Line

$y = mx + c$

slope

$ax + by + c = 0$

$by = -ax - c$

$y = \left(-\frac{a}{b}\right)x - \frac{c}{b}$

m c

w1 w2 w0

weight intercept

$w_1 \cdot x + w_2 \cdot y + w_0 = 0$

→ slope

→ intercept

f1	f2	
15	750	Yes
17	760	Yes
14	780	Yes
13	740	Yes
6	310	No
5	460	No

plot

l_1: $f1 * w1 + f2 * w2 + w_0 = 0$

$l_1 \rightarrow [w_1 \; w_2 \; w_0]$

Best → $[w_1, w_2]$

$l_2 \rightarrow [w_2, w_2 \; w_0]$

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→ equation

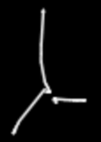
↑

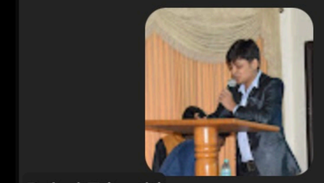
$w1 * f1 + w2 f2 + w3 f3 + w_0 = 0$

↑

equation of line → (2D)

↑





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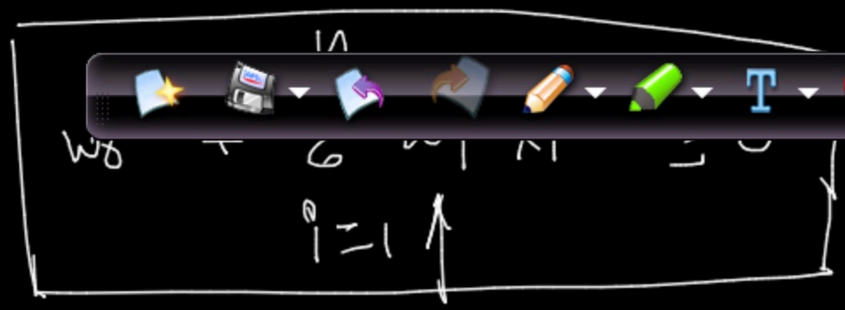
↓

nD

$w_1 f_1 + w_1 f_2 + w_3 f_3 + + w_4 f_4 \quad - \quad + w_n f_n + w_0$

↑

Hyperplane



f_1 f_2

$[w_1 \; w_2]$

equation of line / plane / Hyperplane

2D 3D nD

eg.

f1	f2	y	ŷ
2	3	+ve	+ve
4	5	-ve	-ve

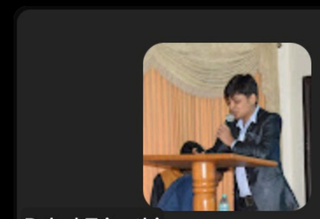
Ex1

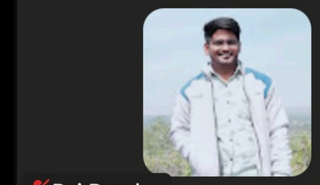
$$w_0 + [w_1 \; w_2] * \begin{bmatrix} f1 \\ f2 \end{bmatrix} = 0$$

w_1 w_2

[0.7 0.8]

$$[0.7, 0.8] \begin{bmatrix} f2 \\ 3 \end{bmatrix} \rightarrow \delta(0.24)$$





↳ Prob & stats

↑

↓ Analysis

Random variable

$X = 2$

↳ Real Numbers $X = 7$

dice →

↳ $X = \{1, 2, 3, 4, 5, 6\}$

↑ discrete Random variable

Continous feature → Age

23

25

!

!

!

Sex → M, F

categorical feature

↑

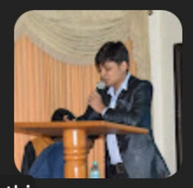
Discrete Random variable

$X = \{ 127, 125 \text{ ------} \}$

↑ ↑

$X \rightarrow$

↑ Continous Random variable



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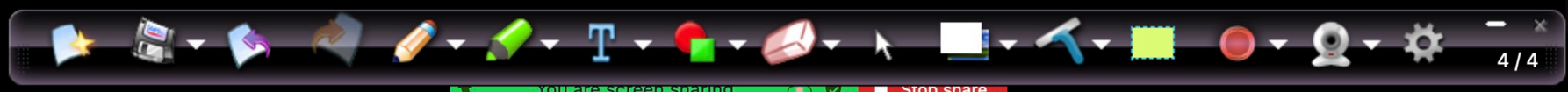

