



Bookmarks

- ▶ Introduction
- ▶ Part 1: Probability and Inference
- ▼ **Part 2: Inference in Graphical Models**

Week 5: Introduction to Part 2 on Inference in Graphical Models

Week 5: Efficiency in Computer Programs
Exercises due Oct 20, 2016 at 02:30 IST



Week 5: Graphical Models
Exercises due Oct 20, 2016 at 02:30 IST



Week 5: Homework 4
Homework due Oct 20, 2016 at 02:30 IST



Week 6: Inference in Graphical Models - Marginalization

Part 2: Inference in Graphical Models > Week 5: Graphical Models > Practice Problem: Computing the Normalization Constant Solution

Practice Problem: Computing the Normalization Constant Solution

🔖 Bookmark this page

PRACTICE PROBLEM: COMPUTING THE NORMALIZATION CONSTANT (SOLUTION)

It turns out that once we know the potential functions, the normalization constant Z becomes fixed since the distribution needs to sum to 1. Let's show this for a simple case. Consider a two node graphical model with an edge between the two nodes corresponding to

$$p_{X_1, X_2}(x_1, x_2) = \frac{1}{Z} \phi_1(x_1) \phi_2(x_2) \psi_{12}(x_1, x_2).$$

Suppose that we are given what the potential functions are. Show what Z is equal to as a function of ϕ_1 , ϕ_2 , and ψ_{12} .

Hint: Sum both sides over all values of x_1 and all values of x_2 . What is $\sum_{x_1} \sum_{x_2} p_{X_1, X_2}(x_1, x_2)$ equal to?

Exercises due Oct 27, 2016 at 02:30 IST



**Week 6: Special Case:
Marginalization in Hidden
Markov Models**

Exercises due Oct 27, 2016 at 02:30 IST



Week 6: Homework 5

Homework due Oct 27, 2016 at 02:30 IST



**Weeks 6 and 7: Mini-project
on Robot Localization (to be
posted)**

Because knowing the potentials fixes what the value of Z is, often times we'll omit writing Z and instead write

$$p_{\underline{X}}(\underline{x}) \propto \prod_{i \in V} \phi_i(x_i) \prod_{(i,j) \in E} \psi_{ij}(x_i, x_j),$$

where " \propto " means "proportional to".

Solution: We have

$$\begin{aligned} 1 &= \sum_{x_1} \sum_{x_2} p_{X_1, X_2}(x_1, x_2) \\ &= \sum_{x_1} \sum_{x_2} \frac{1}{Z} \phi_1(x_1) \phi_2(x_2) \psi_{12}(x_1, x_2) \\ &= \frac{1}{Z} \sum_{x_1} \sum_{x_2} \phi_1(x_1) \phi_2(x_2) \psi_{12}(x_1, x_2), \end{aligned}$$

so

$$Z = \sum_{x_1} \sum_{x_2} \phi_1(x_1) \phi_2(x_2) \psi_{12}(x_1, x_2).$$

In general for a graphical model with graph $G = (V, E)$ and factorization

$$p_{X_1, \dots, X_n}(x_1, \dots, x_n) = \frac{1}{Z} \prod_{i \in V} \phi_i(x_i) \prod_{(i,j) \in E} \psi_{ij}(x_i, x_j),$$

using the same reasoning as above,

$$Z = \sum_{x_1} \cdots \sum_{x_n} \prod_{i \in V} \phi_i(x_i) \prod_{(i,j) \in E} \psi_{ij}(x_i, x_j).$$

© All Rights Reserved



© 2016 edX Inc. All rights reserved except where noted. EdX, Open edX and the edX and Open EdX logos are registered trademarks or trademarks of edX Inc.

POWERED BY
OPENedX®

