



Classification:

Bayesian Decision Theory Parametric and Non-parametric Methods

- * Bayesian Method is used to calculate Conditional Probability in machine learning application that includes Classification tasks.
- * It's also used to reduce computation time and average cost of the project.
- * It helps to determine the probability of an event with random knowledge.
- * Bayes theorem can be derived using product Rule and Conditional probability of event 'x' with known event 'y'

$$\hookrightarrow P(x|y) = P(x|y) P(y) \text{ ————— } \textcircled{1}$$

Probability of event y with known event x

$$\hookrightarrow P(x|y) = P(y|x) P(x) \text{ ————— } \textcircled{2}$$

$$\hookrightarrow P(x|y) = \frac{P(y|x) P(x)}{P(y)}$$

↳ The above Eqn is called Bayes Rule (or Bayes theorem)



* Multivariate Regression is a simple extension of multiple Regression

* Examples

If E Commerce Company has collected the data of its customer such as Age, purchased history of a customer, gender and Company want to find the relationship between these different dependent and independent variables.

Steps:

- Step 1: Import the necessary common libraries
- Step 2: Read the dataset
- Step 3: Normalize the data
- Step 4: Archive Regression [use Eqn = $y = mx + c$]
- Step 5: Train the model using hyperparameter
- Step 6: Measure the loss/cost function
- Step 7: Hypothesis Value is true [check]
- Step 8: Minimize the loss
- Step 9: Analyse the Loss Eqn
- Step 10: check the final Result



* $P(x|y)$ is called Posterior, which we need to calculate, it's defined as updated Probability after considering the evidence.

* $P(y/x)$ is called the likelihood. It's the Probability of evidence when hypothesis is true.

* $P(x)$ is called the Prior Probability.

* $P(y)$ is called Marginal Probability. defined as the Probability of evidence under any consideration.

* Posterior = likelihood * Prior / Evidence

Example

Rolling a dice, there are two events 'A' and 'B'

A → Event when an even number is obtained = {2, 4, 6}

B → Event when a number is greater than 4 = {5, 6}

* Probability of event A $P(A) \Rightarrow$

$$P(E) = 3/6 = 1/2 = 0.5$$

* Probability of event B $P(B) \Rightarrow$

$$P(E) = 2/6 = 1/3 = 0.33$$



① Independent Event

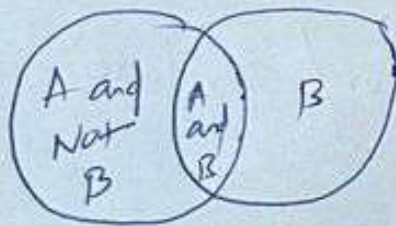
$$\rightarrow P(A \cap B) = P(A \cap \overline{B}) = P(A) \cdot P(B)$$

② Conditional Probability

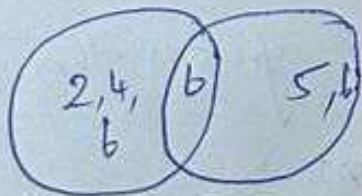
$$\rightarrow P(A|B) = P(A \cap B) / P(B)$$

③ Marginal Probability

$$\rightarrow P(A) = P(A|B) \cdot P(B) + (P(A|\sim B)) \cdot P(\sim B)$$



④ Union of Event



$$A \cup B = \{2, 4, 5, 6\}$$

$$A \cap B = \{6\}$$