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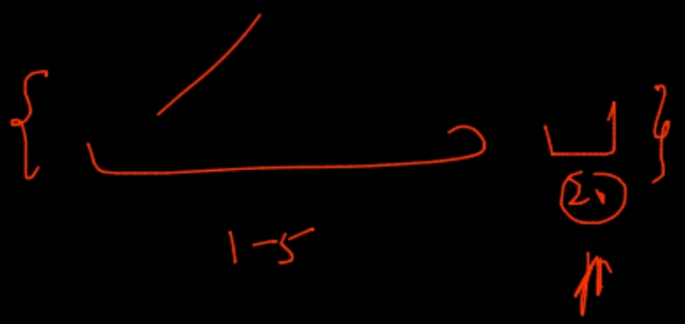
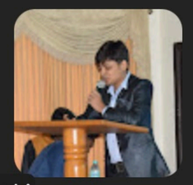
↳ outliers

Y : height of a student

{ 122.2, 146.4, 132.5 - - ---- 12.22 }

'outliers' → model





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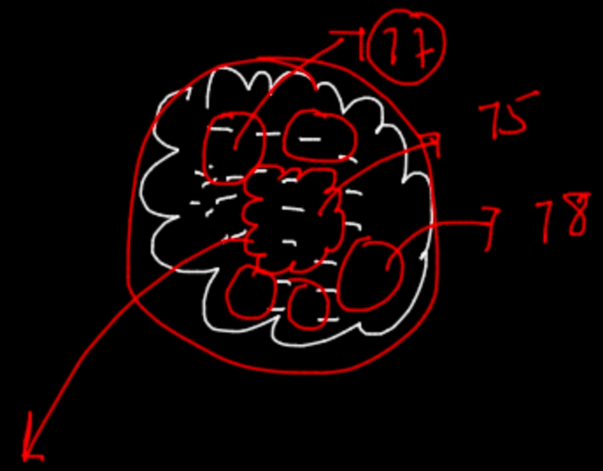
Population and sample

↑

Avg ht of → $\frac{122 + \cdots + 78}{78}$

paper ↗

↳ $\equiv$



$\bar{h}$ = mean = $\frac{1}{1000}\sum_{i=1}^{1000} h_i$ ↙ S1

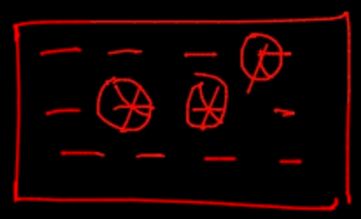
code ↑ $\equiv$

↗ with Replacement

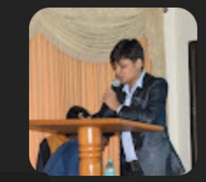
⇒ without Replacement

S1 → [- - -]

S2 → [- - -]

← 

S2 ← S2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A
Anushka Banerjee

D.R.V

$X \rightarrow \{1, 2, 3, 4, 5, 6\}$

Sample / Experiment

Q more than

$P(X > 3)$

$= \frac{3}{6}$ $\frac{1}{2}$

X	1	2	3	4	5	6
f(x)	1/6	1/6	1/6	1/6	1/6	1/6

P.D.

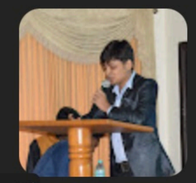
$= 50\%$

$\sum_{i=1}^{n} P(x = x) \longrightarrow 1$

$P(X > 5) = \frac{1}{6}$

P.M.F

P.D. mass f^n ← D.R.V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C.R.V

↑

Age → { 155, 165, 167, 168 - - - - - - - - }

↑ ↑

↑

plot it

$\hat{f}(x)$

sin - 1nm

$\int_{160}^{\infty} f(x)\,dx$

160 ↓↓

0.3 ← 30%

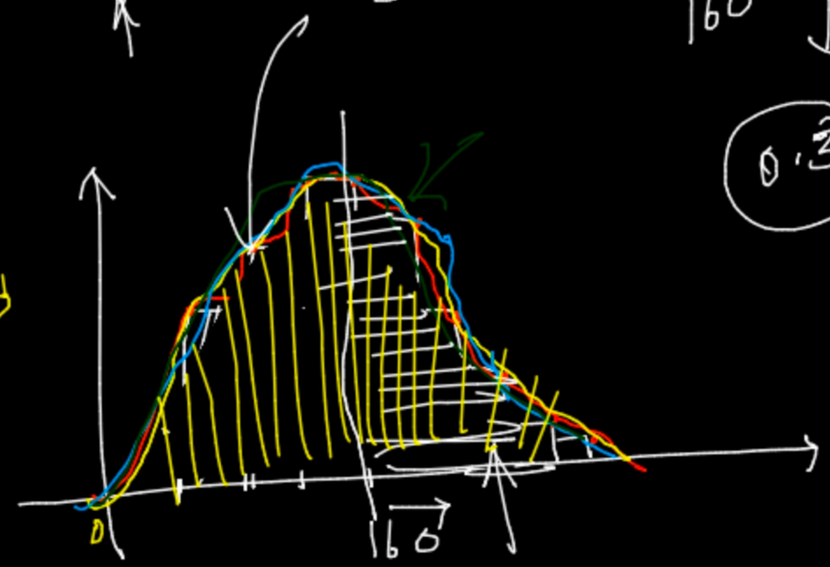
P(h > 160) ⇒ ?

