

## Report Bayes Network Lab

During our various attempts to solve the lab, we found that although we had the intuition for solving Bayes Networks, we weren't able to translate our knowledge into code, it is rather difficult to come up with a solution to a problem in which we consider that some human intelligence and processing is needed to fully deliver. At least that was our point of view, it was rather difficult for both team members to understand fully the implementation example that was given as help in the comments of the syllabus, so we went with our gut feeling and tried to implement it as our intuition told us. Big mistake. This is exactly what happened, we encountered quite a tricky problem that we were not able to abstract into code.

As we know the Enumeration algorithm is not the fastest nor the most optimized one to work with Bayes Networks, we searched for some like the Querying best parents, and we even found that A\* (A star) can also be implemented with this type of exercises. Hugin tool implements the PC algorithm and the extended version of it NPC that allows it to be faster than the Enumeration algorithm.

Hugin tool was a great way to represent what we attempted to do in a visual manner, the way the queries are represented are by selecting nodes from a list and double clicking the evidences we wanted to provide in order to get the results, Hugin employs a different algorithm because their results are displayed in a very fast way, besides after some research we found that their tool is powered by their own engine for making all the queries and optimizing as much as possible getting results efficiently.

For real life applications, or when a GUI is needed, Hugin Tool would be a better choice, even if our code had worked, because the enumeration algorithm that we had to implement is very slow,  $O(n^2)$  kind of slow, so with big networks the algorithm would take a lot of time to calculate the probability of certain nodes. But for simplicity maybe it is easier to construct the network from statements and also the

queries and in a single run have all the results. The problem we found while playing with the GUI of Hugin Tool is that if you want to create a very complex network, it can be quite a hassle to create it with that GUI, so the tool also has its limitations for more complex situations.