

## Thesis proposal: Application of deep learning and/or numerical analysis to Bayesian estimation

### About Smartr

Smartr is an expert bureau within data and AI. We work with the entire value chain from data strategy, research, algorithm development, prototyping, validation, software development and data engineering. We have a high level of seniority and we work close to academia. Supervising students at different levels gives us a great opportunity to develop unique skills but also serves as a base for recruitment. We intend to supervise two projects 2020.

### Thesis project

Efficient and accurate parameter estimation for state-space models of time series is important in a number of areas such as medicine, biology, finance, engineering and physics. In this thesis proposal the student will work with deep learning for training surrogate likelihood. This has a great chance of speeding up computationally heavy MCMC methods for Bayesian computations. We have some different ideas along these lines using deep learning approximation for the likelihood and the students can also try data augmentation/bootstrapping by training generative adversarial networks (GANs) to learn the data distribution in a black box fashion and using it both for training the surrogate likelihood and in the MCMC computation. Students with interest in numerical methods for ODE and SDE can also tweak the project into such a direction, putting a little extra emphasis on the time-series modelling. Methods will be evaluated on neural axon time-series data.

We seek 1-2 students for this project. We expect the students to be familiar with Bayesian methodology. Experience with training deep neural networks in TensorFlow or PyTorch is very meriting. The thesis project can for the interested student be seen as an extended recruitment process and therefore good programming and social skills are of high value. On the other hand we don't close the door to talented students who are aiming for a PhD position.

### Supervisors

Supervisor at Smartr is Adam Andersson and at Chalmers Umberto Picchini. The student(s) can expect an active and interactive supervision. Daytime the thesis work is mainly to be committed at Smartr's office at Vallgatan 3.

### Contact and application

A complete application contains CV, personal letter and transcripts from university. Please send it to [adam.andersson@smartr.se](mailto:adam.andersson@smartr.se) and feel free to ask any questions.