Conditional probability

Conditional probability is a measure of the likelihood of an event occuring, given that another event has already occured or is assumed to have occured.

Product rule (for independent event)
When A and B independent;

$$P(A \cap B) = P(A) \cdot P(B)$$

1. What is the probability of dice that first is 6 and the sum is 10. if two dice is thrown?

ans

$$P(1^{st} \text{ is } 6 \cap \text{sum} = 10) = \frac{(6,4)}{\text{total sample space}}$$

$$= \frac{1}{36}$$

General product rule

$$P(A \cap B) = P(A) \cdot P(B|A)$$

when independent

$$P(B|A) = P(B)$$

Dependent VS independent

① **Dependent event** : Two events are considered dependent if the occurrence of one event affects the probability of the other event.

$$P(B/A) \neq P(B)$$

$P(B|A) \Rightarrow$ is the conditional probability of event B occuring given that event A has occurred

$P(B) \Rightarrow$ is the probability of event B occuring ~~given that event A has occured~~, without any knowledge about event A.

② **Independent events** : Two events are ~~consid~~ considered independent if the occurence of one event does not affect the probability of the other event.

mathematically, two events A and B are independent if and only if;

$$P(A \cap B) = P(A) \times P(B)$$

$$P(B|A) = P(B)$$

Bayes Theorem

"likelihood: The likelihood is sometimes ~~as~~ also called the measurement model."

Bayes theorem allow's us to invert the relationship between x and y given the likelihood.

That's why its called the probabilistic inverse.

Bayesian inference is ~~about learning~~ about learning the distribution of random variables

Bayesian inference inverts the relationship between parameters and the data.

Bayes' theorem: Bayes' theorem is a fundamental principle in probability theory and statistics that describes ~~the~~ the probability of an event based on prior knowledge or information related to the event.

It is named after Thomas Bayes, an 18th-century statistician & ~~theologi~~ theologian

mathematically: If $B_1, B_2, \ldots B_n$ are mutually exclusive events of which one must occur the

$$P(B_r/A) = \frac{P(B_r) \cdot P(A|B_r)}{\sum_{i=1}^{n} P(B_i) \cdot P(A|B_i)}$$

for $r = 1, 2, \ldots, n$

Bayes' theorem is a ~~the theorem~~ tool for updating beliefs about the probability of an event based on observed evidence. It calculates the revised probability of an event given new information.

Simplified fmla (in terms of notatn)

$$P(A|B) = \frac{P(A) . P(B|A)}{P(A) . P(B|A) + P(A') . P(B|A')}$$

Bayes theorem fmla

$$P(spam|lottery) = \frac{P(spam) . P(lottery|spam)}{P(spam) . P(lottery|spam) + P(not\ spam) . P(lottery|not\ spam)}$$

$$P(spam|lottery) = \frac{P(spam) . P(lottery|spam)}{P(spam) . P(lottery|spam) + P(not\ spam) . P(lottery|not\ spam)}$$

Bayes Theorem :

- Prior
- ~~Event~~
- Posterior

Prior probability (P(A)) : refers to the initial or existing probability of an event occuring before considering any new evidence. it represents our initial belief about the likelihood of event A happening, based on prior knowledge, experience or assumptions.

Posterior probability P(A|B) : is the updated or revised probability of event A occuring, taking into account new evidence or information (event B) that has been observed. It's the probability we're trying to calculate using Bayes' theorem, given the occurrence of event B.