NO Date . .

ANN

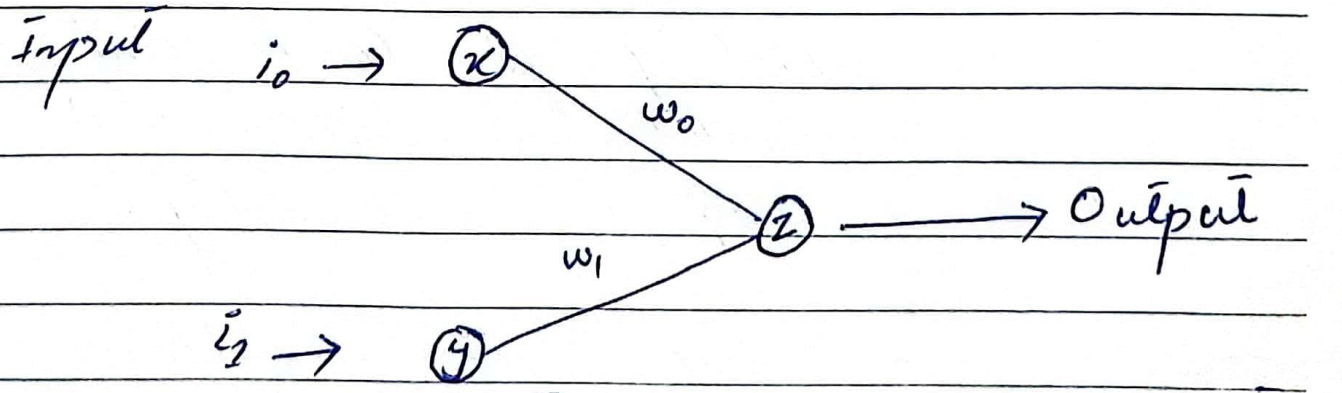
architecture

ANN is an information paradigm that is inspired by biological neurons system.

It is configured for specific application like data classification, and pattern recognition.

In ANN model there are:

i) Interconnection between various neurons (Nodes)
ii) Activation functions
iii) Learning Rules



$$\text{Input} = i_0 \times w_0 + i_1 w_1 \quad (\text{weighted sum})$$

$$\text{Output} = f(\text{Input})$$

↳ Activation function

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Characteristics:

i) Neurally Implemented Mathematical model

ii) Massive number of Interconnected processing elements called neurons for processing

iii) Input signals arrive at processing elements through connections and connected weights.

