Intro

Here we going to look at:

① Not cover the topic very rigorously.

② Give me enough understanding to get me going.

③ Use mathematical insight developed, by using python or r, matlab

④

LA is defined as:

→ Study of vectors

→ vector space

→ and mapping between vector space

LA emerged from study of systems of Linear Equations, and the realization that these can be solved through using matrix and vectors

First thing we will do is:

⇒ look at vectors, and the operations we can do with vectors.

⇒ Then look at matrices

⇒ Then afterwards put it all together and develop an application [pagerank]

→

what are the motivations or type of problems we going to solve with LA?

- Price Discovery.
- By apples and bananas.

① First time I buy 2 apples and 3 bananas and they cost $8.

② Second time I buy 10 apples and 1 banana and it cost $13.

$2a + 3b = 8$

$10a + 16b = 13$

∴ Solve the unknowns to get the individual price of apples / bananas.

But what if we have 1000 of unknowns then determining price may be hard!

~~different type of~~

different types of item or different types of trips this become problematic to calculate

∴ this is an example of a Linear Algebra problem.

We Content linear coefficients 3, 10, 3, 1 that relate the input variable, a and b to output 8 and 13.

Do Lets use a vector (a,b) that describes the apples and bananas, then this will be translated into Cost vector (8,13)
And then we can write down the number of trips as matrix $\begin{pmatrix} 2 & 3 \\ 10 & 1 \end{pmatrix}$

First trip → $\begin{pmatrix} 2 & 3 \\ 10 & 1 \end{pmatrix} \begin{bmatrix} a \\ b \end{bmatrix} = \begin{bmatrix} 8 \\ 13 \end{bmatrix}$ ← Second trip

matrix vector vector.

→

The type of problem we maybe interested in is fitting an equation to some data

But to "get an equation", we first need to determine which equation to use

Eg fitting some data with an equation
⇒ optimization problem.

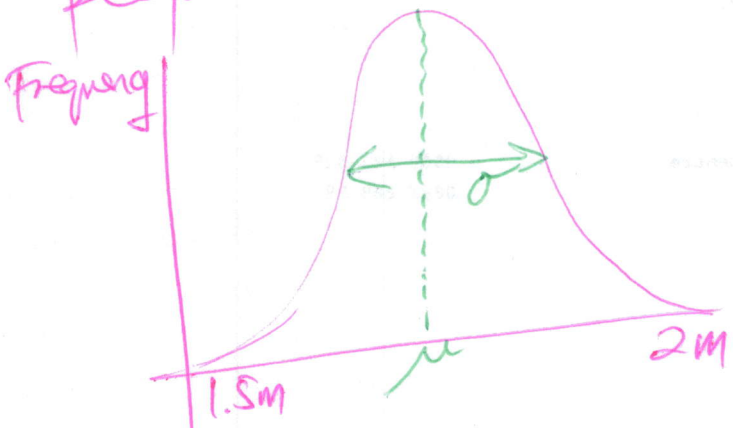
The first thing we need to do is get a handle on vectors.

→ this is very useful in solving LA problems.

Eg problems that are linear in their equations such as most fitting parameters.

— Learn here how and why to use vectors more intuitive.

Eg histogram distribution of heights and people in the population.



∴ Need to fit this distribution with an Equation the variation in height in the population

Here we have just 2 parameters:

① one describing the centre of distribution, μ

② and another describing how wide it is, σ

$$\therefore f(x) = \frac{1}{\sigma\sqrt{2\pi}} \cdot \exp\left\{\frac{-(x-\mu)^2}{2\sigma^2}\right\}$$

(Gaussian Distribution)

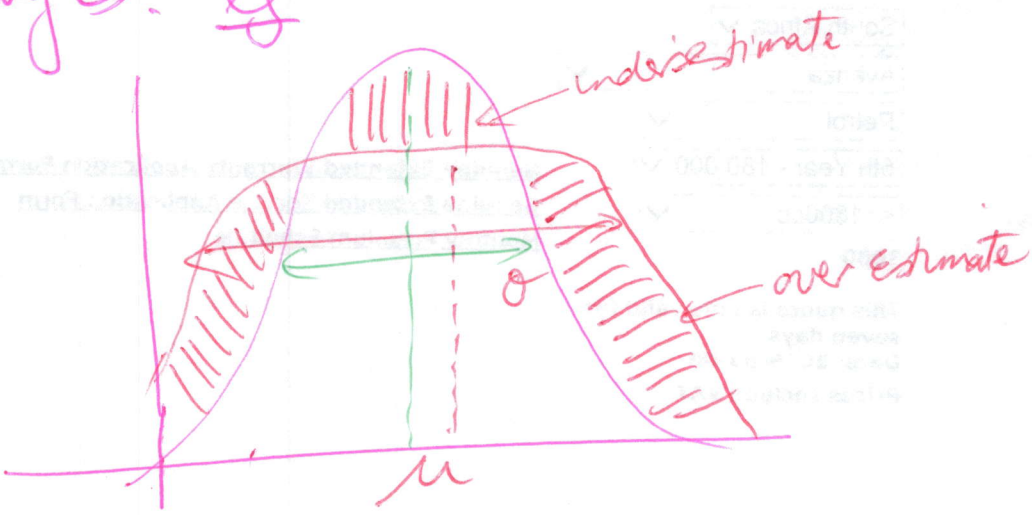
$\therefore$ Some function of x.

