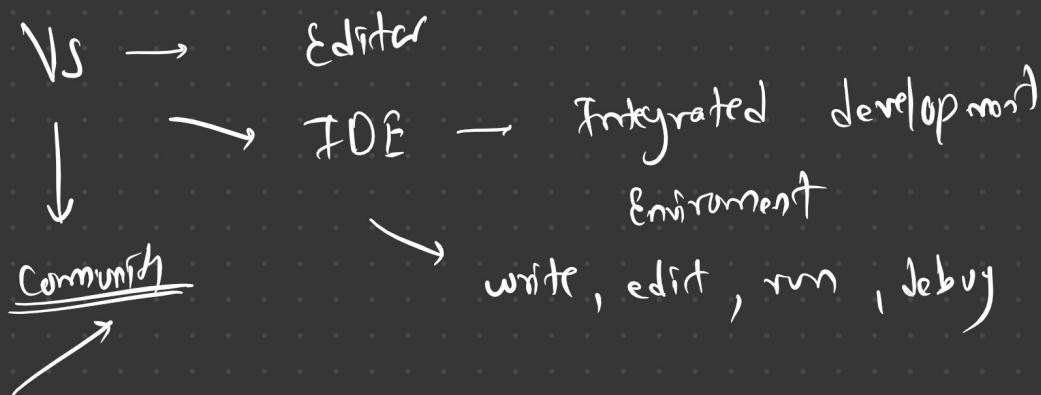
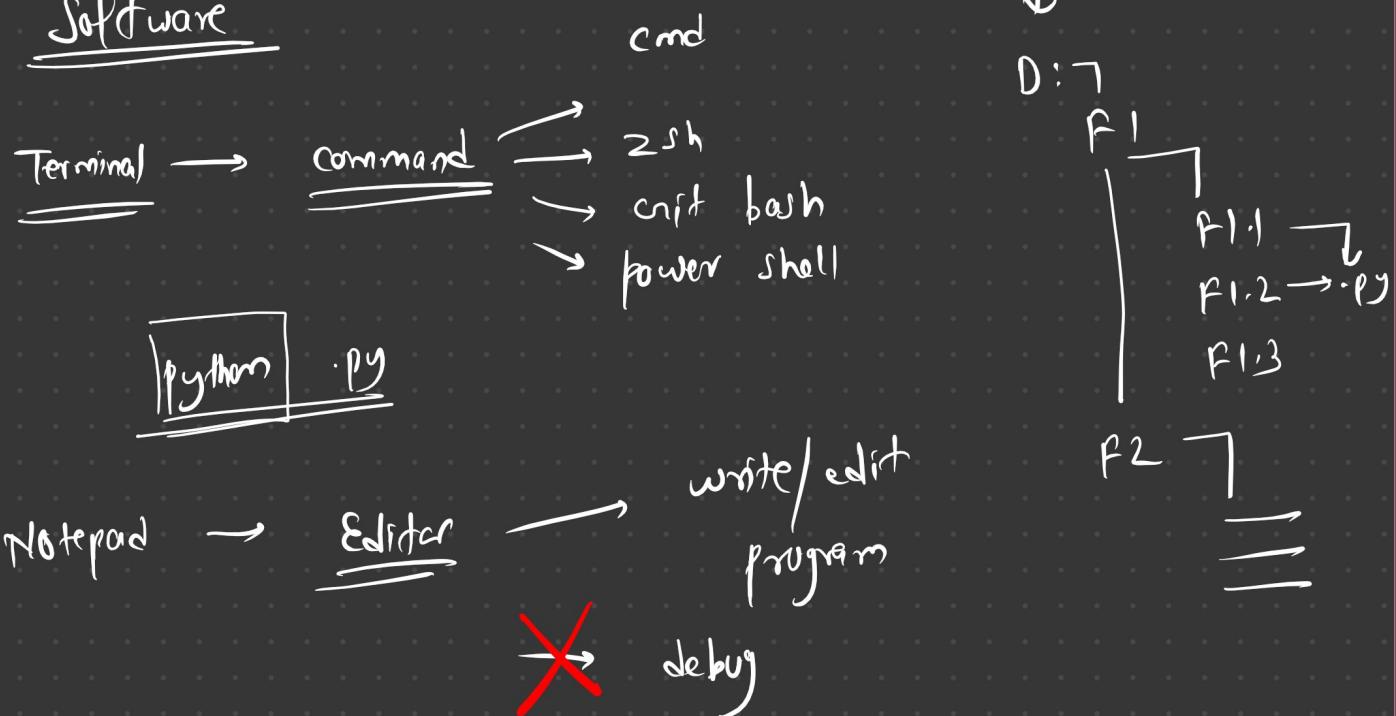
