WEEK-1 ASSIGNMENT

FOREST FIRE DETECTION

1. What is deep learning?

Ans: **Deep learning** is a subfield of machine learning focused on algorithms inspired by the structure and function of the human brain, called **artificial neural networks**. It enables computers to learn from large amounts of data in ways that allow them to recognize patterns, make decisions, and even generate content (like images, text, or audio).

**Key Features of Deep Learning:**

* **Neural Networks:** Uses layers of nodes (neurons), typically organized into an **input layer**, **hidden layers**, and an **output layer**.
* **Hierarchical Learning:** Learns complex patterns by building them from simpler ones (e.g., detecting edges → shapes → objects in images).
* **Data-Intensive:** Requires a lot of labeled data and computational power.

Applications:

* Image and speech recognition
* Natural language processing (e.g., chatbots, translation)
* Autonomous driving
* Recommendation systems
* Medical diagnosis

1. What is Neural Netwoks and its types.

Ans: A **neural network** is a computational model inspired by the human brain. It consists of layers of **interconnected nodes (neurons)** that process data. Each connection has a **weight** and **bias**, and the network learns by adjusting these values during training.

Neural networks are the core of **deep learning**, enabling machines to learn patterns, recognize images, understand text, and more.

**Structure of a Neural Network:**

1. **Input Layer:** Receives raw data (e.g., pixels of an image).
2. **Hidden Layers:** Perform computations and feature extraction.
3. **Output Layer:** Produces final results (e.g., classifies an image as “cat” or “dog”).

**Types of Neural Networks:**

* 1. **Feedforward Neural Network (FNN)**
     + The simplest form: data flows in one direction (input → output).
     + Used for classification and regression tasks.
  2. **Convolutional Neural Network (CNN)**
     + Specializes in image and video recognition.
     + Uses convolutional layers to detect features like edges and shapes.

Recurrent Neural Network (RNN)

Designed for sequential data (e.g., time series, text).

Has loops to retain memory of previous inputs.

Common in language modeling and speech recognition.

Long Short-Term Memory (LSTM)

A type of RNN that solves the memory loss problem in standard RNNs.

Useful for long sequences like paragraphs or financial trends.

Generative Adversarial Network (GAN)

1. What is CNN in simple words.

Ans: A **CNN (Convolutional Neural Network)** is a type of deep learning model designed to **analyze visual data**, like images and videos.

**Imagine This:**

When you look at a photo, your brain first sees **edges**, then **shapes**, then **objects** like a face or a car. A CNN works in a **similar step-by-step way**, using layers to:

1. **Detect simple patterns** (like edges),
2. **Combine them into bigger patterns** (like shapes),
3. **Recognize the whole object** (like a cat or number).

**How It Works (Simply):**

1. **Input Image:** Like a photo (e.g., 28×28 pixels).
2. **Convolution Layer:** Slides small filters over the image to find features (edges, colors, etc.).
3. **ReLU Layer:** Makes the image sharper by removing negative values.
4. **Pooling Layer:** Shrinks the image to reduce complexity and keep important features.
5. **Fully Connected Layer:** Takes the features and makes a final decision (e.g., "This is a dog").

**What It’s Used For:**

* Face recognition
* Self-driving cars (detecting signs, pedestrians)
* Medical image analysis
* Object detection in photos/videos

1. Create a short notes about the pipeline we have discussed in a lecture.

Ans: **Short Notes on Pipeline (Lecture Summary)**

**Definition**:

A **pipeline** is a technique where multiple instruction steps or data processing tasks are overlapped in execution to improve performance and throughput.

**In CPU Architecture:**

* **Instruction Pipeline**: Splits instruction execution into stages:
  1. **Fetch**
  2. **Decode**
  3. **Execute**
  4. **Memory Access**
  5. **Write Back**
* **Goal**: Execute multiple instructions in parallel, each at a different stage.
* **Advantages**:
  1. Increased instruction throughput.
  2. Better CPU resource utilization.
* **Hazards**:
  1. **Data Hazard**: Instruction depends on the result of a previous one.
  2. **Control Hazard**: Caused by branches and jumps.
  3. **Structural Hazard**: Resource conflicts during simultaneous access.
* **Solutions**:
  1. Forwarding, stalling, branch prediction, and hazard detection units.

**In Data Engineering / Software Pipelines:**

* **Pipeline**: A sequence of data processing components where output of one step becomes input to the next.
* **Common Tools**: Apache Airflow, Kafka, AWS Data Pipeline.

**Benefits**:

* + Modular design.
  + Easier debugging and maintenance.
  + Enables real-time or batch data processing.