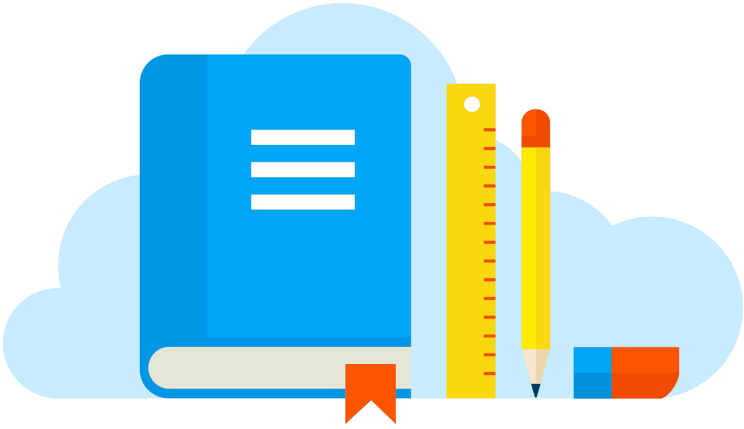

Data Science Notes by Sarowar Ahmed

📊 Chapter: Probability Theory

📊 Topic: Joint, marginal, and conditional probabilities

🔎 Hey there, GitHub family! Let's unravel the mysteries of Probability Theory by diving into three essential concepts: Joint, Marginal, and Conditional Probabilities. Don't worry, I'll break it down in a way that's crystal clear for everyone, regardless of age or background!

🎲 What Do These Terms Mean?

▪ Joint Probability: Ever wondered about the likelihood of two events happening together? That's where joint probability comes in! It

measures the probability of the intersection of two or more events occurring simultaneously.

▪ Marginal Probability: Sometimes, we just want to know the probability of one event happening, regardless of other factors. Marginal probability helps us do just that by focusing on a single event's probability.

▪ Conditional Probability: Imagine you know that one event has already occurred. Now, what's the probability of another event happening given this information? That's where conditional probability steps in, helping us understand the likelihood of an event given that another event has already occurred.

📊 Formulas and Examples:
Let's break down each concept with formulas and examples:

1. Joint Probability ($P(A \cap B)$):

▪ Formula: $P(A \cap B) = P(A) \times P(B)$ (for independent events)
▪ Example 1: Imagine rolling a fair six-sided dice. Let *A* be the event of rolling an even number (2, 4, or 6), and *B* be the event of rolling a number greater than 3 (4, 5, or 6). The joint probability of rolling an even number and a number greater than 3 would be the probability of rolling a 4 or a 6, which is - 2/6 = 1/3

Example 2: Two fair dice are thrown. What is the probability that each will land on a 6?
Since there is only one 6 on each dice and there are six sides to each, then the probability of each is - 1/6.
Hence the joint probability would be - 1/6 * 1/6 = 1/36

2. Marginal Probability ($P(A)$):

▪ Formula: $P(A)=\Sigma_i P(A \cap B_i)$ (for discrete random variables)
▪ Example: Using the same dice example, the marginal probability of rolling an even number is the sum of the probabilities of rolling a 2, 4, or 6, which is 3/6 = 1/2

3. Conditional Probability ($P(B|A)$):

▪ Formula: $P(B|A)= P(A \cap B)/P(A)$

▪ Example: Given that you rolled an even number (event A), what's the probability of rolling a number greater than 3 (event B)? From the joint probability example 1, $P(A \cap B) = 1/3$ and $P(A) = 1/2$.
So, $P(B|A) = (1/3)/(1/2) = 2/3$

🌟 Why Does This Matter?

Understanding joint, marginal, and conditional probabilities helps us make informed decisions in various fields, from finance to medicine, by quantifying uncertainties and predicting outcomes.

Got any questions about Joint, Marginal, and Conditional Probabilities!? Feel free to ask me via Linkedin! Let's keep learning together.

My LinkedIn Date: 08/04/2024