MATRIX INVERSION USING NEURAL NETWORK ...?

What is Matrix Inversion?

→ The product of 2 Square matrix should be Equal to the "Identity Matrix" $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

(i.e) $\boxed{A \cdot A^{-1} = I \quad \& \quad A^{-1} \cdot A = I}$

→ We Need to Satisfy both Condition (Non-Commutable)

How to find the inverse of a 2×2 Matrix ...?

Given $A = \begin{bmatrix} 2 & 5 \\ 1 & 3 \end{bmatrix}$ $A^{-1} = ?$

$$\boxed{A^{-1} = \frac{1}{|A|} Adj(A) \quad \{|A| \neq 0\}}$$

→ $|A| = (2 \times 3) - (5 \times 1)$

$\boxed{|A| = 1}$

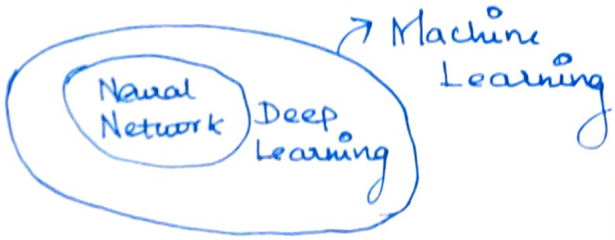
→ $Adj(A) = A =$ interchange. $\begin{bmatrix} 2 & 5 \\ 1 & 3 \end{bmatrix}$

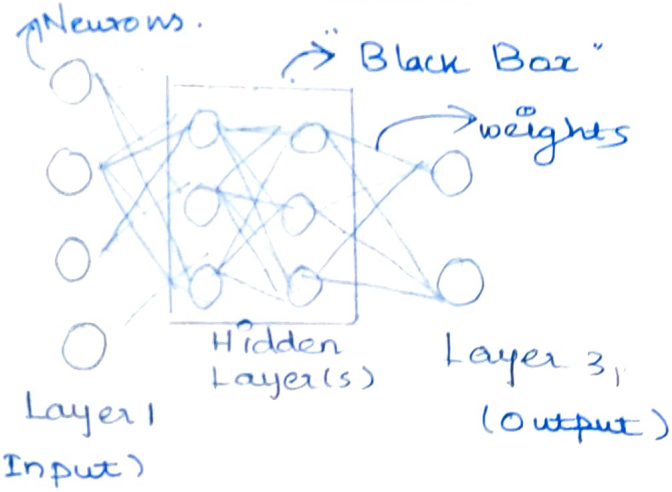
↳ change the sign.

$\because Adj(A) = \begin{bmatrix} 3 & -5 \\ -1 & 2 \end{bmatrix}$

$$\Rightarrow \boxed{A^{-1} = \frac{1}{1} \begin{bmatrix} 3 & -5 \\ -1 & 2 \end{bmatrix}}$$

What is Neural Network?





→ These "Black Box" is the place where the tweaking of the neurons done during training / learning.

Black Box :-

1. How many hidden layers?
   - (usually '1')
2. How many Nodes (neurons)?
   - b/w I/P & O/P.
   - less than 2× I/P

- Activation Function
- Learning Rate & Momentum
- Iterations & Desired Error wt.

The Neural Network is Nothing but an data structure where the hidden layers were adjusted in a manner that it can identify the given i/p. The adjustment is done using "Forward" & "Backward" propagation.

→ These propagation changes the weight according to the actual o/p using several Iterations.

Why do we Use Matrices ?

It will allow us to express the work we need to do Concisely and Easily.

HAND EYE CALIBRATION TECHNIQUE FOR INDUSTRIAL ROBOT MANIPULATORS...

1. Neural Network :- ↳
2. Matrix Inversion :- ↳
3. Implementation of NN in MATLAB (Basics) :- ↳

(X)

Questions...

1. How to implement these MI in NN...?
2. What are the "Objectives" to meet the aim?
3. Approach to the problem?
4. Skills to Solve?

Kinetic Sensor (Microsoft) ↳?

(Python & tensorflow) →

What to do

1. (2nd Article) Implement in.
2. MATLAB only (Recommended).
3. 3rd Paper
4. Imp

Hand Eye Calibration Method :-

① What is HEC?

- Accurate control of Vision based Robotic System.
- enables measurement of Environment.

"Main work (pose)"

Rotation & Translation

Homogeneous Transform Matrix :-

$P^b = H_a^b \, P^a$

Point b — Point a

Homogeneous Matrix

$H_a^b = R_a^b \times t_a^b$

(Rotation) (translation)

Methods :- (6)

1. Tsai & lenz
2. Chou & kamel
3. Park & Martin
4. Dannilidis
5. lu & Chou
6. Li et.Al (2018)

ERROR ...

1. Relative transform Error.
2. Rotation Error.
3. Translation Error.

— x — STUDY. (Simulation)

1. (No. of motion ↑ accuracy)

Fact (Same)

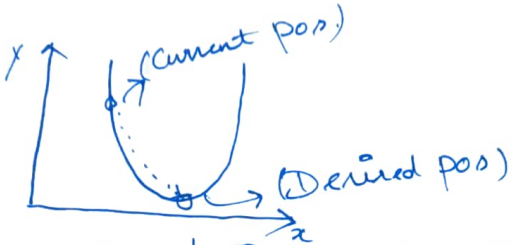
(Real)

(Opposite)

with

A Novel hybrid Zhang Neural Network :-

" Gradient - Descent Method :-



" The process of bringing the data to the desired pos"