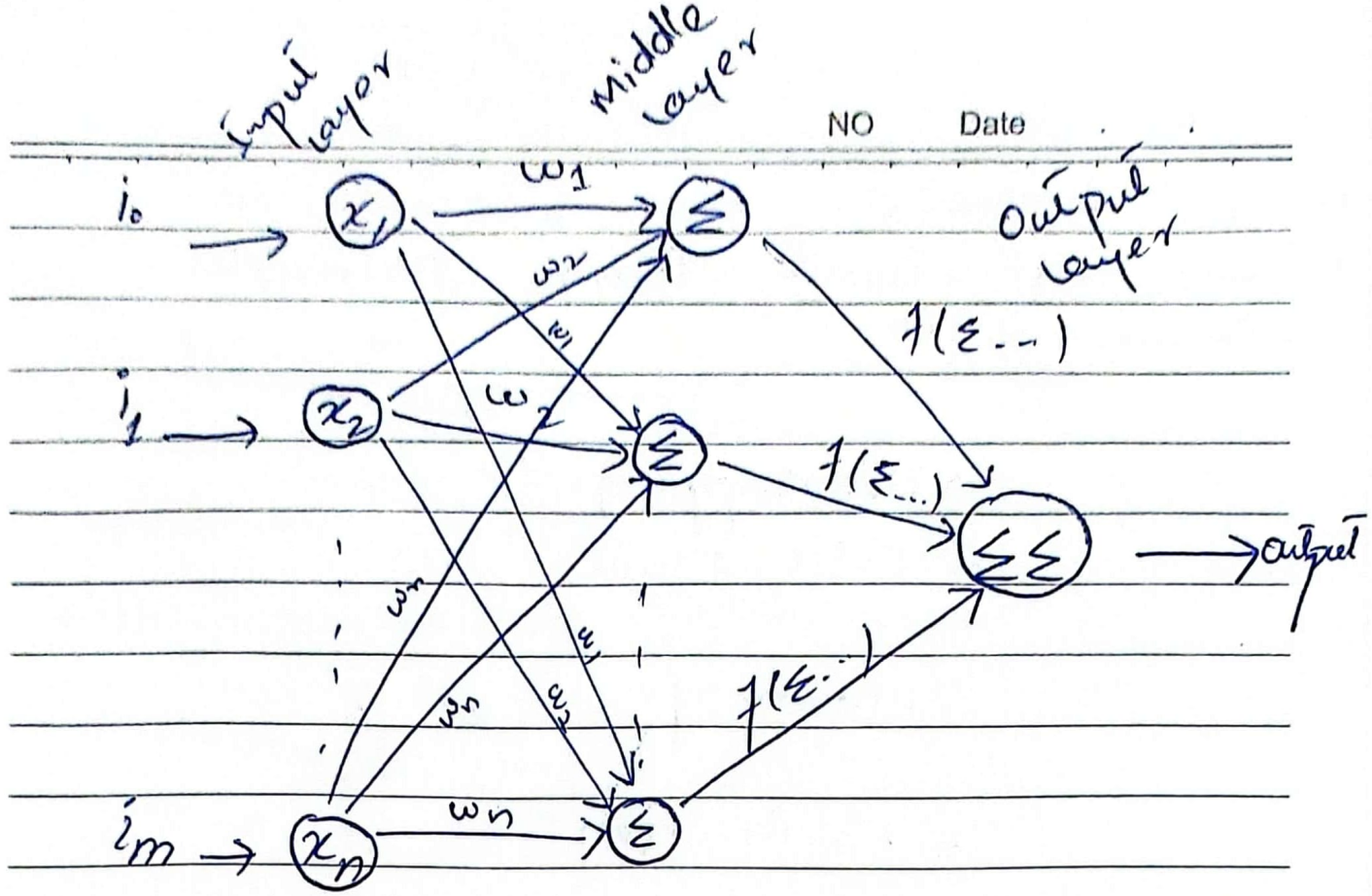
Advantages:

