T.61.5140 Machine Learning: Advanced Probablistic Methods
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`http://www.cis.hut.fi/Opinnot/T-61.5140/`

Read through the article

- Michael I. Jordan: Graphical Models, *Statistical Science*, Vol. 19, No. 1, pp 140–155, `http://dx.doi.org/10.1214/088342304000000026`

and answer the following questions. Remember, the purpose is to learn the material, not just answer the questions and forget about everything else. The material in the Sections 1,2, and 3 should be relatively familiar, a good portion of the questions is related to this material. Read sections 3.2 and 3.3 lightly, we'll go through this material later on the course. The later sections 4 to 7 include a lot of interestings applications of graphical models, read for your own interest. You may find the exciting applications motivating to study more about graphical models!

1. What three types of inference algorithms are listed in the paper?

2. Is the Figure 3 a triangulated moral graph of some directed acyclic graph? If yes, give the original model.

3. What are computational complexities of the marginalization in the first example of the Section 3.1 using a) the trivial summation? b) by ordering sums according to Eq. (6)?

4. What is a treewidth? What is a treewidth of a Naive Bayes model? What happens if the treewidth of a model is overly large?

5. What is the main result of the Reference (Arnborg, Corneil, Proskurowski, 1987)?

6. What are the three types of exact inference algorithms listed in the paper?

7. Construct the junction trees of the models in Figures 6 and 7. What is the treewidth of the models?

8. What is the relationship between the junction tree algorithm and the sum-product algorithm? What representations do they use for the inference? Do the message passing schemes differ from each other in these two cases?