

PhD Position: Detection of sparse mixtures in infinite-dimensional statistical models

Main supervisor: Tatjana Pavlenko

Co-supervisor: Kevin Schnelli

Doctoral program: WASP Graduate School/Applied and Computational Mathematics

KTH Royal Institute of Technology

KTH Royal Institute of Technology in Stockholm has grown to become one of Europe's leading technical and engineering universities, as well as a key centre of intellectual talent and innovation. We are Sweden's largest technical research and learning institution and home to students, researchers and faculty from around the world. Our research and education covers a wide area including natural sciences and all branches of engineering, as well as architecture, industrial management, urban planning, history and philosophy.

Project and job description

The overall goal of this project is to build towards a mathematical theory and novel computational methodologies of advanced and efficient high-dimensional statistical inference that are able to accommodate structured sparsity of the data. A specific aspect of the *Big Data* setting we see today is that many of automatically measured features have little relevance to a given project. This poses a *needle-in-a-haystack problem*: a very few valuable features must be detected among huge amount of useless. The combination of such type of structured sparsity with high-dimensionality is a key challenge of the modern AI and machine learning applications.

The methods of high-dimensional probability have been crucial for recent progress in understanding the performance of new statistical learning algorithms and for designing of contemporary methods of analysis of big data.

The successful candidate will pursue a PhD project at the intersection of the probability theory and statistics in high and infinite dimensions, sparse statistical modeling, empirical processes theory, random matrix theory and artificial intelligence. Leveraging the interplay between the theory of adaptive signal detection in sparse and weak settings, structured sparsity learning, infinite-dimensional asymptotic theory, weighted empirical processes and topics within the random matrix theory such as low rank matrix recovery and other types of structural patterns, will be a central subject of the project. Once the mathematical foundations have been laid, the focus will be placed on devising and implementing fully adaptive, data-driven statistical and algorithmic inferential procedures.

Students interested in one or more fields related to the following are encouraged to apply: high-dimensional statistical inference, empirical processes, theory of statistical learning with sparsity, artificial intelligence, graphical modeling and random matrix theory.

The position is a time-limited, full-time, five year position starting August 2020 or at an agreed upon date. The position is fully funded for four years and will be extended to five years by assigning teaching duties. It also includes generous travel support. The position is funded within the Wallenberg Autonomous Systems and Software Program (WASP), and the student will participate in the WASP graduate school. Through this program the student will have a wide variety of opportunities to interact with other researchers and industry collaborators in AI, ML, and statistics, including events such as conferences and PhD courses; see

<https://wasp-sweden.org/graduate-school/ai-graduate-school-courses/>.

for more information about the WASP program.

The successful candidate will be part of two divisions within the Department of Mathematics, Mathematical Statistics and Mathematics of Data and AI.

Application

The official ad will be available early February 2020 via KTH's webpage. Interested students are encouraged to contact me by email or over the phone (+46 8 790 84 66) for further information about the position.

Once the job is online, log into KTH's recruitment system in order to apply to the position. You are the main person responsible for ensuring that your application is complete according to this advertisement. Your complete application must be received by KTH no later than the stated application deadline, midnight CET/CEST (Central European Time/Central European Summer Time). To apply you must submit the following materials:

- CV including any relevant professional experience and knowledge
- Cover letter (detailing your academic interests, your previous studies and scientific work experience and your interest in this position); maximum 2 pages long
- Copy of the degree certificate(s) and transcripts of records from your previously attended university-level institutions. Translations into English or Swedish if the original documents are not issued in one of these languages
- Contact information (email, address, and phone number) for two references.

General information

Type of employment: Temporary position longer than 6 months.

Contract type: Full-time.

First day of employment: 1 August 2020 or an agreed upon date.

Contact: Tatjana Pavlenko, Email: pavlenko@kth.se

Application Submission Deadline: To be announced.