→ Ability to learn and model *non-linear and complex relationships

* activation function

→ Easy generalization

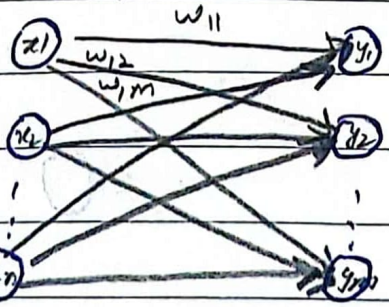
→ No restriction on input variables



$x_1 + w_1 + x_2 w_2 + \dots$

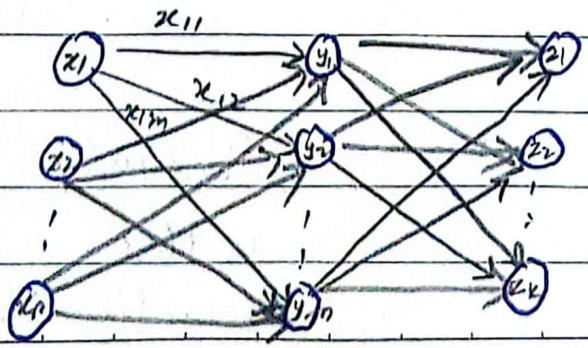
ANN Types

i) Single Layer Feed Forward NN



↳ Two Layers
i) Input
ii) Output

iii) Multilayer Feed Forward NN

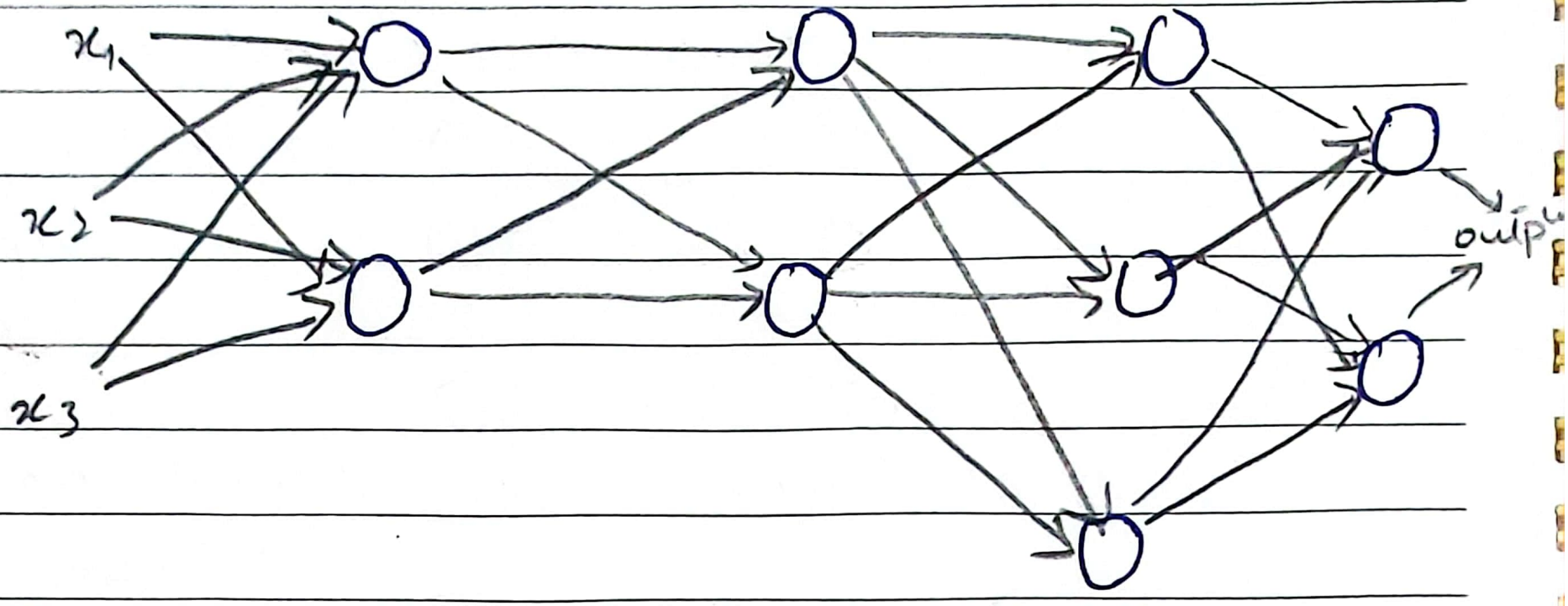


↳ Hidden Layer
↳ Computationally more strong

↳ Hidden Layer

(iii) Multilayer Perceptron

↳ 3 or more layers to classify non-linearly separable problems



↳ Fully connected

↳ Uses non-linear activation function

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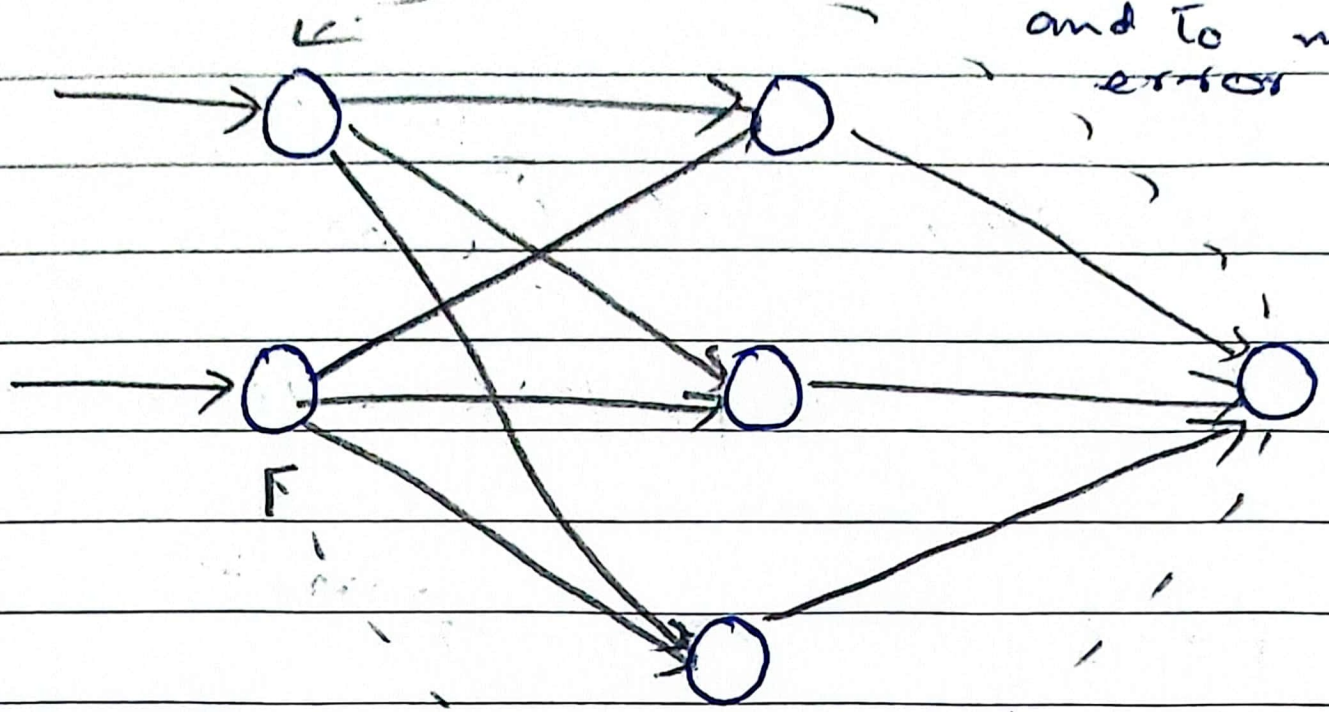
iv) Feedback ANN

