

Machine Learning for Computer Vision
Winter term 2017

April 27, 2018
Topic: Probabilistic Graphical Models

Exercise 1: Reading a graphical model

We have the following graphical model:

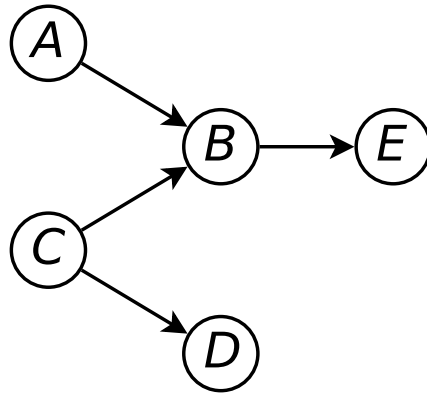
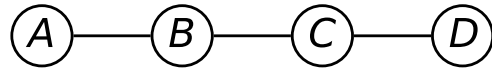


Figure 1: Graphical model.

- a) Write the joint probability distribution corresponding to the graphical model depicted in Fig. 1.
- b) What are the conditional independence assumptions of this model?
- c) Which of the following assertions are true, and why?
 - B is d-separated from D by C,
 - A is d-separated from C by E,
 - A is d-separated from C by D,
 - E is d-separated from D by B,
 - E is d-separated from D by A.
- d) Write a program in python, which can prove for a hardcoded graph if two nodes are d-separated from each other, by a third node. You can use the given *graph.py* on the website.

Exercise 2: Markov Chain

We have the following Markov Chain:



- Write the joint probability distribution associated to this Markov Chain.
- Each variable can take value 0 or 1, and we want to express that it is 9 times more probable that neighboring variables have equal values than they have different value. Give the potential functions of this Markov Chain.
- Compute the probability distributions $p(A)$ and $p(C)$.
- Now, we observe that D is 1, recompute the distributions over A and C : $p(A \mid [D = 1])$ and $p(C \mid [D = 1])$.
- Compute $p(C \mid [A = 0], [D = 1])$.