SUPERVISED LEARNING - TEST 1 (20 to 30 mins)

15-Question Test on Linear Regression, Gradient Descent, Bias & Variance

Topics:

Linear Regression:

Gradient Descent:

Bias & Variance:



Section 1: Linear Regression

Q1. What is Linear Regression?   
Answer: Linear Regression is the process of giving the relationship between dependent and independent variables. It used linear equation to observe the data in graphical method.

Q2. Write the formula for simple linear regression. Answer:

Ypred = mx + c

Q3. What is the purpose of the cost function in linear regression? Answer: The cost function in linear regression measures the error between the actual values and the predicted values. Its purpose is to give how well the model’s predictions match the real data, by summing the squared differences between actual and predicted values and averaging them. The model aims to minimize this cost function during

training.

Q4. How do you interpret the coefficients in a multiple linear regression model?

Answer: In a multiple linear regression model , The sign of

the coefficient indicates the direction of the relationship

between the predictor variable and the response variable.

A positive coefficient indicates a positive relationship,

while a negative coefficient indicates a negative

relationship. The magnitude of the coefficient represents

the change in the response variable for a one-unit change

in the predictor variable, while holding all other predictor

variables constant.

Q5. What are the assumptions of Linear Regression? Answer:

• The sample is representative of the population.

•There is a linear relationship between the independent and dependent variables.

•The residuals are normally distributed.

•There are no outliers.

•The independent variables are not collinear.

•The mean of the errors is zero.

•The variance of errors is constant.

•The errors are independent



Section 2: Gradient Descent

Q6. What is Gradient Descent?

Answer: Gradient descent is an optimization algorithm

used to minimize the error (cost function) in machine

learning models by iteratively adjusting the model

parameters in the direction opposite to the gradient of the

cost function

Q7. Write the formula for parameter update in Gradient Descent. Answer:

The parameter update formula in Gradient Descent is:

θ = θ – α ∇J(θ)

Where:

- θ: Model parameters (weights)

- α: Learning rate

- ∇J(θ): Gradient of the loss function J with respect to θ

Q8. What is the role of the learning rate in Gradient Descent? Answer: The learning rate determines the size of the steps taken towards minimizing the cost function. If the learning rate is too large, the algorithm may overshoot the minimum and fail to converge. If it is too small, convergence will be very slow.



Q9. What is the primary purpose of regularization in machine learning models?

A) To increase the complexity of the model to fit the training data better.

B) To minimize the training error without regard to generalization.

C) To prevent overfitting by penalizing large coefficients in the model.

D) To ensure that all features are included in the final model regardless of their importance.

Answer: C

Q10. What happens if the learning rate is too small or too large? Answer: If the learning rate is too large, the algorithm may overshoot the minimum and fail to converge. If it is too small, convergence will be very slow



Section 3: Bias & Variance

Q11. Define Bias and Variance in the context of machine learning models. Answer:

Bias is the error introduced by approximating a real-world problem with a simplified model. High bias leads to underfitting.

Variance is the error introduced by the model’s sensitivity to small fluctuations in the training set. High variance leads to overfitting

Q12. What is the Bias-Variance tradeoff?

Answer: The bias-variance tradeoff is the balance between

a model’s ability to minimize bias and variance .

Increasing model complexity reduces bias but increases

variance, while decreasing complexity increases bias but

reduces variance. The goal is to find a balance for optimal

predictive performance.

Q13. How does increasing the complexity of a model affect bias and variance?

Answer: Increasing model complexity reduces bias but

increases variance, while decreasing complexity increases bias

reduces variance.

Q14. What is underfitting and overfitting in machine learning? Answer: Underfitting occurs when a model is too simple to capture the underlying patterns in the data, resulting in high bias and poor performance on both training and test data.

Overfitting occurs when a model is too complex and captures noise in the training data as if it were true patterns, resulting in high variance and poor performance on new, unseen data.

Q15. How can you reduce overfitting in a model? Answer:

Using regularization techniques (like L1 or L2 penalties).

Reducing model complexity.

Using more training data.

Cross-validation.

Pruning decision trees or using dropout in neural networks.