↳ Feedback is provided to adjust parameters and to minimize error



Feedback

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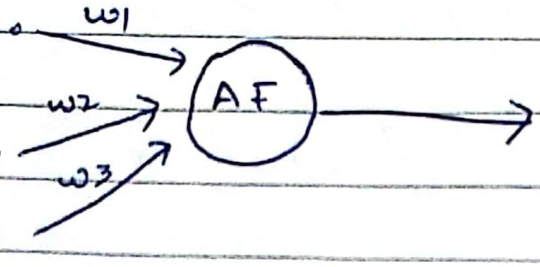
Activation Function

→ Activation function is an internal state of neuron.

→ It is used to connect the input signal on node of ANN to an output signal



It is the weighted sum of the input that becomes input signals for activation function to provide one output signal

Activation functions introduce the non-linear properties to the network

without Activation function output would be simple linear function
↳ Easy to solve but limited in process complex learning

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Complicated Tasks

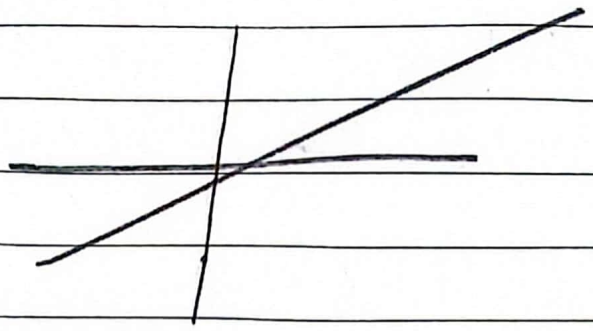
Image Processing
Video Processing
Audio Processing

