# SVM and Grid Search Test Paper

Q1. What is a Support Vector Machine (SVM)?

Answer :

Support Vector Machine (SVM) is a supervised machine learning algorithm used for classification and regression tasks. It finds the optimal hyperplane that separates the data into different classes, maximizing the margin between support vectors.

Q2. How does SVM differ from logistic regression?

Answer :

SVM focuses on maximizing the margin between classes, while logistic regression models the probability of class membership using a logistic function. SVM can handle non-linear data using kernels, while logistic regression is typically linear unless extended.

Q3. What is a hyperplane in the context of SVM?

Answer :

A hyperplane is a decision boundary that separates data into different classes. In 2D, it's a line; in 3D, it's a plane; and in higher dimensions, it's called a hyperplane.

Q4. Define margin in SVM.

The margin is the distance between the hyperplane and the nearest data points from each class. A larger margin has a better generalization of the model.

Q5. What is the kernel trick in SVM, and why is it useful?

Answer :

The kernel trick allows SVM to operate in a high-dimensional space without explicitly computing the coordinates. It enables handling of non-linearly separable data by transforming it into a higher dimension where a linear separator is possible.

Q6. List four common types of kernels used in SVM.

Answer :

The Four common types of kernels used in SVM are :

1. Linear Kernel  
2. Polynomial Kernel  
3. Radial Basis Function (RBF) Kernel  
4. Sigmoid Kernel

Q7. Explain the concept of soft margin in SVM.

Answer :

Soft margin allows some margin violations to improve the model’s ability to generalize. It provides a balance between maximizing the margin and minimizing classification errors.

Q8. What is the role of the C parameter in SVM?

Answer :

The C parameter controls the trade-off between achieving a low training error and a large margin.

A smaller C creates a wider margin with more tolerance for errors, while a larger C tries to classify all training examples correctly.

Q9. How does the Radial Basis Function (RBF) kernel work?

Answer :

The RBF kernel measures the similarity between two points as a function of the Euclidean distance between them, mapped into a higher-dimensional space. It works well for non-linear data by creating complex decision boundaries.

Q10. Define Grid Search.

Answer :

Grid Search is a hyper parameter tuning method that searches through a specified subset of hyperparameters to find the best combination based on model performance.

Q11. Why is cross-validation used with Grid Search?

Answer :

Cross-validation is used with Grid Search for reducing the risk of overfitting and improving generalization.

Q12. What is GridSearchCV in Scikit-Learn?

Answer :

GridSearchCV is a function in Scikit-Learn that performs grid search with cross-validation. It tests all combinations of hyperparameters and selects the one that gives the best cross-validated score.

Q13. What are the types of machine learning algorithms?

Answer :

1. Supervised Learning  
2. Unsupervised Learning  
3. Reinforcement Learning

Q14. How is C parameter related to the soft margin in SVM?

Answer :

The C parameter controls the softness of the margin. A smaller C allows a softer margin with some misclassifications; a larger C has a harder margin for accurate classification.

Q15. What is the purpose of the cv parameter in GridSearchCV?

Answer :

The cv parameter specifies the number of folds in cross-validation, determining how the dataset is split during model evaluation. If cv=2 means 2-fold cross-validation.

Q16. What are support vectors in SVM?

Answer :

Support vectors are the data points closest to the decision boundary. They are critical in defining the margin and are used to construct the optimal hyperplane.

Q17. How would you interpret best\_score\_ from GridSearchCV?

Answer :

The best\_score from GridSearchCV represents the highest cross-validation score achieved among all tested hyperparameter combinations, indicating the best model performance during training.

Q18. Give an example of when Grid Search might not be suitable.

Answer :

Grid Search may not be suitable for large datasets or when there are many hyperparameters with wide ranges, as it can become computationally expensive and time-consuming.

Q19. Why might SVM not perform well on large datasets?

Answer :

SVMs can be computationally intensive, especially with non-linear kernels, because they scale poorly with the number of samples and features, leading to slow training and prediction times.

Q20. What is Supervised Machine Learning and how is it different from unsupervised machine learning?

Answer :

Supervised learning uses labeled data to train models, where the target output is known. Unsupervised learning works with unlabeled data without predefined outputs.