ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

TRAINING TR-102 REPORT DAY 12 8 JULY 2025

Overview:

The twelfth day of training focused on one of the most fundamental and powerful concepts in Artificial Intelligence — Neural Networks.

We learned how neural networks mimic the human brain, process data, and learn from examples through forward propagation and backward propagation.This session provided an in-depth understanding of how data flows through layers of a neural network and how weights are adjusted to minimize errors during training. These processes form the foundation of all deep learning models used in AI today.

Learning Objectives:

- Understand the basic structure and components of an Artificial Neural Network (ANN).
- Learn how forward propagation computes predictions.
- Study the concept of backward propagation for model training.
- Understand the role of activation functions and loss functions.
- Explore how neural networks learn through iterative weight updates.

Introduction to Neural Networks

A Neural Network (NN) is a computational model inspired by the human brain, consisting of interconnected nodes called neurons.Each neuron processes input data, applies mathematical transformations, and passes the result to the next layer.

Neural networks are used for:

- Pattern recognition

- Image classification
- Natural Language Processing

Forward Propagation

Forward Propagation is the process through which input data passes through the neural network to generate an output (prediction).

Steps in Forward Propagation:

1. **Input Layer:**
   Accepts input features (e.g., image pixels, numerical data).

2. **Weighted Sum:**
   Each neuron multiplies inputs by weights and adds bias.

3. **Activation Function:**
   Non-linear functions like ReLU, Sigmoid, or Tanh are applied to introduce non-linearity.

4. **Output Layer:**
   Produces final results such as classification probabilities or continuous values.

Backward Propagation

Backward Propagation (Backpropagation) is the process of updating the weights and biases of a neural network to minimize prediction error.It is based on the chain rule of calculus to compute how changes in weights affect the overall loss.

Steps in Backward Propagation:

1. **Calculate the Loss (Error):**
   Compare the predicted output with the actual target using a loss function (e.g., Mean Squared Error, Cross-Entropy).

2. **Compute Gradient:**
   Determine how much each weight contributed to the error.

3. **Update Weights:**
   Adjust weights using Gradient Descent:

4. **Repeat:**

This process is repeated for many epochs until the model reaches the desired accuracy.

Applications of Neural Networks:

- Image and speech recognition
- Sentiment analysis
- Forecasting and predictive modeling
- Autonomous systems and robotics

Conclusion:

Day 12 provided a deep understanding of how Neural Networks learn from data through forward and backward propagation.
We learned how the flow of information and error correction enables models to become intelligent over time.This session marked an important milestone in our AI journey — moving from traditional algorithms to deep learning systems capable of self-learning and adaptive decision-making.