

Master Projects with Probabilistic Graphical Models

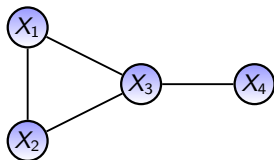
Johan Pensar

Department of Mathematics, University of Oslo

Probabilistic Graphical Models

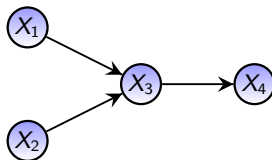
- **Aim:** Used for modelling the joint distribution over set of variables $p(X_1, \dots, X_d)$.
- **Key idea:** Use a graph to represent the dependence structure (in form of conditional (in)dependencies) over the variables and factorize the distribution accordingly.

Markov network (undirected)



$$p(X) = \frac{1}{Z} \phi(X_1, X_2, X_3) \phi(X_3, X_4)$$

Bayesian network (directed)



$$p(X) = p(X_1)p(X_2)p(X_3|X_1, X_2)p(X_4 | X_3)$$

Possible PGM-related Master Projects

① High-dimensional structure learning of graphical models

- Development/comparison of methods for learning the graph structure from data.

② Computational causal inference with Bayesian networks

- Combining structure learning and causal calculus for inferring causal effects from data.

③ Discriminative vs generative models in probabilistic classification

- Comparison of discriminative models, $P(Y | \mathbf{X})$, and generative models, $P(Y | \mathbf{X}) \propto P(\mathbf{X} | Y)P(Y)$, for classification.

Coming this spring...

- **STK4290 - Selected Themes in Advanced Statistics:** A course on graphical models that will cover *representation, inference, and learning*.