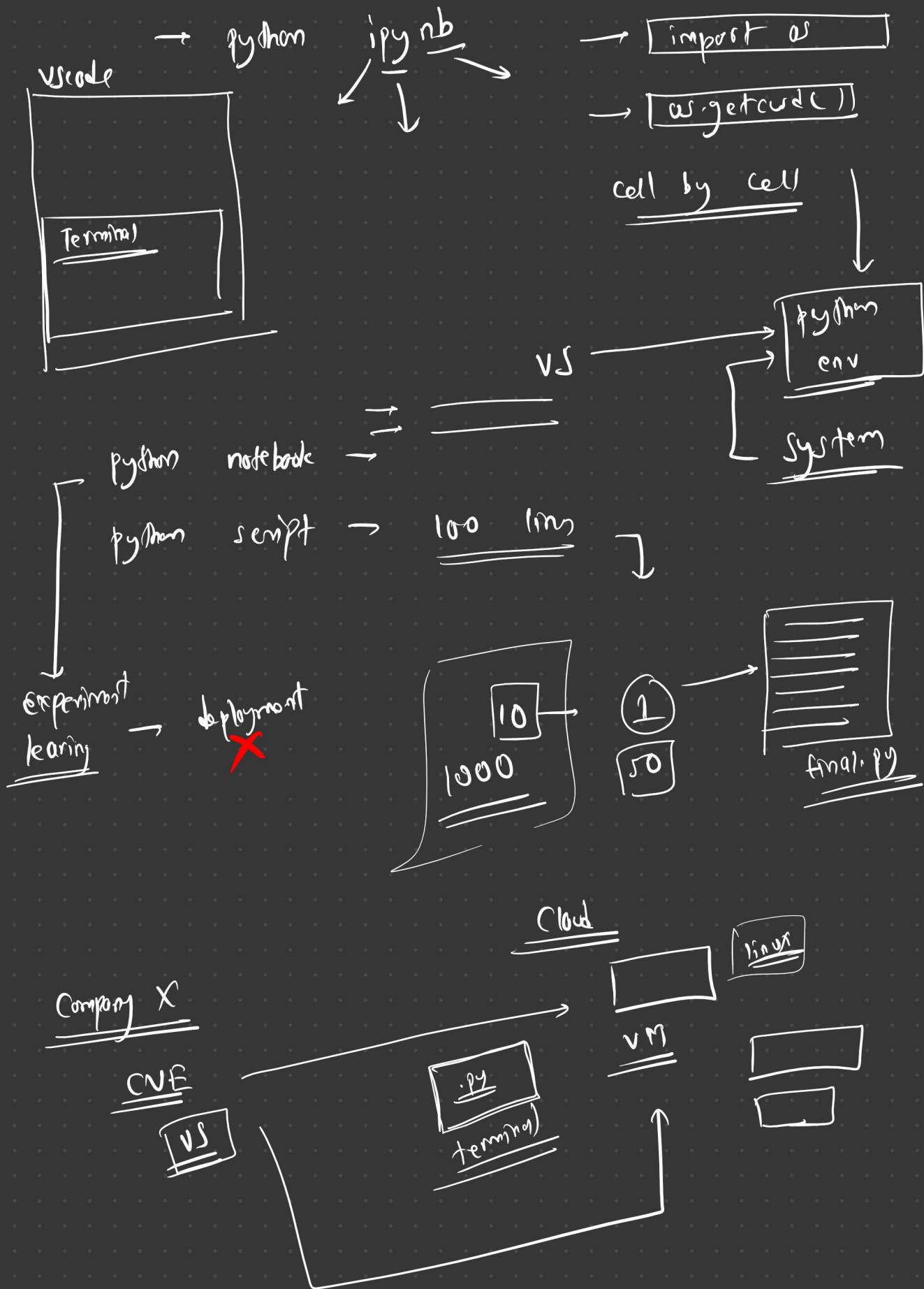


