Ex.No-14 **StudyofArtificialNeuralNetwork(ANN)**

Aim:

TostudyaboutArtificialNeutralNetwork(ANN)andBiologicalNeuralNetwork(BNN).

Theory:

ArtificialNeutralNetwork:

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.

ActivationFunctionsin 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

Thesigmoidfunctionmapsanyinputtoavaluebetween0and1,followinganS-shapedcurve.

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

Pros:

- Smoothgradient,preventingsharpjumpsinoutput values.
- Outputvaluesboundbetween0and1,makingitusefulforbinaryclassificationproblems.

Cons:

- Cancausevanishinggradientproblem.
- Outputnotzero-centered

2. Tanh(HyperbolicTangent)

Thetanhfunctionmapsanyinput toavaluebetween-1and1.

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

Pros:

- Smooth gradient.
- Outputvaluesboundbetween-1and1,makingitzero-centered.

Cons:

- Cancausevanishinggradientproblem,thoughlessseverethansigmoid.

3. ReLU(RectifiedLinearUnit)

TheReLUfunctionisdefinedas: $ReLU(x)=\max(0,x)$

Pros:

- Efficientcomputation.
- Alleviatesvanishinggradientproblem.
- Sparsityinactivation(manyneuronsoutputzero).

Cons:

- CancausedyingReLUproblem(neuronscangetstuckat0).

ComparisonbetweenANNand BNN:

Parameter	**ANN**	**BNN**
Neurons	ANNconsistsof10millions of neurons.	BNNconsistsofbillionsof neurons.
Learning	Veryprecisestructuresand formatteddata.	Theycantolerateambiguity.
Expertise	Numericalandsymbolic manipulations	Perceptualproblems
Computing	Centralizedsequential storedprogram	Distributedparallelself-learning
Reliability	Veryvulnerable	Robust

Result:

ArtificialNeutralNetwork(ANN)andBiologicalNeuralNetwork(BNN)werestudied successfully.