# Randomized Grid Search & Decision Trees

Q1. What is Randomized Grid Search, and why is it used?

Answer :

Randomized Grid Search is a hyperparameter tuning technique that randomly selects combinations of parameters from a given distribution and evaluates them. It is used to find the best combination when the search space is large.

Q2. How does Randomized Grid Search differ from Grid Search?

Answer :

Grid Search evaluates all possible combinations in the parameter grid, while Randomized Grid Search samples a fixed number of parameter combinations randomly from the grid.

Q3. What is the purpose of the n\_iter parameter in Randomized Grid Search?

Answer :

The n\_iter parameter specifies how many parameter combinations to try. It controls the number of random combinations that will be tested.

Q4. What are the advantages of using Randomized Grid Search over Grid Search?

Answer :

Randomized Grid Search is faster, more efficient, and works well when the parameter space is large. It avoids evaluating every possible combination, saving time and computational resources.

Q5. When might Randomized Grid Search be preferable to Grid Search?

Answer :

When the parameter space is large or when computational resources are limited, Randomized Grid Search is preferable because it evaluates fewer combinations while still finding good parameters.

Q6. What is a Decision Tree in machine learning?

Answer :

A Decision Tree is a supervised learning algorithm used for classification and regression. It splits the data into subsets based on feature values, forming a tree-like structure.

Q7. Describe the structure of a Decision Tree.

Answer :

A Decision Tree consists of root nodes, internal decision nodes, and leaf nodes. Each internal node represents a test on a feature, each branch represents an outcome, and each leaf node represents a final decision or prediction.

Q8. What is Gini impurity, and how is it used in Decision Trees?

Answer :

Gini impurity measures the probability of a randomly chosen element being incorrectly classified. It is used to decide the best split at each node in the tree.

Q9. How does entropy help Decision Trees make splits?

Answer :

Entropy measures the level of disorder or impurity. Decision Trees use entropy to calculate information gain, helping to choose the best feature for splitting the data.

Q10. What is a leaf node in a Decision Tree?

Answer :

A leaf node is a terminal node that does not split further. It represents the final prediction or outcome for a given path in the tree.

Q11. What does the max\_depth parameter do in a Decision Tree?

Answer :

The max\_depth parameter limits the maximum depth of the tree, preventing it from growing too large and overfitting the training data.

Q12. Define information gain and explain its role in Decision Trees.

Answer :

Information gain is the reduction in impurity (entropy or Gini) achieved by splitting a node. It helps in selecting the best feature to split the data at each node.

Q13. What are some common ways to avoid overfitting in Decision Trees?

Answer :

Common methods include setting limits on max\_depth, min\_samples\_split, min\_samples\_leaf, and using pruning techniques to remove branches that do not improve generalization.

Q14. What is pruning in the context of Decision Trees?

Answer :

Pruning is the process of removing nodes from the tree that do not provide significant predictive power, helping to reduce overfitting and improve model generalization.

Q15. How does a Decision Tree handle continuous and categorical features differently?

Answer :

For continuous features, Decision Trees find optimal split points based on thresholds. For categorical features, they split based on unique category values.

Q16. Describe the role of the min\_samples\_split parameter in a Decision Tree.

Answer :

min\_samples\_split specifies the minimum number of samples required to split an internal node. It helps control the growth of the tree and prevent overfitting.

Q17. What are some advantages and disadvantages of using Decision Trees?

Answer :

Advantages: easy to interpret, no need for feature scaling, works with both types of data. Disadvantages: prone to overfitting, sensitive to small data changes.

Q18. Why are Decision Trees considered "greedy" algorithms?

Answer :

Decision Trees make locally optimal decisions at each node (choosing the best split at that step), without considering the overall tree structure, hence are considered greedy.

Q19. Explain the difference between classification and regression Decision Trees.

Answer :

Classification trees predict discrete class labels, while regression trees predict continuous values. Splitting criteria also differ (e.g., Gini for classification, MSE for regression).

Q20. What is the impact of the min\_samples\_leaf parameter in a Decision Tree?

Answer :

min\_samples\_leaf sets the minimum number of samples required at a leaf node. Higher values lead to smoother trees with fewer splits, helping prevent overfitting.