Master thesis project

IT (Computational science & Engineering, Mathematics)

Advisor: Prof. Ivan Oseledets, joint with Dr. Dmitry Vetrov (CMC MSU)

Tensor train approximation for learning graphical models

Prerequisites.

Linear algebra, probability and statistics, machine learning, calculus, MATLAB

Background.

Probabilistic graphical models play important role in many real-life applications, including video segmentation problems, natural language processing and many others. The goal of this project is to develop new and much more accurate techniques for learning graphical models. This project is a part of broader collaboration of between the Bayesian methods research group (CMC MSU) and Scientific computing group at Skoltech.

Problem description.

Probabilistic graphical models are widely used for modelling the joint distributions of random variables. Such joint distributions are typically extremely high-dimensional, and graphical models allow for their compact representations. However, the problem of maximum likelihood estimation in graphical model for the case when a corresponding graph has large number of cycles, is known to be NP-hard. The goal of this project is to develop fast approximate numerical techniques based on the Tensor Train (TT)-decomposition and related algorithms to estimate the parameters of discrete graphical models.

Tasks.

1. Get familiar with graphical models and tensor trains
2. Develop new approximate algorithms for at least one step of the maximum likelihood estimation in graphical models (the more the better!)
3. Apply the algorithms to real-life problems

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