Types of Activation Functions

i) Identity Function

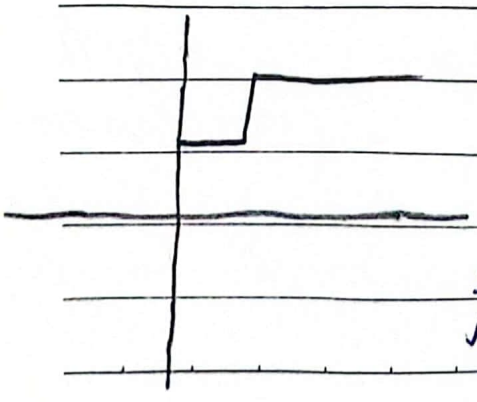
$$f(x) = x \quad \forall x$$

↳ Linear function output is same as input



ii) Binary step Function

↳ Single layer neural network used to convert I/p to O/p.



Input → Output → 0
→ 1

$$f(x) = \begin{cases} 1 & \text{if } x \geq t \\ 0 & \text{if } x < t \end{cases}$$

t = Threshold value

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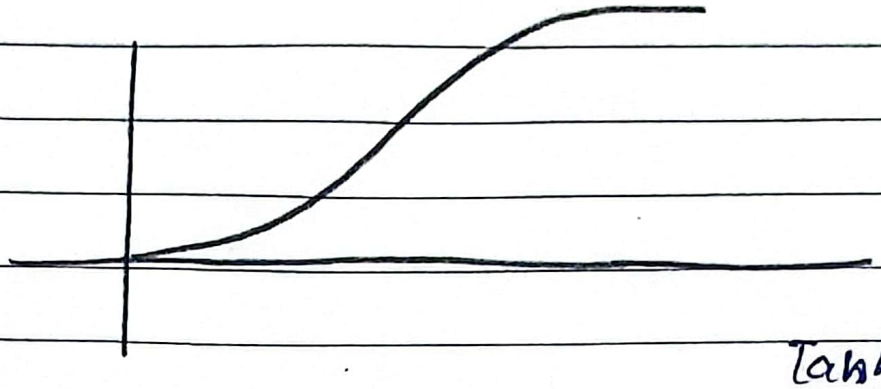
iii) Sigmoidal Function

↳ Used in back propagation network

↳ Range is 0 to 1.

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



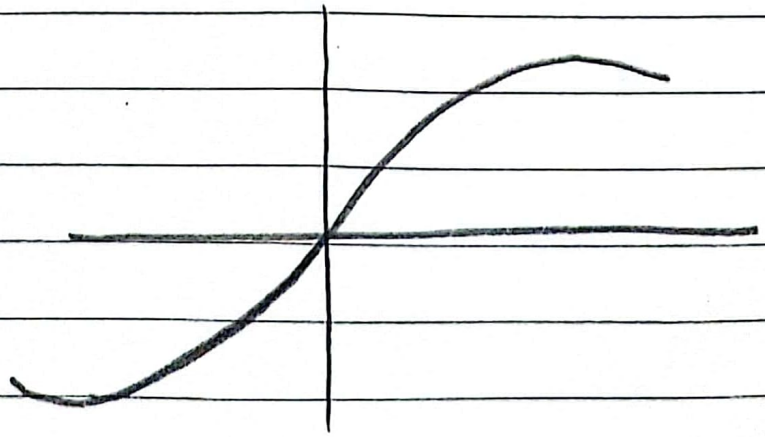
Tanh

iv) Hyperbolic tangent function

↳ Optimization is easy

↳ Range = -1 To 1

$$f(x) = \frac{1-e^{-2x}}{1+e^{-2x}}$$



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v) Ramp Function

$$R(x) = \begin{cases} x & x \geq 0 \\ 0 & x < 0 \end{cases}$$