Image Processing - II

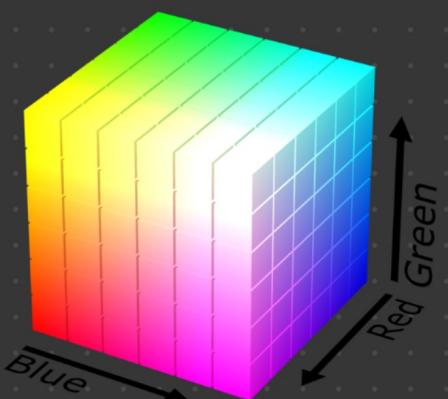
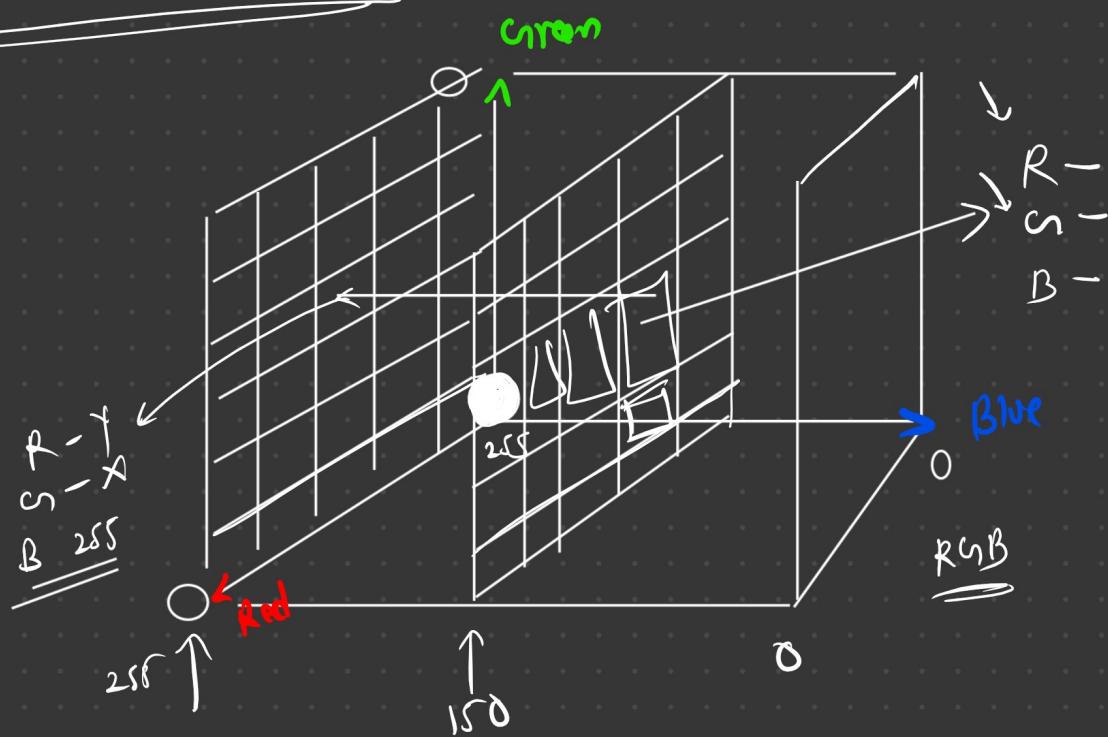
- Software
- HSV, L - More color space
- Color Thresholding
- Contours
- Augmentation

