ML

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PAC Average

Q-1 Explain Ensemble learning with example

- Ensamble learning combines multiple models to make better predictions than a single model alone

- It works by averaging or voting across models to reduce errors and improve accuracy

- Ex In a movie recommendation system, you could combine predictions from decision tree

  - K-nearest neighbour and svm; methods like Bagging and bosting enhance model performance by reducing error & refine predictions with each new model

Q-2 Write the steps of ID3 Algorithm & also explain the capabilities and limitation of ID3

- Step 1:- Begin the tree with the root node says S which contain the complete dataset

- Step 2: Find the best attribute in the dataset using Attribute Selection measure - Consider Highest value of Information Gain feature as best feature

Step 3:- Divide the S into subsets that contain value for the best attributes

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Step 4:- Generate the design tree node, which contain the best attribute

Step 5:- Recursively make new decision tree using the subsets of the dataset created in Step 3. Continue this process until a stage is reached where you cannot further classify the node, and called the final node as leaf node.

=> Capabilities

- Simple and Easy to Implement
- Effective with categorical data
- Quick Decision making
- Readable & Interpretable models

=> Limitations:

- Limited to Static Trees
- Doesn't Handle missing Data
- Not ideal for continuous data
- A tendency to overfit
- Prone to bias for attributes with more values

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Q-3 Find out the Equation for Linear Regression line for the following data. Also find out MAE, MSE, RMSE

X	1	2	3	4	5
Y	2	3	4	5	5

Slop. b and intercept a

$$b = \frac{n\Sigma(xy) - \Sigma x \Sigma y}{n\Sigma x^2 - (\Sigma x)^2}$$

$$a = \frac{\Sigma y - b\Sigma x}{n}$$

$$Y = a + bx$$

$$MAE = \frac{1}{n}\Sigma|y - \hat{y}|$$

$$= 0.24$$

$$MSE = \frac{1}{n}\Sigma(y - \hat{y})^2$$

$$= 0.08$$

$$RMSE = \sqrt{MSE} = 0.283$$

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Q-4 What is L1 and L2 Regression Techniques and why it is used?

- L1 and L2 Regression are techniques used to prevent overfitting in linear regression by adding regularization term to loss function.

- L1: Adds absolute value of co-efficient as a penalty term, it can shrink some coefficient to zero, effectively selecting features and creating a sparse model

- L2: Adds square of coefficient as a penalty which discourses large coefficient but doesn't set any zero, It helps in reducing model complexity while keeping all features

- These techniques are used to improve model generation, especially when dealing with multicollinearity or a large number of features

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Q-5 Explain Nave Bayes classification?

- It is Probalistic models based on Bayes Theorem used for classification task.

- They assume that features in dataset are independant of each other, which is why they are called "nave"

=> Bay's Theorem

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

P(A|B) is probability of class A give evidence B.

P(B|A) is probability of evidance B give class A

P(A) is prior probability of class A.

P(B) is probability of evidance B

- Naive Assumption: Each features is considered independent of others, making it computationaly efficient & simple to implement

Types
- Gaussian
- Multinomial
- Bernoulli