# Meeting 4

Rui Castro & Martin, 22-09-2021, duration: 65 minutes.

First, we discussed the papers a little bit. No DAG learning in the paper of Raskuti.

In the other paper, DAGs were discussed but were only found because a topological ordering is **given**. That imposes problems as we do not know the topological ordering in advance.

Conversation directed to finding a (or the best, or the most suitable) topological ordering in a graph of *n* variables.

Also talked about LASSO and how it forced coefficients to shrink towards zero, taking either the value 0 or the “actual solution” – some shrinkage factor. Hence, a proper optimization should force them to be exactly zero. Therefore, be careful with using scipy.minimize for example, as they might not be suitable or proper. For prototyping it might be okay but be very careful with this.

The current goal of the thesis is now clearer: Given a time series of length *T* consisting of *n* variables, find a matrix A\* such that:

* A\* is a DAG, where an arc (i, j) indicates that i helps in predicting j, and that i helps in predicting j more than vice versa.
* A\* is sparse.

Methods:

Naïve way is to just estimate the parameters of A and then create a DAG by taking the largest coefficients.

Other approach, the interesting one. Constrain A to be a upper (or lower) triangular matrix, and then also learn the permutation at the same time (a permutation matrix P). This is quite difficult but could be promising (or not useful at all, who knows). Could be learned using e.g., coordinate descent (alternate between learning P and learning A).

Todo:

Find more literature on structure learning and learning the topological ordering of such a graph, be able to construct a DAG.

Investigate the permutation approach.

Start writing some formal problem description, which could change in the future, as a useful starting point. Goal is now to make stuff clearer.

Nice end goal is to make something like a paper: introduction, problem statement, model, method to estimate parameters of model, theoretical results / guarantees, validation on simulated data, and on real life data, conclusion, discussion, future work.