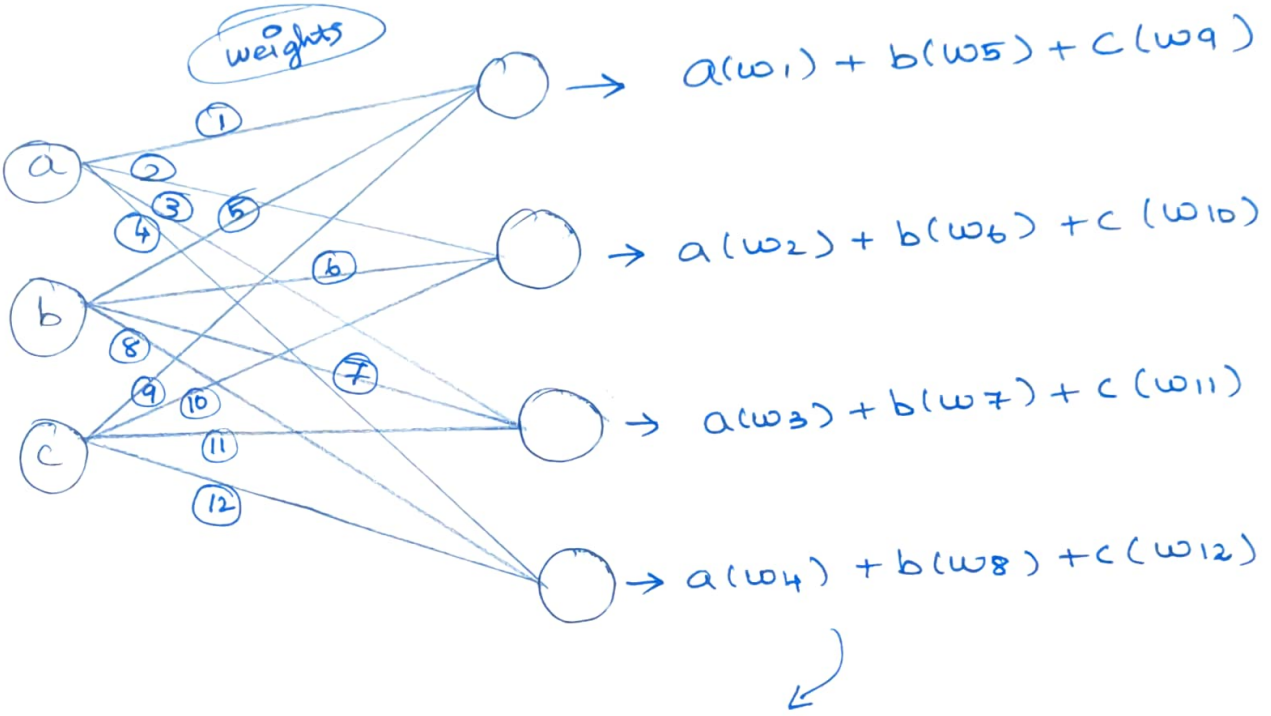
Gradient Neural Network

* [It uses "gradient - Descent" method]

* (Can find solution for constant matrix inversion problems)

Zhang Neural Network → * It is an RNN.
* Used to Solve time Varying Matrix inversion & Quadratic Program.

How To Convert Neural Network into Matrices...



m x r
1 x 3

a	b	c

r x n
3 x 4

w_1	w_2	w_3	w_4
w_5	w_6	w_7	w_8
w_9	w_{10}	w_{11}	w_{12}

Thus : m x n → 1 x 4

a(w1) + b(w5) + c(w9)	a(w2) + b(w6) + c(w10)	a(w3) + b(w7) + c(w11)	a(w4) + b(w8) + c(w12)

m x n → 1 x 4

For details: look at the Video in project playlist.

RECURRENT NEURAL NETWORK :-

1. What is Deep learning ?

Method of representing "differentiable function" that maps a Variable of one type to a Variable of another type.

$$f(in\_var) = Out\_Var$$

2. What is a Vector ?

It is a [n x 1] matrix → "Abstraction of Raw Data"

Eg...,

Convert the pixels of picture → Vector $\begin{bmatrix} 0.5 \\ 2.3 \\ 1.4 \\ \vdots \end{bmatrix}$

3. What are Sequences ?

temporally Ordered Set of Data points.

RNN → Seq → Vector $f[seq \to \mathbb{R}^D]$ & Vice Versa.

4. What are Dynamical System ?

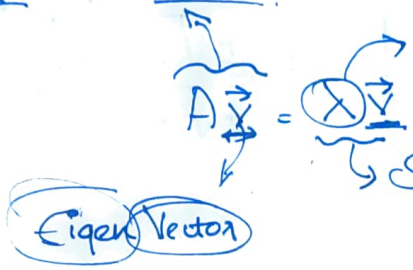
Predicting the "future" based on "current" System State & data

"Simply RNN's are good at processing Sequence data for Predictions"

Matrix Inversion | Trace | Eigen Value

Matrices → Manipulation of Space. → can be used for (Robotics & Computer graphics)

Matrix Vector Multiplication :-



It would be difficult to calculate with a Matrix on one side & a Scalar Value on the other side.

→ What we are gonna do is to introduce new term with it.

* $A\vec{v} = \lambda\vec{v}$ → Identity matrix.

→ $A\vec{v} = \lambda \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \vec{v}$

→ $A\vec{v} = \lambda I \vec{v}$

→ $A\vec{v} - (\lambda I \vec{v}) = \vec{0}$

$(A - \lambda I)\vec{v} = \vec{0}$.

$$\boxed{\det(A - \lambda I) = 0.}$$