

MITx: 6.008.1x Computational Probability and Inference

Heli



- ▶ Introduction
- ▼ 1. Probability and Inference

Introduction to Probability (Week 1)

Exercises due Sep 22, 2016 at 02:30 IST

Probability Spaces and Events (Week 1)

Exercises due Sep 22, 2016 at 02:30 IST

Random Variables (Week 1)

Exercises due Sep 22, 2016 at 02:30 IST

Jointly Distributed Random Variables (Week 2)

Exercises due Sep 29, 2016 at 02:30 IST

Conditioning on Events (Week 2)

Exercises due Sep 29, 2016 at 02:30 IST

1. Probability and Inference > Inference with Bayes' Theorem for Random Variables (Week 3) > Exercise: The Product Rule for Random Variables - Medical Diagnosis Revisited

■ Bookmark

Exercise: The Product Rule for Random Variables - Medical Diagnosis Revisited

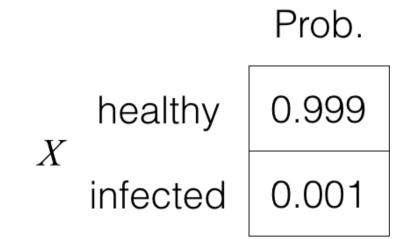
(4/4 points)

(d)

(A)

Let's revisit the medical diagnosis problem we saw earlier. We now use random variables to construct a joint probability table.

Let random variable X represent the patient's condition — whether "healthy" or "infected", with the following distribution for X:



Homework 1 (Week 2)

Homework due Sep 29, 2016 at 02:30 IST

(A)

(A)

(A)

Inference with Bayes' Theorem for Random Variables (Week 3)

Exercises due Oct 06, 2016 at 02:30 IST

Independence Structure (Week 3)

Exercises due Oct 06, 2016 at 02:30 IST

Homework 2 (Week 3)

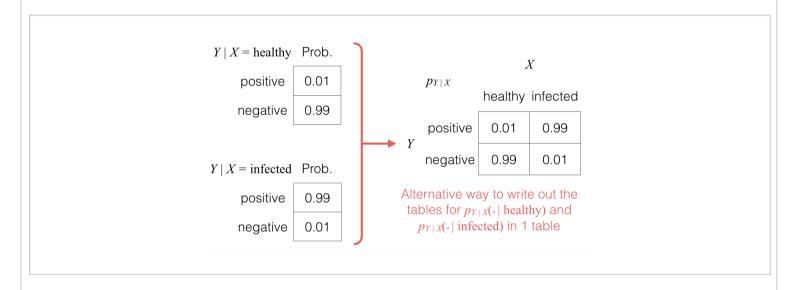
Homework due Oct 06, 2016 at 02:30 IST

Notation Summary (Up Through Week 3)

Mini-project 1: Movie Recommendations (Week 3)

Mini-projects due Oct 13, 2016 at 02:30 IST

Meanwhile, the test outcome \boldsymbol{Y} for whether the patient is infected is either "positive" (for the disease) or "negative". As before, the test is 99% accurate, which means that the conditional probability table for \boldsymbol{Y} given \boldsymbol{X} is as follows (note that we also show how to write things out as a single table):



Using the product rule for random variables, what are the four entries for the joint probability table? **Please provide the exact answer for these four quantities.**

Solution:

$$egin{aligned} p_{X,Y}(ext{healthy}, ext{positive}) &= p_X(ext{healthy}) p_{Y|X}(ext{positive} \mid ext{healthy}) \ &= 0.999 imes 0.01 \ &= \boxed{0.00999} \end{aligned}$$

$$p_{X,Y} ext{(healthy)}p_{Y|X} ext{(negative | healthy)} \ = 0.999 imes 0.99 \ = \boxed{0.98901}$$

$$p_{X,Y}(ext{infected}, ext{positive}) = p_X(ext{infected}) p_{Y|X}(ext{positive} \mid ext{infected}) = 0.001 imes 0.99 = \boxed{0.00099}$$

$$p_{X,Y}(ext{infected}, ext{negative}) = p_X(ext{infected}) p_{Y|X}(ext{negative} \mid ext{infected}) \ = 0.001 imes 0.01 \ = \boxed{0.00001}$$

You have used 1 of 5 submissions

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