

This workshop emphasizes a competence-based approach, ensuring that students not only gain theoretical knowledge but also develop practical skills and professional attitudes required for the effective application of AI and ML techniques. Through hands-on activities, real-world projects, and continuous assessment, participants will build a robust understanding and capability to leverage LLMs in various industrial and everyday contexts.

ESCO Learning outcomes

<https://ec.europa.eu/eurostat/documents/1978984/6037342/ISCO-08.pdf>

1. Digital Skills and Competences
 - a. Data Preprocessing and Management (ISCO-08 / 2521.3.1):
 - i. Perform data cleaning, normalization, feature extraction, and selection for textual data.
 - ii. Utilize data preprocessing tools such as NLTK, SpaCy, and Pandas.
 - b. Programming and Coding (ISCO-08 / 2512.2.1):
 - i. Write and execute Python scripts for AI and ML tasks.
 - ii. Implement machine learning algorithms using libraries such as Scikit-Learn and TensorFlow/Keras.
 - c. Deploying AI Models (ISCO-08 / 2521.3.4):

- i. Deploy machine learning models to cloud services and edge devices.
 - ii. Integrate AI models into real-world applications and monitor their performance.
- 2. Cognitive and Analytical Skills
 - a. Problem Solving (ISCO-08 / 2512.1.2):
 - i. Apply AI and ML techniques to solve real-world problems related to Natural Language Processing.
 - ii. Develop end-to-end solutions for industrial applications using LLMs.
 - b. Analytical Thinking (ISCO-08 / 2421.2.1):
 - i. Analyze and interpret the outputs of machine learning models.
 - ii. Evaluate the performance of models and make necessary adjustments to improve accuracy.
- 3. Technical Skills
 - a. Understanding AI and ML Concepts (ISCO-08 / 2521.2.1):
 - i. Describe the fundamental principles of AI and ML.
 - ii. Explain the architecture and functionality of LLMs like BERT and GPT.
 - b. Implementing Supervised Learning (ISCO-08 / 2521.2.2):
 - i. Build and evaluate supervised learning models for NLP tasks.
 - ii. Fine-tune pre-trained LLMs for specific applications.
- 4. Ethical and Professional Competences
 - a. Ethical Use of AI (ISCO-08 / 2521.2.3):
 - i. Identify and discuss ethical considerations in the use of LLMs.
 - ii. Develop strategies to mitigate bias and ensure data privacy in AI applications.
- 5. Communication and Collaboration Skills
 - a. Project Management and Teamwork (ISCO-08 / 2421.3.1):
 - i. Collaborate effectively on a final project, applying AI and ML concepts to a real-world problem.
 - ii. Present project outcomes, demonstrating the practical application and impact of LLMs.
- 6. Creative and Innovative Skills
 - a. Innovation in AI (ISCO-08 / 2421.3.4):
 - i. Create and deploy innovative NLP applications, such as chatbots and text generation tools.
 - ii. Explore new use cases and applications for LLMs in various industries.

ECTS workload

Activity	Hours
Lectures and Practical Sessions	30
- Interactive lectures	20
- Hands-on practical sessions	10
Self-Study	21

- Reading materials & studying	11
- Online resources	10
Project Work and Assignments	30
- Group project development	15
- Project presentation preparation	10
- Presentation delivery	5
Total Workload	81 = 3 ECTS

Type of assessment

The course will be assessed as pass-fail.

The assessment will be multi-phase, combining formative and summative approaches. Participants will be evaluated through a series of hands-on practical assignments and quizzes that reinforce their understanding of key concepts and techniques throughout the course. Additionally, a collaborative group project will require students to apply their knowledge to solve a real-world problem using Large Language Models, resulting in a presentation to showcase their findings and implementation strategies. This approach not only assesses individual comprehension and technical skills but also emphasizes teamwork, problem-solving, and the practical application of AI and ML in industrial contexts. Feedback will be provided at each stage to support continuous learning and improvement.

Form of participation

On-site

Teaching methods

The teaching methods for the workshop will be interactive and engaging, combining a variety of instructional strategies. The course will utilize a blend of lectures, hands-on practical sessions, and collaborative group activities to foster an active learning environment. Lectures will introduce theoretical concepts and industry applications, while practical sessions will provide participants with the opportunity to work directly with tools and frameworks used in AI and ML. Group discussions and peer-to-peer learning will encourage participants to share insights and collaborate on problem-solving, enhancing their understanding and application of Large Language Models in real-world scenarios. Additionally, the use of online resources and guided self-study will support independent learning and reinforce key concepts outside of the classroom.

Prerequisites

Participants are encouraged to have an interest in programming, preferably in Python, but no prior coding experience is required. A basic understanding of statistics and mathematics will be helpful but is not essential. A willingness to learn and engage in hands-on activities, along with a curiosity about AI and Natural Language Processing (NLP), are the most important prerequisites for this workshop.

The course is designed to be accessible to beginners, providing a supportive environment for all participants to explore the exciting applications of Large Language Models in real-world scenarios.

Description of the target group

This course is ideal for individuals from diverse backgrounds, including students, professionals, and enthusiasts looking to enhance their understanding of artificial intelligence and machine learning, particularly in the context of Large Language Models. Those in fields such as engineering, data science, software development, and business will benefit from the practical skills gained in applying AI techniques to solve real-world problems. Additionally, educators and researchers interested in exploring innovative applications of AI and NLP will find valuable insights that can inform their work. By participating in this workshop, attendees will acquire foundational knowledge and hands-on experience that can enhance their career prospects, drive innovation in their respective fields, and equip them with the tools to navigate the rapidly evolving landscape of AI technologies. No special skills or prerequisites are needed for this course.