Ex.No-14

Study of Artificial Neural Network(ANN)

Aim:

To study about Artificial Neutral Network(ANN) and Biological Neural Network(BNN).

Theory:

Artificial Neutral Network:

Artificial Neural Network (ANN) is a type of neural network that is based on a Feed-Forward strategy. It is called this because they pass information through the nodes continuously till it reaches the output node. This is also known as the simplest type of neural network.

Activation Functions in ANN:

Activation functions play a critical role in the functioning of neural networks by introducing non-linearity into the model, which enables the network to learn and model complex patterns in the data. Here are some common activation functions used in neural networks:

1. Sigmoid

The sigmoid function maps any input to a value between 0 and 1, following an S-shaped curve.

$\sigma(x)=1+e^{-x}1$

Pros:

- Smooth gradient, preventing sharp jumps in output values.
- Output values bound between 0 and 1, making it useful for binary classification problems.

Cons:

- Can cause vanishing gradient problem.
- Output not zero-centered

2. Tanh (Hyperbolic Tangent)

The tanh function maps any input to a value between -1 and 1.

$$\tanh(x) = \frac{e^{x}-e^{-x}}{e^{x}+e^{-x}}$$

Pros:

- Smooth gradient.
- Output values bound between -1 and 1, making it zero-centered.

Cons:

- Can cause vanishing gradient problem, though less severe than sigmoid.

3. ReLU (Rectified Linear Unit)

The ReLU function is defined as:

$\text{ReLU}(x)=\max(0,x)$

Pros:

- Efficient computation.
- Alleviates vanishing gradient problem.
- Sparsity in activation (many neurons output zero).

Cons:

- Can cause dying ReLU problem (neurons can get stuck at 0).

Comparison between ANN and BNN:

Parameter	**ANN**	**BNN**
Neurons	ANN consists of 10 millions of neurons.	BNN consists of billions of neurons.
Learning	Very precise structures and formatted data.	They can tolerate ambiguity.
Expertise	Numerical and symbolic manipulations	Perceptual problems
Computing	Centralized sequential stored program	Distributed parallel self-learning
Reliability	Very vulnerable	Robust

Result:

Artificial Neutral Network(ANN) and Biological Neural Network(BNN) were studied successfully.