Homework

- Submit your answers before the next class.
- You may discuss with peers but submissions must be individual.
- Responses may be shared anonymously during class discussion!

Homework

Question 1

Think of a recent situation in which you changed your mind. Make a Bayesian knowledge-building diagram that includes your prior information, explain how new data helped you change your mind and your posterior conclusion.

Homework

Question 2

There are several data scientist openings at a heavily hyped company. Having read the job description, you know for a fact that you are qualified for the position (this is your data). Your goal is to ascertain whether you will actually be offered a position (this is your hypothesis).

a. From the perspective of someone using frequentist thinking, what question is answered in testing the hypothesis that you'll be offered the position?

b. Repeat part (a) within a Bayesian framework

c. Which question would you rather have the answer to: the frequentist or the Bayesian? Explain.

Homework

Question 3

a. Identify a topic that you know about (e.g., a sport, a school subject, music).
b. Identify a hypothesis about this subject.
c. How would your current expertise inform your conclusion about this hypothesis?
d. Which framework are you employing here, Bayesian or frequentist?

Homework

Question 4

A university health center is considering whether to recommend a costly new screening test for a rare disease among students. Historical data suggest that only 2% of students have the disease. The test correctly identifies diseased students 95% of the time. The test falsely identifies healthy students as diseased 8% of the time. A student tests positive.

a. What is the probability the student actually has the disease?
b. Should the health center automatically recommend treatment after one positive test?
c. What are the risks of a false positive? a false negative?
d. How would the decision change if the disease were more common?

Homework

Question 5

Suppose two analysts disagree about the probability of a cyberattack before seeing evidence:

- Analyst A believes the probability is 1%.
- Analyst B believes the probability is 20%.

Then, both observe the same security alert.

a. How can Bayesian reasoning explain why the analysts may still reach different conclusions?
b. What role do priors play in decision-making under uncertainty?
c. When is it reasonable for two people to maintain different posterior beliefs after observing the same data?
d. How do costs and risks influence the final decision, beyond just the posterior probability?

Homework

Question 6

Your friend just became interested in Bayesian statistics.
Explain the following to them:

a. Why is Bayesian statistics useful?
b. What are the similarities in Bayesian and frequentist statistics?