Software





RGB vs HSV



$$R \rightarrow 0 - 255$$

$$G \rightarrow 0 - 255$$

$$B \rightarrow 0 - 255$$

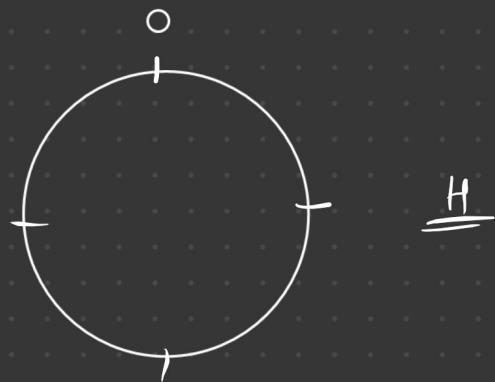
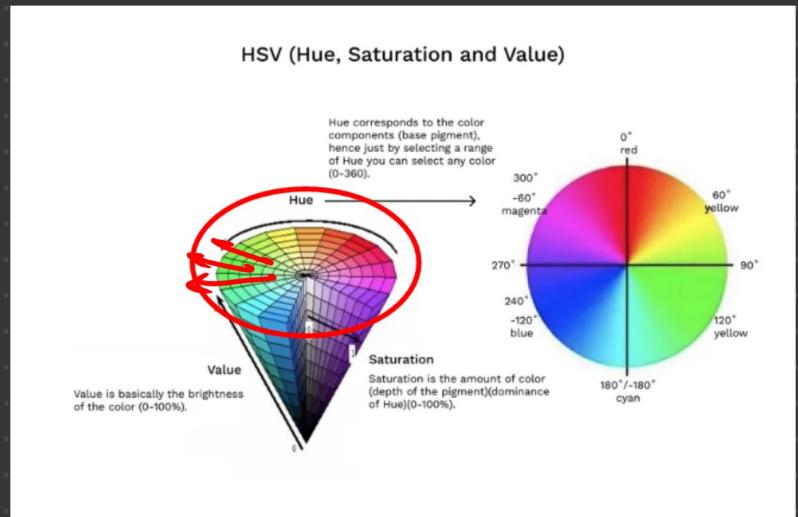
16.7 19

HSV

H → Hue

S → Saturation

V → Value/Brightness



R → $0 - 30^\circ$

$330 - 360^\circ$

R → 0
→



D

HSV

H → degree → $0 - 360$

S → percent → $0 - 100\%$

V → percent → $0 - 100\%$



$$\text{color} = (100, 255, 180) \quad (R \quad G \quad B \quad \rightarrow \quad H \quad S \quad V)$$

- (1) Divide each r,g,b by 255
- (2) Compute c_{\max} , c_{\min} , difference $c_{\max} - c_{\min}$
- (3)
 - if c_{\max} & c_{\min} are equal, $h = 0$
 - if $c_{\max} == R$

$$h = (60 * ((G - B) / \text{diff})) + 360 \quad \% \cdot 360$$
 - if $c_{\max} == G$

$$h = (60 * ((B - R) / \text{diff})) + 120 \quad \% \cdot 360$$
 - if $c_{\max} == B$

$$h = (60 * ((R - G) / \text{diff})) + 240 \quad \% \cdot 360$$
- (4) S
if $c_{\max} = 0$, $S = 0$
 $c_{\max} != 0$, $(\text{diff} / c_{\max}) * 100$
- (5) V
 $c_{\max} != 100$

$$R = 100$$

$$G = 255$$

$$B = 180$$

$$(1) \quad R - 100 / 255 = \underline{\underline{0.392}}$$

$$c_{\max} = G = 1$$

$$G - 255 / 255 = \underline{\underline{L}}$$

$$c_{\min} = R = \underline{\underline{0.392}}$$

$$B - 180 / 255 = \underline{\underline{0.706}}$$

$$(2) \quad \underline{\underline{\text{diff}}} = c_{\max} - c_{\min} = 0.608$$

(3) if G

$$\left(60 * \left((B - R) / \underline{\underline{\text{diff}}} \right) + 120 \right) \% 360$$

$$\left(60 * \left(\underline{\underline{0.706 - 0.392}} \right) / 0.608 + 120 \right) \% 360$$

$$\left(60 * \underline{\underline{0.314 / 0.608}} \right) + 120 \% 360$$

$$\left(60 * \underline{\underline{0.516}} \right) + 120 \% 360$$

$$30.986 + 120 \% 360$$



$$(4) \quad \text{diff} / c_{\max} \nleq 100$$

$$\left(0.608 / 1 \right) \nleq 100 \rightarrow$$



Saturation

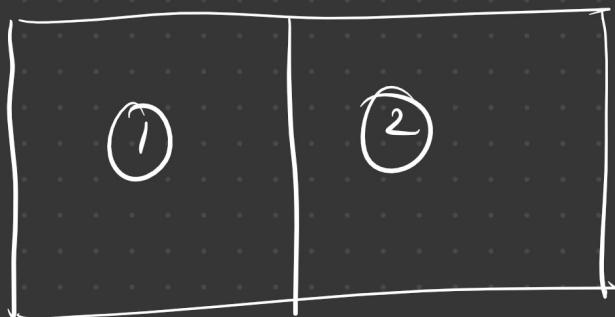
(5) $\text{Cmax} \neq 100 \rightarrow 1 * 100 \rightarrow$ 
value

