Q1. Explain the Architectures of Neural

## ****1. Explain the Architectures of Neural Networks****

Neural networks are a set of algorithms inspired by the human brain, designed to recognize patterns and relationships in data. Different architectures are used depending on the complexity and nature of the task.

### ****1. Feed forward Neural Network (FNN)****

**Structure:** Information flows only in one direction — from input to output.

**Use Case:** Basic classification and regression problems.

**Example:** Predicting housing prices, image classification (simple).

**Layers:**

Input Layer → Hidden Layer(s) → Output Layer

### ****2. Convolutional Neural Network (CNN)****

**Specialized for:** Image and spatial data.

**Key Components:**

**Convolutional layers**: Detect features like edges, shapes

**Pooling layers**: Reduce dimensionality

**Fully connected layers**: Final classification

**Use Cases:** Object detection, face recognition, medical imaging.

**3. Recurrent Neural Network (RNN)**

**Designed for:** Sequential or time-series data.

**Feature:** Loops allow information to persist between time steps.

**Use Case:** Text prediction, stock price forecasting, language modeling.

**Limitation:** Struggles with long-term dependencies.

### ****4. Long Short-Term Memory (LSTM)****

**An improvement over RNNs.**

**Feature:** Uses memory cells and gates to retain long-term information.

**Use Case:** Machine translation, speech recognition, time-series prediction.

### ****5. Generative Adversarial Network (GAN)****

**Two networks:**

**Generator**: Creates fake data

**Discriminator**: Distinguishes real from fake

**Use Case:** Image generation, deepfake technology, data augmentation.

### ****6. Transformer Architecture****

**Based on self-attention mechanism.**

**Use Case:** NLP tasks like translation, text summarization (e.g., ChatGPT, BERT)

**Key Feature:** Processes entire input sequence at once (parallelization)