$\therefore$ This Equation only has 2 parameter, σ and μ

$\therefore$ Centre of μ
and width σ

$\therefore$ How do we fit this distribution, that means finding μ and σ, that fits data

Let say we with that we wider, that it really is: eg



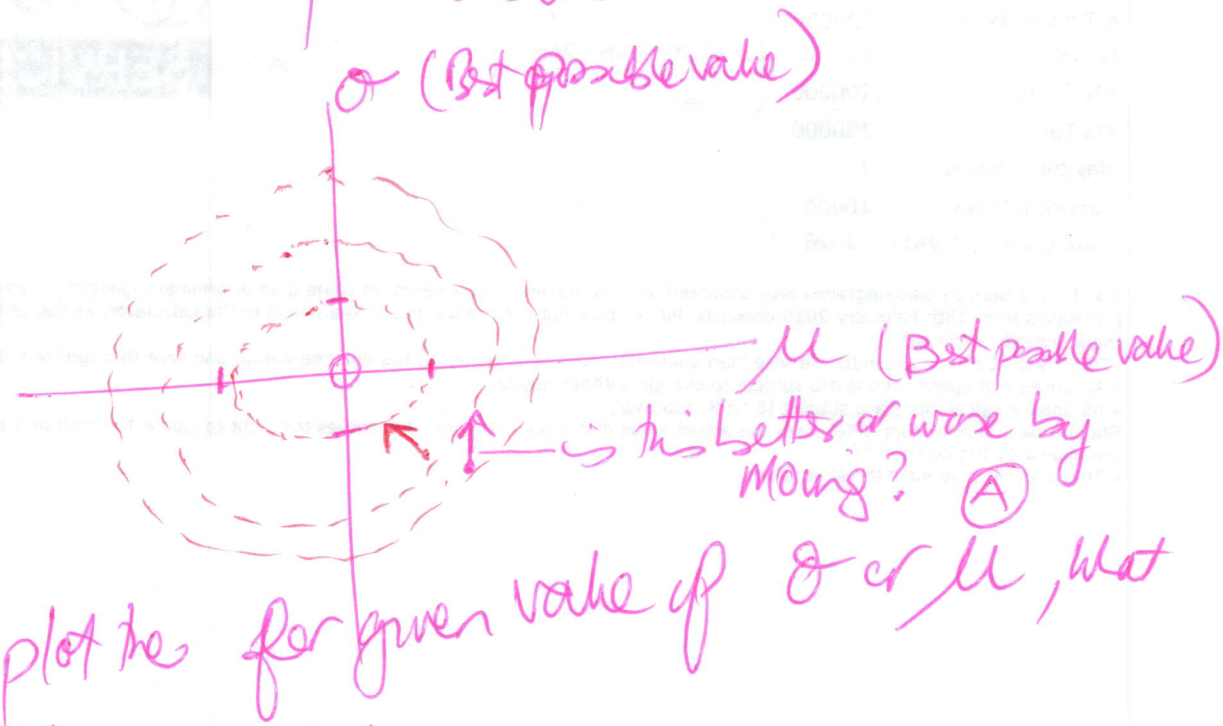
∴ has under σ, ~~But~~ and also short μ

that mean it's too wide at edge and too low in middle

⇒ that mean we will have to add up the difference.

or Square of difference to get the goodness or badness of fit

So we have our best possible value



then plot the for given value of σ or μ, what the difference was.

(A) that means making a vector by change in μ, change in σ

$$\begin{bmatrix} \mu \\ \sigma \end{bmatrix} \quad \begin{bmatrix} d\mu \\ d\sigma \end{bmatrix}$$ → then get new value

∴ these are little moves around space (, best move to get to zero)

∴ they not moves around physical space (axis), But moves around parameter space

(But its same thing, so if we understand vectors then we will be able to solve this problem)

Can also think of vectors as simply lists

eg write down all properties of car in vector.

eg
$$\begin{bmatrix} \text{Cost \$} \\ \text{Emissions grams } CO_2 \\ \text{No\#} \\ \text{rating} \\ \text{topspeed} \end{bmatrix}$$

~~When we~~

When we look at this like this, we can think of all space of all setting parameters of function, and vectors as things around that space.

⇒ we then find a location in that space where Badness is minimise, goodness maximised, and function which fits the data best.

⇒ Moves around the space is just vectors!