ANN (Artificial Neural Networks)

1. **What is an Artificial Neural Network (ANN)?**

a computational model inspired by the structure and function of the human brain

1. **What are the main components of a neural network?**

**Input Layer:** Receives data.

**Hidden Layers:** Perform computations and learn features.

**Output Layer:** Produces the final prediction.

**Weights & Biases:** Parameters adjusted during training.

**Activation Functions:** Add non-linearity.

1. **What is an activation function? Give examples.**

An activation function determines whether a neuron should be activated or not. It adds non-linearity so the network can learn complex patterns.

Ex. ReLU (Rectified Linear Unit): f(x) = max(0, x)

1. **What is the purpose of the hidden layer in a neural network?**

Hidden layers extract features and perform intermediate computations between input and output. They help the network learn complex relationships in the data

1. **What is the difference between a perceptron and a multi-layer perceptron (MLP)?**

A **perceptron** has a single layer and can only solve simple, linear problems.

An **MLP** has multiple hidden layers and can solve more complex, non-linear problems.

1. **What is forward propagation in a neural network?**

Forward propagation is the process of passing input data through the network layers to generate an output. It calculates the prediction based on current weights and biases.

1. **What is backpropagation, and how does it work?**

Backpropagation is the training method that adjusts weights by computing gradients. It compares the output with the actual label, calculates the error, and moves backward through the network to minimize that error using techniques like gradient descent.

1. **What is overfitting, and how can it be prevented in ANN models?**

Overfitting happens when a model learns the training data too well—including noise—causing poor performance on new data.

Prevention methods:

* Regularization (e.g., L2 penalty)
* Dropout
* Early stopping
* More training data
* Simplifying the model

1. **What role does the learning rate play in training an ANN?**

The learning rate controls how much the model's weights are updated during training. A rate too high may skip optimal values; too low can make training slow or stuck.

1. **What is the function of an optimizer in neural networks?**

An optimizer updates the network’s weights to minimize error. It uses gradients from backpropagation to guide the learning process.

Examples:

* SGD (Stochastic Gradient Descent)
* Adam
* RMSprop