Optimization in hierarchical Bayesian graphs: application in Pharmacodynamics


Expectation Maximization (EM) is an algorithm for the optimization of the hyper-parameters in a Bayesian graph with hidden (latent) variables. Such optimization problems occur for instance when someone wants to infer the parameters in a Pharmacodynamics model after observing some measurements. Then predictions for the future of the patient can be made using the optimized hyper-parameters.

The goal of this project is to implement modern versions of the EM algorithm in Π4U, a state-of-the art high-performance framework for uncertainty quantification. The implementation will then be applied in a Pharmacodynamics problem. The student will get insights into modern optimization techniques, modelling and will develop statistical skills.

This project is suitable for both Bachelor and Master Thesis.

PREREQUISITES
- Good knowledge of C
- Basic knowledge of probability
- Some experience in Monte Carlo sampling

CONTACT
Prof. Petros Koumoutsakos
Dr. Georgios Arampatzis

e-mail: petros@ethz.ch
garampat@ethz.ch

In the CSE Lab, we combine computational methods, computer science tools and domain specific knowledge to solve scientific and engineering problems in areas such as Fluid Mechanics, Nanotechnology and Life Sciences. The core computational competences of our group are in particle methods and in stochastic optimization techniques. Motivated by challenges in application fields, we focus on identifying the common elements among computational techniques and on formulating common methodological, algorithmic and software structures that facilitate their further development.