Data Science Notes by Sarowar Ahmed

📊 Chapter: Bayesian Statistics

📊 Topic: Bayesian inference

🔎 Hello, GitHub community! Today, let's dive into an exciting topic in statistics that might sound daunting but is incredibly powerful and useful: Bayesian inference. Whether you're a student just starting out, a professional looking to brush up on stats, or just curious about how decisions are made using data, this post will help you understand Bayesian inference in a straightforward way. Let's break it down with simple explanations, a visual guide, and real-life examples!

🌟 What is Bayesian Inference?

▪ Bayesian inference is a method of statistical inference in which Bayes' theorem is used to update the probability for a hypothesis as more evidence or information becomes available. It's a fantastic tool for making decisions with uncertainty, allowing us to combine prior knowledge with new evidence.

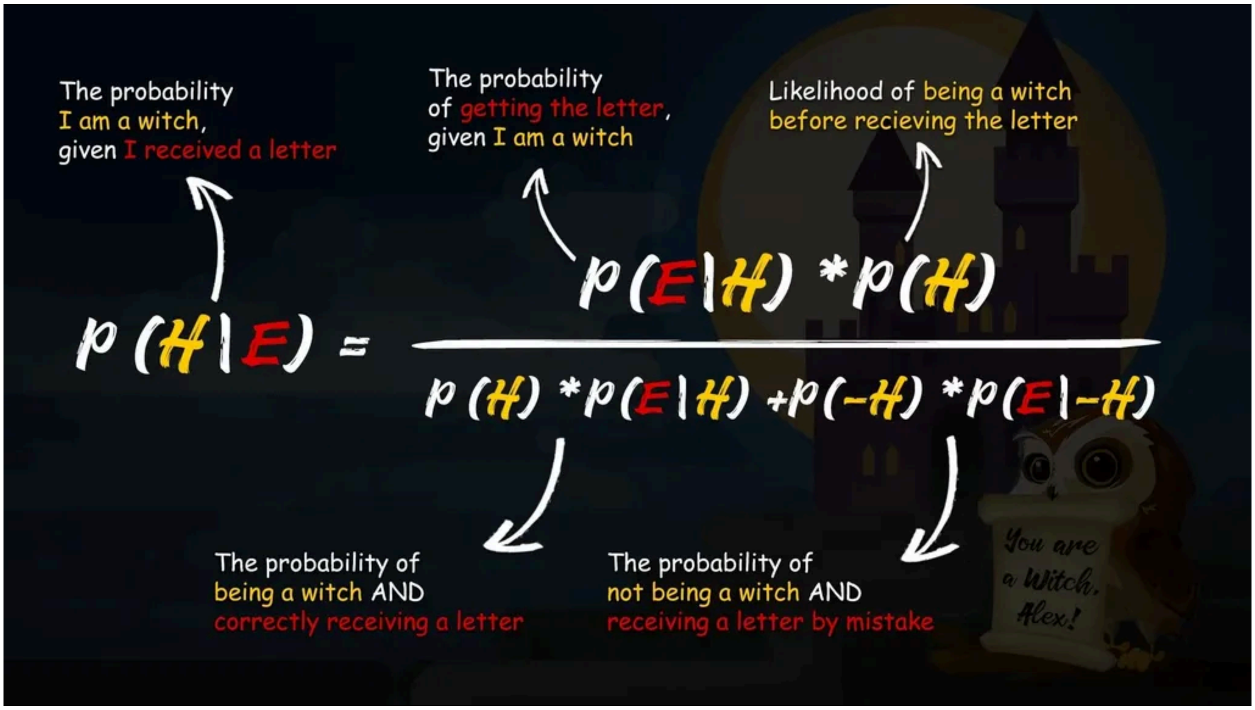
📐 Formula of Bayesian Inference:

▪ Bayesian inference revolves around updating our prior belief about something based on new data or evidence. The formula used is:

$$P(H|E)=P(E|H)\times P(H)/P(E)$$

Where:
▪ P(H | E) is the probability of the hypothesis H given the evidence E (posterior probability)
▪ P(E | H) is the probability of observing the evidence E given that H is true (likelihood).
▪ (H) is the probability of the hypothesis before seeing the evidence (prior probability).
▪ P(E) is the total probability of the evidence under all possible hypotheses.

🖼️ Visual Aid:



🌍 Real-Life Example:

▪ Scenario: Let's consider a medical diagnosis. A doctor knows that 1% of the population has a certain disease (prior). A test for the disease is 99% accurate (likelihood).

▪ Question: What’s the probability a patient has the disease if they test positive?
Using Bayesian Inference:

▪ Prior probability ($P(H)$): 1% or 0.01
▪ Likelihood ($P(E|H)$): 99% or 0.99
▪ Probability of the evidence ($P(E)$): $(0.01 * 0.99) + (0.99 * 0.01) =$ 0.0198

$P(H|E) = 0.99 \times 0.01 / 0.0198 \approx 0.5$

So, there’s a 50% chance the patient actually has the disease despite testing positive, given the rarity of the disease.

🚀Why This Matters:

▪ Bayesian inference is crucial in many fields like healthcare, finance, and machine learning. It helps incorporate uncertainty into decision-making processes and adjust predictions as more data becomes available.
Got any questions about Bayesian inference!? Feel free to ask me via Linkedin! Let's keep learning together.

My LinkedIn Date: 30/04/2024