مستقبلات

The perceptron:

* the perceptron is a simplified representation of the biological neuron in the brain

* the preceptron model was proposed by Mccullo h and pitts in 1943

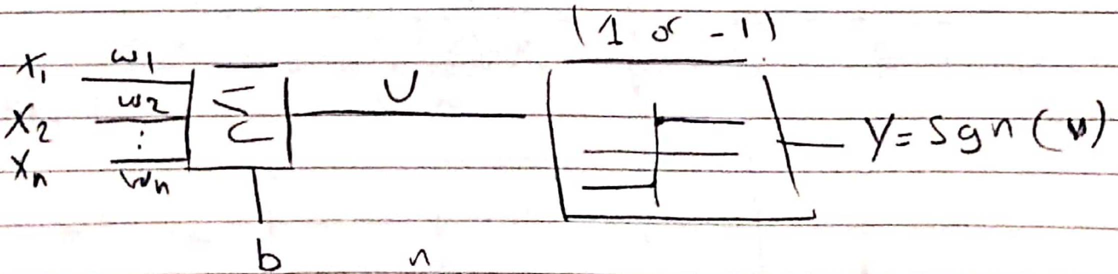
* the preceptron is the simplest form of a neural network for patterns that are lineary. separable.

* the structure of a perseptron consist of a single neuron with adjustable synaptic weights and bias. تشابكي

* the weights are adjusted during the tranning phase, as traning data is presented to it

* the model consist of a linear combiner follawed by a hard limites (performing the signum function)

* Also incorporates an externally applied bais.



$$v = \sum_{i=1}^{n} w_i x_i + b$$

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Linearly Seperebable?

* perceptrons can only classify linearly seperabale cases.

* lets say we want to classify a set of data into a Group (A) (G_A) either or group B (G_B).

* if GA and G_B are linearly seperable there exist a seperating hyperplane between the two groups which is linear in nature.

* in simple terms there is a straight line deviding between GA and G_B.

EX: consider a case of AND and OR.

INPUT (A)	(B)	output (AND)	
0	0	0	} GA
0	1	0	
1	0	0	
1	1	1	} GB

(A)	(B)	output (OR)	
0	0	0	} GA
0	1	1	} → GB
1	0	1	
1	1	1	

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* Maltematical Review for Neural networks:

System: is a Collection of elements of components that are orgnized for a Common Purpose.

input ⟶ $\boxed{\text{system}}$ ⟶ output

- Systems have structure, defined by components / elements and their composition.

- systmes have behaviour, which involves inputs, Processing and outputs of material energy, information or data.

- systems have interconnectivity, the various parts have structural or functional relationships to each other.

- linear system:
linear system is a maltematical model of a system based on the use of a linear operator

input ⟶ $\boxed{\mathcal{L}(\cdot)}$ ⟶ output

linear operator.

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- linear system satisfies the properties of superposition, additivity and homogeneity

Superposition principle:

- homogeneity:

$$\left.\begin{array}{l} L(u_1) = y_1 \\ L(u_2) = y_2 \end{array}\right\} \Rightarrow \begin{array}{l} L(a u_1) = a y_1 \\ L(a u_2) = a y_2 \end{array}$$

- additivity:

$$\left.\begin{array}{l} L(u_1) = y_1 \\ L(u_2) = y_2 \end{array}\right\} \quad L(u_1 + u_2) = L(u_1) + L(u_2) = y_1 + y_2$$

$$\xrightarrow{\alpha_1 u_1 + \alpha_2 u_2} \boxed{L(\cdot)} \xrightarrow{\alpha_1 y_1 + \alpha_2 y_2}$$

→ Non linear System:

a non linear system is a mathematical model of a system that does not satisfy the superposition principle. The output of a non linear sys is not directly proportional to its input.

Ex: $\int (\alpha_1 y_1 + \alpha_2 y_2)\, dy = \alpha_1 \int y_1\, dy + \alpha_2 \int y_2\, dy$ linear

$\cos(\alpha_1 x_1 + \alpha_2 x_2) \neq \alpha_1 \cos x_1 + \alpha_2 \cos x_2$

Non linear

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State space :

To provide a convenient way to model and analyze sys with multiple inputs and outputs, one needs to represent the state space of a system and can be represented as a vector within that space.

the space is a domain that determines the conditions of the sys.

$$\frac{d\,x(t)}{dt} = \underset{\substack{\text{system} \\ \text{matrix}}}{A} . x(t) + u \rightarrow \text{time invariant}$$

(numerical valus of physical components of a system)

(No time dependence)

$$\frac{d\,x(t)}{dt} = A(t) . x(t) + u \rightarrow \text{time variant}$$

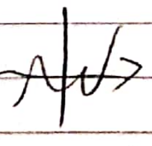
time dependence.)

متحولات المصفوفة
مرتبطة بالزمن.

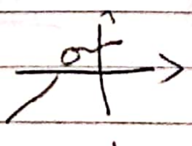
→ functions :

* continues :

$$\lim_{x \to c} f(x) = f(c).$$



Continuous



discontinues

* increasing functions.

→ if $y > x$ $f(y) \geq f(x)$

$f(\cdot)$ monotonically increasing.

(non-decreasing).

→ if $y > x$ $f(y) > f(x)$.

$f(\cdot)$: strictly increasing.

* decreasing :

if $y > x \Rightarrow f(y) \leq f(x)$

$f(\cdot)$: Monotonically decreasing.

(non increasing)

if $y > x \rightarrow f(y) < f(x)$

$f(\cdot)$: strictly decreasing.

* Derivative fun :

if $\frac{d f(x)}{dx} > 0$, $\forall x \Rightarrow f(\cdot)$ strictly increasing.

if $\frac{d f(x)}{dx} \leq 0$ $\forall x \Rightarrow f(\cdot)$ strictly decreasing.

if $\frac{d f(x)}{dx} = 0$, $\forall x \Rightarrow$ Stationary Point

global max

global min

local max

local min

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↳ $d''(f) > 0 \Rightarrow$ (local/Global) min

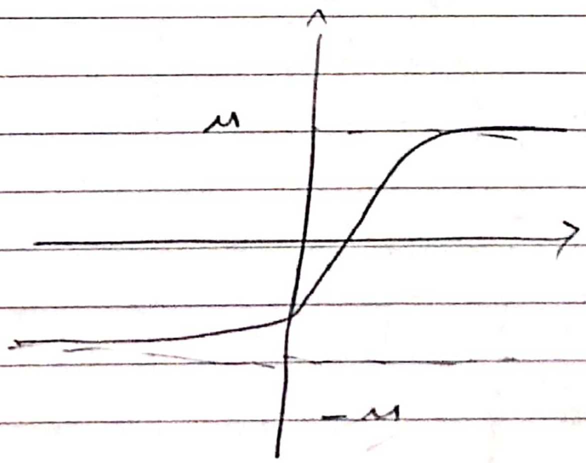
$d''(f) < 0 \Rightarrow$ (Local/Global) max

∴ pinveles "x" ⇒ y: local
N: Global

* Bounded fun is:

if there exist a real number $M < \infty$
such that

$|f(x)| \le M \;,\; |x| \to \infty \longrightarrow f(\cdot)$: Bounded.



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