NAIVE BAYES ALGORITHM

NAIVE BAYES

- Supervised machine learning algorithm
- Based on Bayes' Theorem
- It assumes that the features are independent of each other – which is a naive assumption

Formula for Bayes' Theorem:

$$P(A|B) = [P(B|A) \cdot P(A)] / P(B)$$

P(A|B) - probability of event A happening given that B is true (posterior)

P(B|A) - Probability of B given A (likelihood)

P(A) - Probability of A (prior)

P(B) - Probability of B (Evidence)

EXAMPLE

We wanttopredict - “Ifsunny,should we play?

Step-1: Calculate prior probabilities

Total Record = 5

P(play = Yes) = 3/5 = 0.6

P(play = No) = 2/5 = 0.4

Step-2: Likelihoods

P(W = Sunny|P = Yes) = How many sunny days when play = Yes. → ⅓ = 0.33

P(W=S|P=No) = How many sunny days when play = No? →2/2= 1.0

EXAMPLE

Bayes' Theorem:

P(p = Yes|Sunny) = P(Sunny|P=Yes).P(play=Y) / P(Sunny)

P(p = No|Sunny) = P(Sunny|P=No).P(p=No) / P(Sunny)

Proportional Formula (Comparison only)

P(Class|Feature) pro P(Feature|Class).P(Class)

P(p=Y|Sunny) pro P(sunny|p=Y)*P(Y) → 0.33*0.6 = 0.198

P(p=N|Sunny) pro P(sunny|p=N)*P(N) → 1.0*0.4 = 0.4

0.4>0.198

predict = No

TYPES OF NAIVE BAYES CLASSIFIER

Naive Bayes Type	Class in `sklearn`	Suitable For	Assumptions / Notes
GaussianNB	`GaussianNB()`	Continuous numerical features	Assumes features follow a **normal (Gaussian)** distribution
MultinomialNB	`MultinomialNB()`	Discrete counts (e.g., word counts)	Good for text classification using **Bag of Words / TF-IDF**
BernoulliNB	`BernoulliNB()`	Binary/Boolean features (0 or 1)	Useful for tasks like spam detection with **binary features**
ComplementNB	`ComplementNB()`	Imbalanced text classification	Variant of MultinomialNB, works better for **imbalanced classes**
CategoricalNB *(v0.22+)*	`CategoricalNB()`	Categorical/discrete features	Encoded categorical features (e.g., label-encoded)

MCQS

1.Naive Bayes is based onwhichprobabilityconcept?

a) Bayes' Theorem

b) Pythagoras Theorem

c) Central Limit Theorem

d) Law of Large Numbers

2. What does the "Naive" in Naive Bayes refer to?

a) It is simple to implement

b) It assumes that all features are independent

c) It is a beginner algorithm

d) It ignores the training data

3. Which type of problems is Naive Bayes commonly used for?

a) Regression Problems

b) Time Series Forecasting

c) Classification Problems

d) Clustering Problems

THANK YOU