

# Mini-project report

Martin Petterson

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**Project:** Construction of Bayesian Networks from data. It can be tested with a Python 3.0 interpreter.

## **Implementation:**

I implemented a `BayesNet` class in Python with the following functionality:

It's able to

- Randomize a valid structure given the number of variables and causal links.
- Randomize all the parameters of the structure.
- Generate data from the structure + the parameters.
- Calculate  $\log(P(\text{Data} | \text{BN}))$  given a data-set.
- Calculate the Bayesian Information Criterion (used as the utility function), given a data-set.
- Estimate the parameters given a data-set.
- Do a hill-climbing local search for the best structure given a data-set.

Generally, since I didn't have any test data, I had to generate data from a given structure to have something to test it with. This process looked like this:

- Create an instance of the `BayesNet` class, with a specified number of variables and causal links. This will generate a random valid BN without cycles.
- Randomize the parameters.
- Generate some data from this structure (taking all the conditional probabilities into consideration).
- Create a new `BayesNet` with the same number of variables and do a local search for the best structure.

## **Specifics about the techniques I used:**

- For representing the BN-graph I used two types of adjacency-lists in parallel, one for getting the variables you have a causal link to, and one for getting your parents. This because I needed to get the parents for calculating the parameters etc and the other one for searching etc.
- For storing the adjacency-lists and the parameters, I used the built in Dictionary in Python.

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