↑ ↑

P.D.f

↑

C.R.V →



'Histogram'

↑

KDE

↑

Kernel

Density estimation

↑

Bins

120 - 130 → 60

130 - 140 →

140 - 150 →

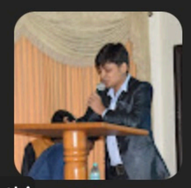
150 - 160 →

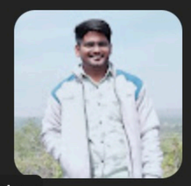
- - →

$\int_{-\infty}^{+\infty} f(x)\,dx \to 1$

12%

← Area under curve





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Normal distribution / Gaussian distribution

f(x)

Age | Height | weight

↑

Normal distribution

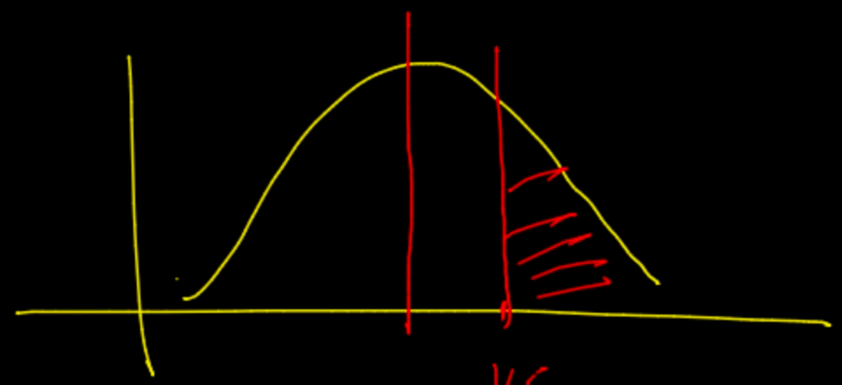
$X \sim N(\mu, \sigma^2)$

NP

Age →

↑

NP



$P(X > 165)$

$\int_{165}^{\infty} f(x)$

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

Let $\mu = 0$

$\sigma^2 = 1$

→ x moves away from μ → y reduce

↳ ② symmetric

