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Reading: Define and Demonstrate Probability

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After completing this topic, you will be having knowledge about:

1. Statistical Probability

2. Categorical Data

3. Quantitative Data

1. Statistical Probability

Probability is the branch of mathematics concerning numerical descriptions of how likely an event is to occur or how likely it is that a proposition is true. Probability is used extensively in AI to develop machine learning models which will predict the outcome based on probability.

Probability of an event happening is written as:

Probability Formula

$$P(\text{an Event}) = \frac{\text{Number of times an event can happen}}{\text{Total number of possible outcome}}$$

Example of probability:

Let's calculate the chances of rolling a 4 with a die when it is rolled once.

Number of ways it can happen: 1 (There is only one face with a"4" on it)

Total number of possible outcomes: There are 6 faces altogether

So, the probability is of the event, 4 on the face of the die, happening is 1/6

Machine Learning uses Bayes theorem of probability to predict the probability of an event happening.

$$P(A \mid B) = \frac{P(B \mid A) \cdot P(A)}{P(B)}$$

A, B　　　　= events

$P(A|B)$　　　= probability of A given B is true

$P(B|A)$　　　= probability of B given A is true

$P(A), P(B)$ = the independent probabilities of A and B

Bayes theorem states that the probability of an event A happening, given that event B has happened, is equal to the probability of an event B happening, given that A has happened multiplied by the probability of A happening divided by the probability of B happening.

Let's understand this with playing cards. We know that there are 4 sets (♦ ♥ ♣ ♠)and 13 cards in each set. We know that if we randomly draw a card and we know the card is red, it can only be a ♦ or a ♥. What is the probability it is a ♥ ? One out of the two possible outcomes. So the probability is 1/2.

Let's try to apply the formula and verify if the answer is right. We have two events.

Event A - The card is a ♥.

Event B - The card is red.

We are trying to find what is the probability it is a heart, given that it is red. P(A/B)

As per the formula,

P(B/A) - Probability that it is red given that it is a ♥, which 1 as ♥ can only be red.

P(A) - Probability that it is a ♥ - 1/4th of the cards are hearts, so 1/4.

P(B) - P() Probability that it is red - Half the cards are red in a pack, so 1/2

= ((1)*(1/4))/(1/2) = 1/2, which is the same we already knew and didn't have to go through all the trouble, if didn't want to learn how to do it with Bayes Theorem.
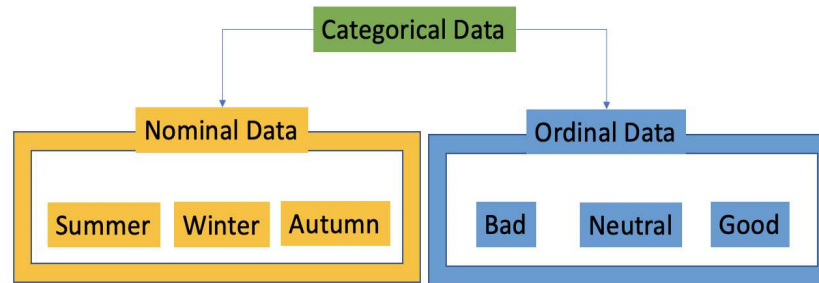
2. Categorical data:

Categorical data is a collection of information that is divided into groups.

Types of Categorical Data:

1. **Nominal Data:** This is a type of data used to name variables without providing any numerical value.

2. **Ordinal Data:** This is a data type with a set order or scale to it. However, this order does not have a standard scale on which the difference in variables in each scale is measured.

Examples of Categorical Data

Rate your satisfaction - Very Unsatisfied, Unsatisfied, Neutral. Satisfied, Extremely Satisfied. This is an ordinal data example.

Which is your most convenient day to call - Monday, Tuesday, Wednesday, Thursday, Friday, Saturday. This is a nominal data example.

3. Quantitative data

Quantitative data are measures of values or counts and are expressed as numbers, both whole numbers and numbers with decimals.

Quantitative data are data about numeric variables (e.g. how many; how much; or how often).

Types of Quantitative data:

- **Counter:** Count equated with entities. For example, the number of people who download a particular application from the App Store.
- **Measurement of physical objects:** Calculating measurement of any physical thing. For example, the HR executive carefully measures the size of each cubicle assigned to the newly joined employees.

- **Sensory calculation:** Mechanism to naturally "sense" the measured parameters to create a constant source of information. For example, a digital camera converts electromagnetic information to a string of numerical data.

Quantitative Data Examples:

- I updated my phone 6 times in a quarter.

- My teenager grew by 3 inches last year.

- 83 people downloaded the latest mobile application.

- My aunt lost 18 pounds last year.

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