

## Meeting Notes 8 12 2023

Dennis, Amber, Zhongming and Patrick met.

We decided that we had learned a lot, but that we didn't have a clear way forward on this project and so it was time to go into 'hibernation.'

1. Patrick said he had learned more about NOTEARS and GOLEM, but that they weren't what he had thought they were. NOTEARS works on an algebraic representation of links and weights as real values, updating all with a least squares objective and using a Langrangian descent method subject to a hard constraint that represents acyclicity. Don't ask to me to explain all that.

GOLEM builds on NOTEARS but uses a likelihood-based score function instead of least squares and a 'soft' constraint on acyclicity.

But this doesn't seem to offer a plausible analogue of scientific discovery any more than the other machine learning algorithms do.

2. Dennis developed gCastle for GES as well as PC, with graphs of their performance on a full set of metrics and a great animation of changes in the networks.

This was very cool, and is Patrick's major regret in letting go of the project—it seems that beautiful work should be useful for something.

Not everything works out the way you think or hope it will. That's science.

We're going into hibernation, then, unless or until it looks like this falls into philosophical place somehow.

Thanks to all. Keep in touch and let me know if I can be of any help with your other projects.

Patrick