$$p(x) = \frac{1}{\sqrt{2\pi}} \exp(-x^2)$$

google

$\exp(-x^2)$ → e^{-x^2} → plot

④ Bell shape curve

④ X moves away from ⑦ y reduce

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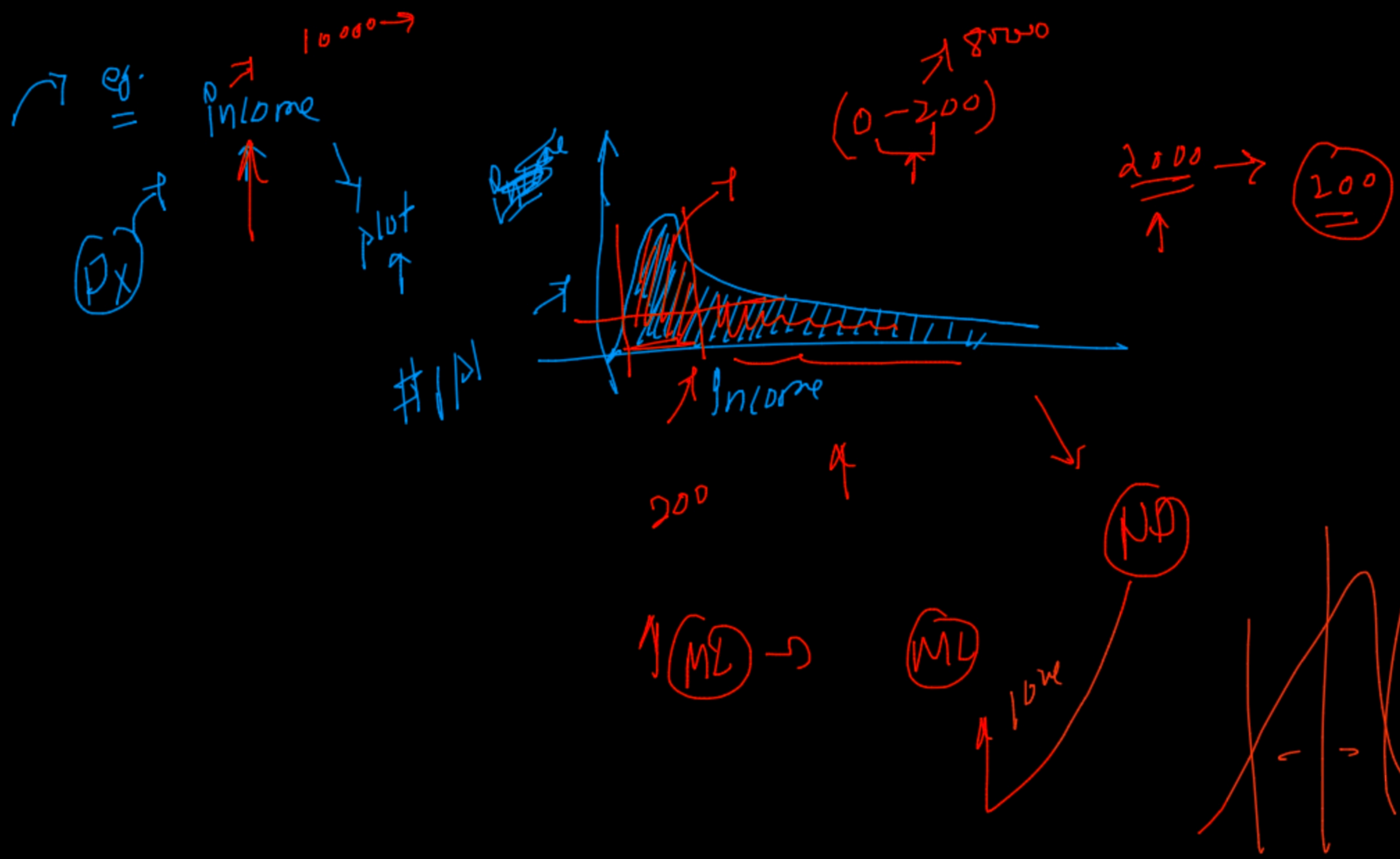

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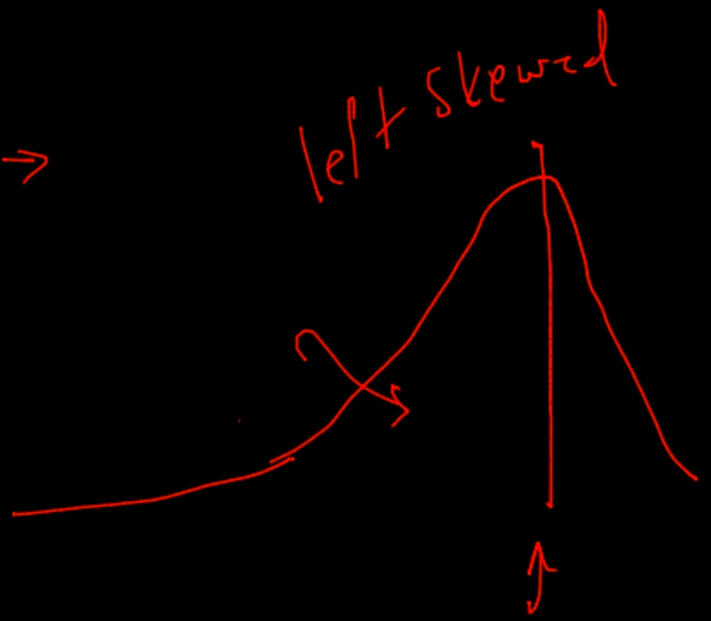
Skewness

↑

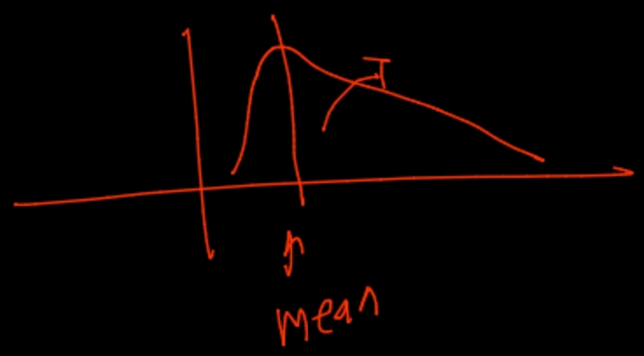
age/Income →



(i) Negative skewed

↑

(ii) Positive



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$$\text{Excess kurtosis} = \frac{\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^4}{\left(\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2\right)^2} - 3$$

$\uparrow$

$(\text{Var}(X))^2$

excess kurtosis $\rightarrow$ zero