CSSS/STAT/SOC 321:
Case-Based Statistics I

Extra Credit Essay

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Due: Friday, November 16, 2012, in class.
Worth up to 2 points on your final course grade.

Extra credit assignment: Choose a recent newspaper or magazine article about a social, economic, or political issue which implicitly discusses a conditional probability,[1] and which includes at least one statement (either a quote within the article, or a statement by the author of the article) which reflects at least one of the three following errors:

Mistaking the *marginal probability* of an event for the conditional probability. The author or source treated was worried about event A happening under circumstances B, and used $\Pr(A)$ instead of $\Pr(A|B)$.

Example: The lightning example from lecture, in which two people know that the probability of death by lightning is low in general, but mistakenly think that means the probability of death by lightning is low given that you go for a run in a lightning storm.

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1 Naturally, the authors of the article are unlikely to use the words "conditional probability," so you will have to recognize a debate about a social phenomenon as a debate about a conditional probability.

Mistaking the *conditional probability* of an event for the marginal probability. The author or source was worried about event A happening in general, but used $\Pr(A|B)$ instead of $\Pr(A)$.

Example: Problem 3 of the midterm, in which people focus on the probability that someone is a victim of crime given their appearance in the news, instead of the overall probability of being a victim.

Mistaking the *inverse probability* of an event for the correct conditional probability. The author or source was worried about event A happening under circumstances B, but used $\Pr(B|A)$ instead of $\Pr(A|B)$.

Example: Problem 4 of the midterm, in which Bart worried about the probability it snows given a forecast of snow, but mistakenly used the probability of a forecast of snow given that it snows.

In an essay of at least two pages, identify and explain the error(s) and demonstrate through a probability calculation how the correct probability statement leads to a different conclusion. For this step, you may need to provide your own estimates of some of the relevant probabilities if the article is not specific. Choose numbers which best reflect the biases of the source material in your article and avoid simply assuming your answer – calculate the probability you need using the probability rules we have learned.

Writing a paper that connects a quantitative argument to a substantive issue takes care. Be sure that your essay identifies the nature and substantive import of the probability misunderstanding in plain language, explicitly states the correct probability rules for solving the problem (that is, your paper should include a formal, mathematical statement of the probability of interest), shows the steps in calculating this quantity, and finally, explains how the claims in the article would change given the correct calculation. All four steps should flow together; don't just staple some calculations to the end of your essay, but integrate your mathematical and substantive arguments.

You must also include a copy of the original article with your essay.

Evaulation. You will be graded on the creativity of your application, how well you apply concepts from the course to your article, and how important a proper understanding of probability is to understanding the issue raised by your article.

Sketch of an example essay: An article on a recent shooting in Belltown might have a quote from a Seattle resident who says that "Belltown used to be a safe place to go, but now every time it appears in the news, it's because someone has been shot or stabbed." The resident decides that going to Belltown restaurants is now "too dangerous."

In this case, the most obvious error is that the resident has used the news to estimate

$$\Pr(\text{someone is shot or stabbed in Belltown}|\text{Belltown mentioned in the news}), \quad (1)$$

when the real question is what is the probability someone is shot or stabbed in Belltown,

$$\Pr(\text{someone is shot or stabbed in Belltown}). \quad (2)$$

Like Problem 3 in the midterm, the person quoted has overestimated the risk of crime in Belltown by failing to understand that the news filters out most of the non-criminal events that occur in the neighborhood.

After explaining this confusion, the next step is to put some quantitative probabilities to the assumptions and statements in the article. You might, for the sake of argument, *suppose* that the person quoted believes that the probability of being shot or stabbed given an appearance on the news is two in three. Then you could stipulate, again for the sake of argument and based on nothing more than your reason and experience, that the probability of appearing on the news is 1 in 200, the probability of being shot of stabbed without a news appearance is a mere 1 in 100, and use these three probabilities to calculate the marginal probability of being shot or stabbed in Belltown.

Next, you should provide the correct way to calculate the probability

$$\Pr(\text{shot or stabbed in Belltown}), \quad (3)$$

calculate this quantity, and explain how the proper calculation would change the conclusion of the news article. (As a check, solving for the probability of being shot or stabbed with these assumed probabilities is about 1.3%.)

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IMPORTANT NOTE: Because we used crime as the example here and on the midterm, you should find an example that doesn't involve crime. Possibilities include discussions of public health, national security and terrorism, election outcomes, and more.