Bookmarks

Introduction

1. Probability and Inference

Introduction to Probability (Week 1)
Exercises due Sep 21, 2016 at 21:00 UTC

Probability Spaces and Events (Week 1)
Exercises due Sep 21, 2016 at 21:00 UTC

Random Variables (Week 1)
Exercises due Sep 21, 2016 at 21:00 UTC

Jointly Distributed Random Variables (Week 2)
Exercises due Sep 28, 2016 at 21:00 UTC

Conditioning on Events (Week 2)
Exercises due Sep 28, 2016 at 21:00 UTC

Homework 1 (Week 2)
Homework due Sep 28, 2016 at 21:00 UTC

Inference with Bayes' Theorem for Random Variables (Week 3)
Exercises due Oct 05, 2016 at 21:00 UTC

Independence Structure (Week 3)
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Homework 2 (Week 3)

1. Probability and Inference > Independence Structure (Week 3) > Exercise: Mutual vs Pairwise Independence

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Exercise: Mutual vs Pairwise Independence

(1/1 point)

Suppose random variables X and Y are independent, where X is 1 with probability 1/2, and -1 otherwise. Similarly, Y is also 1 with probability 1/2, and -1 otherwise. In this case, we say that X and Y are *identically distributed* since they have the same distribution (remember, just because they have the same distribution doesn't mean that they are the same random variable — here X and Y are independent!). Note that often in this course, we'll be seeing random variables that are independent and identically distributed (i.i.d.).

Suppose we have another random variable Z that is the product of X and Y, i.e., $Z = XY$.

Select all of the following that are true:

- [x] The distributions p_X, p_Y, and p_Z are the same. ✔
- [x] The joint distributions $p_{X,Y}$, $p_{X,Z}$, and $p_{Y,Z}$ are the same. ✔
- [x] X, Y, and Z are pairwise independent. ✔
- [ ] X, Y, and Z are mutually independent.

✔

Solution:

The fastest way to solve this problem is to realize that it's actually the same problem as in the previous video where we had X and Y independent and identically distributed as $\text{Bernoulli}(1/2)$, and Z was the exclusive-or (XOR) of X and Y. All we did was slightly change the labels of the outcomes to get this problem! Notice that Z takes on value -1 precisely when X and Y are different, and 1 otherwise. Hopefully that should sound like XOR. Basically -1 is what used to be 1, Homework due Oct 05, 2016 at 21:00 UTC

Notation Summary (Up Through Week 3)

Mini-project 1: Movie Recommendations (Week 3)
Mini-projects due Oct 12, 2016 at 21:00 UTC

and 1 is what used to be 0. The problem is otherwise the same and the identical reasoning used in the video can be used here, so we won't actually spell out the solution again in detail (it's in the video!).

As a reminder, you can check that p_X, p_Y, and p_Z are each going to have 1/2-1/2 chance of being either 1 or -1, so they have the same distribution, and when we look at any pair of the random variables, they are going to appear independent with (1, 1), (1, -1), (-1, 1), and (-1, -1) equally likely so the pairs of random variables also have the same distribution. However, as before, when we look at all three random variables, they are not mutually independent!

You have used 1 of 5 submissions