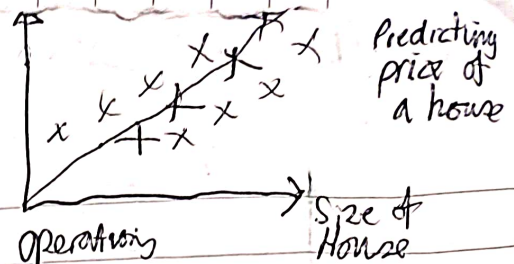


③

Machine Learning and AI

① Model Training

using linear algebra for multiple matrix multiplication + matrix arithmetic operations



Linear Equations

Equation of a straight line - $ax + by + c = 0$
 $y = mx + c$

② Dimensionality Reduction

PCA

Linear Algebra algorithms

used in linear

uses EIGEN VALUE & EIGEN VECTOR

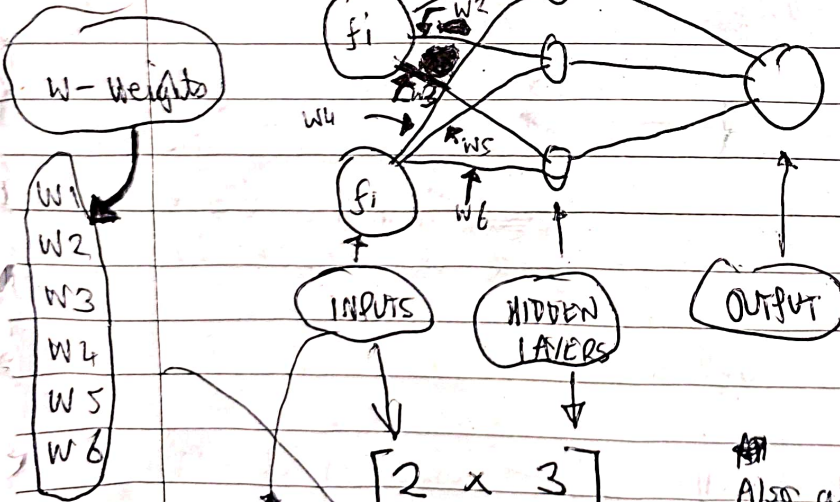
Helps to reduce Higher Dimension to Lower Dimensions

③ Neural Networks

Forward Propagation and Backward Propagation

Example

INPUT		OUTPUT
Area	No. Rooms	Price
f_1	f_2	



$\begin{bmatrix} f_1 \\ f_2 \end{bmatrix}$

$\begin{bmatrix} w_1 & w_2 & w_3 \\ w_4 & w_5 & w_6 \end{bmatrix}$

= Requires Matrix Multiplication

Also add bias

Forward Propagation

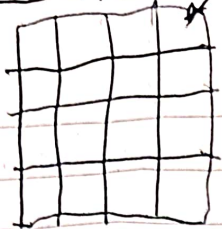
- GPU - cores - parallel
 TensorFlow - Tensors
 Values turned into tensors

④

④

Computer Graphics

Image



Pixel

8 - 255

Each Pixel has a
RGB value

changes in
— Scale, rotate, colour

done by ~~linear~~ linear algebra
to transform image

⑤

Optimisation

Solving equations

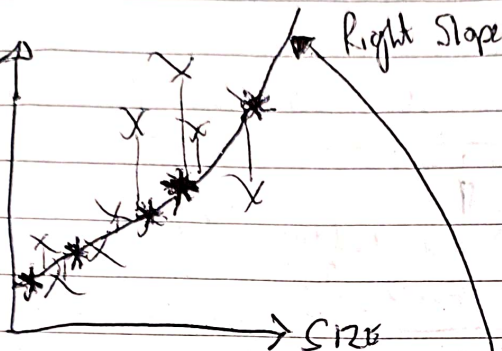
→ linear equation

$$y = mx + c$$

= regression

equation
of a straight
line

PRICE



* correct points
x out of range

slope
or
coefficient

~~intercept~~
intercept

$y = mx + c$ → finds
right slope
and intercept

→ This
is calculated
using

~~Will apply~~

use a function

$f(x)$ - maximise function to
~~to find~~ minimise the error
to find the right line

This is called Optimisation

Will use Gradient Descent - uses an Optimiser

INPUT

OUTPUT

(1, 2)

x

= \emptyset

y

Predicted
Eraser

~~Eraser~~
1-Pencil

$w = 0.1, 0.3$

$b = 0.5$

$$z = w_1 \cdot x_1 + w_2 \cdot x_2 + b$$

$$1 \times 0.1 + 2$$

$$0.1 \times 1 + 0.3 \times 2 + 0.5$$

$$0.1 + 0.6 + 0.5$$

$$= 1.2 \text{ Weighted Sum}$$

$$F(x) = \begin{cases} 1 \Rightarrow \emptyset \checkmark \\ \emptyset < \emptyset \end{cases}$$

Pencil

Model is
Wrong

Weights and/or bias
is wrong

OTHER NOTE - changing weight 0.3 to -0.3
would change weighted sum for first example
- Not 2.8 but -1.4 so

INPUTS (2, 7)

would not be 1 they'd be \emptyset

TRUE

FALSE

$y_T = 1$

$y_P = \emptyset = 0$

Correct

wrong
prediction

UPDATE WEIGHTS AND FORMULA

$$w_i = w_i + \eta \cdot (y_{\text{TRUE}} - y_{\text{PRED}}) \cdot x_i$$

$y_T = 1$

$y_P = \emptyset$

$$b = b + \eta \cdot (y_{\text{TRUE}} - y_{\text{PRED}})$$

$b = b$

y_T y_P

$$0.5 + 0.1 \times 1$$

$$0.6 + 0.1$$

x (2, 7)

w (0.1, 0.3)

b (0.5)

η (0.1)

$$\cancel{w_1 = 0.1 + 0.1 \cdot (1 - 0) \cdot 2}$$

$$w_1 = 0.1 + 0.1 \cdot (1 - 0) \cdot 2 = 0.3$$

$$w_2 = -0.3 + 0.1 \cdot (1 - 0) \cdot 7 = 0.4$$

$$z = w_1 \cdot x_1 + w_2 \cdot x_2 + b$$

$$0.3 \times 2 + 0.4 \times 7 + 0.6$$

$$0.6 + 2.8 + 0.6$$

$$= 4.0$$

$$F(x) = \begin{cases} 1 \Rightarrow \emptyset \checkmark \\ \emptyset < \emptyset \end{cases}$$

CORRECT
PREDICTION
WITH
UPDATED FORMULA

$$0.1 + 0.1 \times 1 \times 2$$

$$0.1 + 0.1 \times 2$$

$$0.1 + 0.2 = 0.3$$

$$0.3 \times 2 + 0.4 \times 7 + 0.5$$

$$0.6$$

$$-0.3 + 0.1 \times 1 \times 7$$

$$-0.3 + 0.1 \times 7$$

$$-0.3 + 0.7$$

$$= 0.4$$