MIT CSAIL

6.819/6.869 Advances in Computer Vision

Spring 2022

Problem Set 8: Graphical Models and Mid-term Progress Report

Posted: Tuesday, April 19, 2022 **Due:** Midnight, Tuesday, April 26, 2022

Note: All students are expected to complete problems 1 and 2.

Submission Instructions: **Read Carefully! We will deduct points for not following instructions.** Please submit a .zip file named <**your kerberos**>**.zip**. It should contain 1) a report named <**your kerberos**>**.pdf** including your answers to problem 1; and 2) a mid-term progress report of your final project named <**your kerberos**>**-project.pdf**.

Late Submission Policy: If your pset is submitted within 7 days (rounding up) of the original deadline, you will receive partial credit. Such submissions will be penalized by a multiplicative coefficient that linearly decreases from 1 to 0.5.

Problem 1 [4 points] *Markov Network*

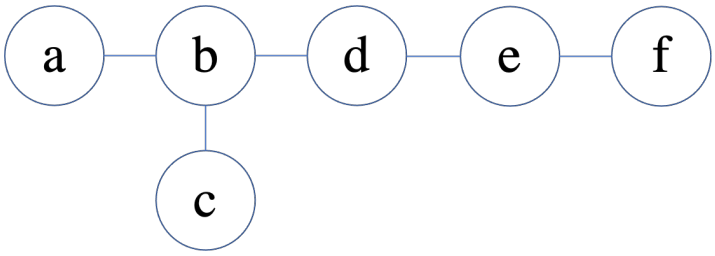

Figure 1: A Markov network

Consider the Markov network in Figure 1. Each variable is binary and can be in state 0 or state 1. c is observed to be in state 1 and f is observed to be in state 0. Additionally, the compatibility matrices Φ and Ψ are given by

$$\Phi(b,c) = \begin{pmatrix} 0.9 & 0.1 \\ 0.1 & 0.9 \end{pmatrix} = \Phi(e,f)$$

$$\Psi(a,b) = \begin{pmatrix} \alpha & 1-\alpha \\ 1-\alpha & \alpha \end{pmatrix} = \Psi(b,d) = \Psi(d,e)$$

(a) [**2 points**] For $\alpha = 0.99$ find $\mathrm{P}(a)$, the marginal probabilities of variable a being in either of its two possible states, 0 and 1.

(b) [**2 points**] Do the same for $\alpha = 0.6$. Discuss why the result is different in these two cases.

Problem 2 [4 points] *Final project progress report*

The progress report should be around 1∼2 pages, including a sketch of abstract, introduction, related work, the proposed method (as rigorous as possible), what you have done so far, and the plans for the next few weeks. It should be in the CVPR format[1]. The key idea of the report is to help your organize your thoughts and the results you have so far. Consolidating the report can also provide you a clearer picture of the state of the project and help you make future plans. Most importantly, the content could be re-used for your final project report!

[1] https://cvpr2022.thecvf.com/author-guidelines