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Dissertation press release 30.11.2018

Computational modelling detects genes under selection and genes with time-dependent expression levels

Title of the dissertation	Gaussian Process Modelling of Genome-wide High-throughput Sequencing Time Series
Contents of the dissertation	Imagine that you have watched a trailer of a thriller, and you are asked to guess who are the culprits. How would you make the decision based on this short trailer? Has the trailer provided you with enough information about the characters? How sure are you? In this thesis, we are entering to the world of genomics, which presents various scenarios such as natural selection and development of diseases. Here, the main characters are the genomic elements, and sequencing methods are our equipment showing which genomic elements tell us what at different time points in various plots. We are interested in finding out the most interesting characters, i.e., the genomic elements, which have a consistent change in their behaviors across time. Given the current status of sequencing technologies, we are not yet (and maybe never will be) able to reveal the whole movie which would show everything completely and accurately, but instead we have a short and blurry trailer which provides incomplete and uncertain data about thousands of genomic elements. How can we then make a good guess and pick up the most interesting genomic elements? Computational probabilistic methods come to the rescue! In this thesis, computational modelling of time series is used to understand the temporal behaviours of genomic elements involved in different biological processes and to detect those with systematic time-dependent activity instead of just random variation. Presented methods help to detect, for example, genetic variants under natural selection or genes with time-dependent expression levels. The methods are made publicly available as a software package, providing a tool for researchers to understand the temporal dynamics in different genomic movies, each one telling a different story.
Field of the dissertation	Computer Science
Doctoral candidate	Hande Topa, M.Sc.
Time of the defence	14.12.2018 at 12 noon
Place of the defence	Aalto University School of Science, lecture hall T2, Konemiehentie 2, Espoo
Opponent	Associate Professor Barbara Engelhardt, Princeton University, US
Custos	Professor Samuel Kaski, Aalto University School of Science, Department of Computer Science
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