OpenCV

$$H \rightarrow \underline{\underline{360^\circ}} \rightarrow \underline{\underline{180^\circ}}$$

$$S \rightarrow 0 - 255$$

$$V \rightarrow 0 - \underline{\underline{255}}$$



200	60	0	50	20
40	251	150	10	20



0	1			
0	0	0	0	0
1	1	1	1	1
1	1	1	1	1
0	0	0	0	0



warn

1-D

1	0	0	0
0	1	0	0
1	1	0	0
1	1	0	0
0	0	0	0

(00)

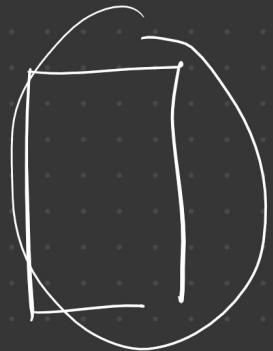
$$\begin{bmatrix} 100 \\ 500 \end{bmatrix} \times 100$$

$$\begin{bmatrix} 500 \\ 200 \end{bmatrix} / 500$$

$$400 \times 200$$

warn

$$500$$



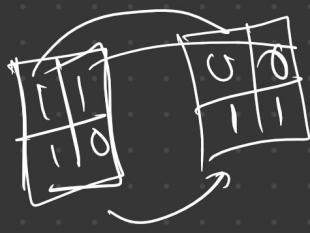
$$\begin{bmatrix} \text{upper} \\ \text{lower} \end{bmatrix} = \square$$

mask →

$$10$$

$$1 \leftarrow 10^0$$

$$1^{\infty}$$



$$\begin{bmatrix} 0 & 0 \\ 1 & 0 \end{bmatrix}$$

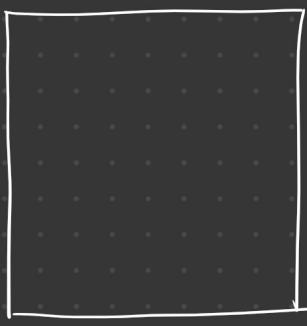
$$\text{img}$$

$$\text{img}$$

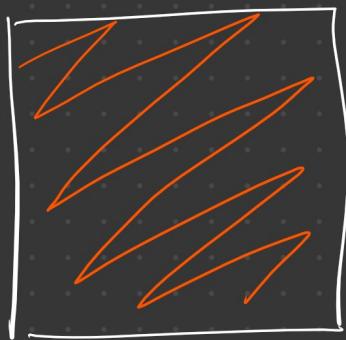
marks ?

$$\begin{array}{c} \text{img} \quad \times \quad \text{mask} \\ \times \quad = \quad \text{op} \end{array}$$

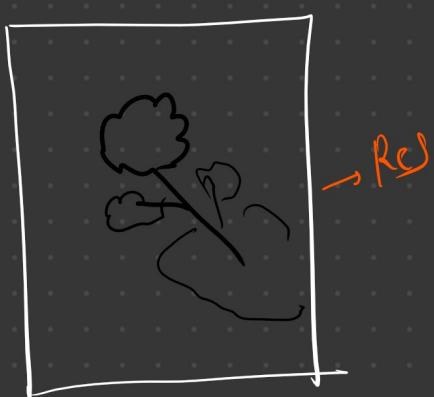
①



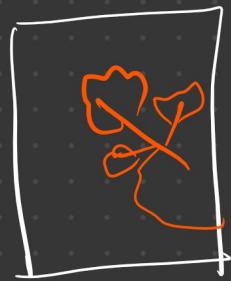
②



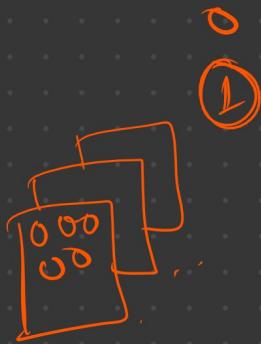
③



④



→ image mask

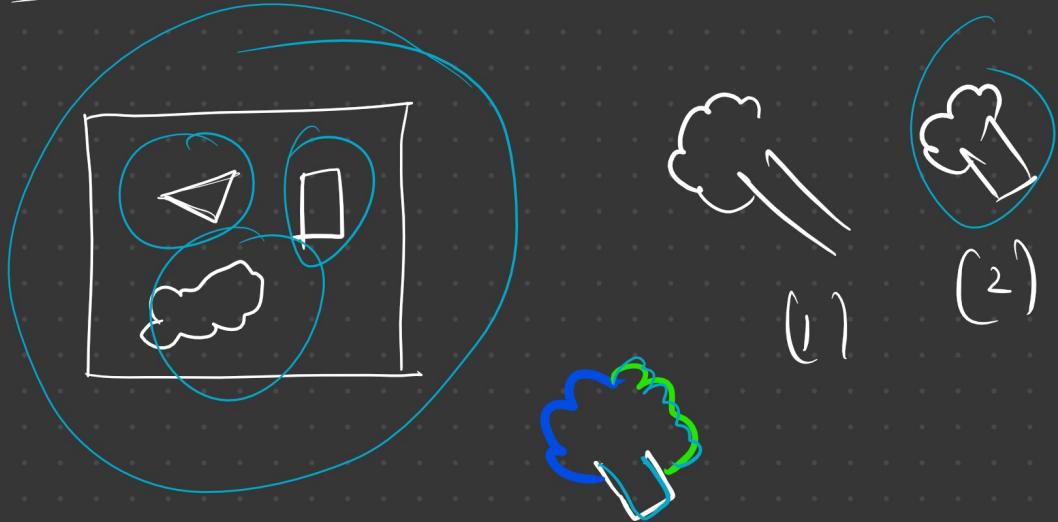


zero →

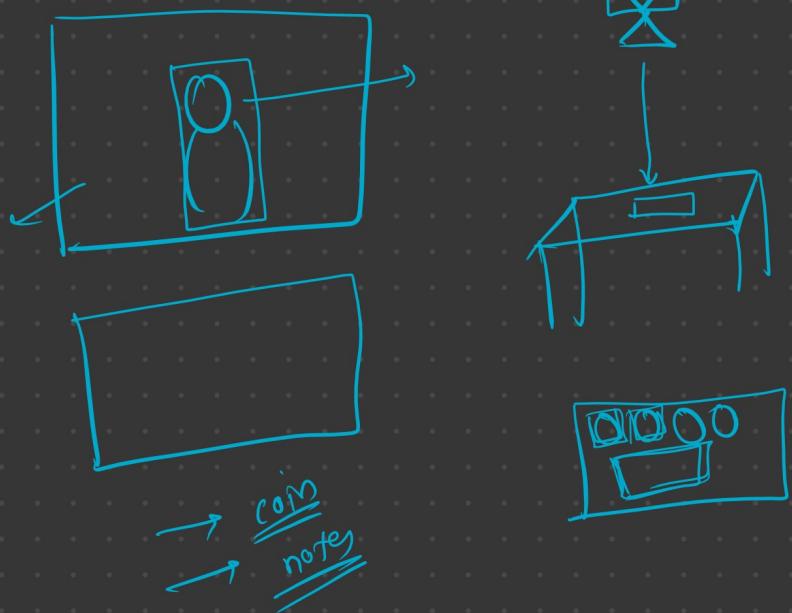
→ 500 x 500 x 3

→ image ->rgb

Contours

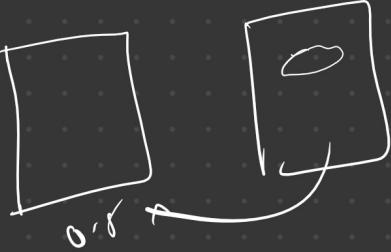
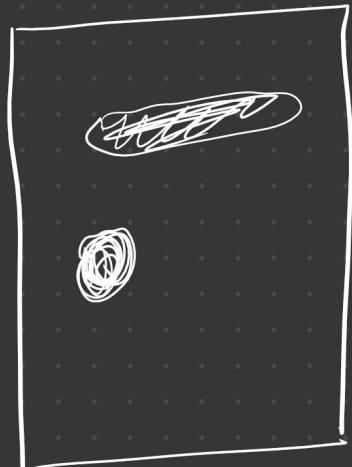
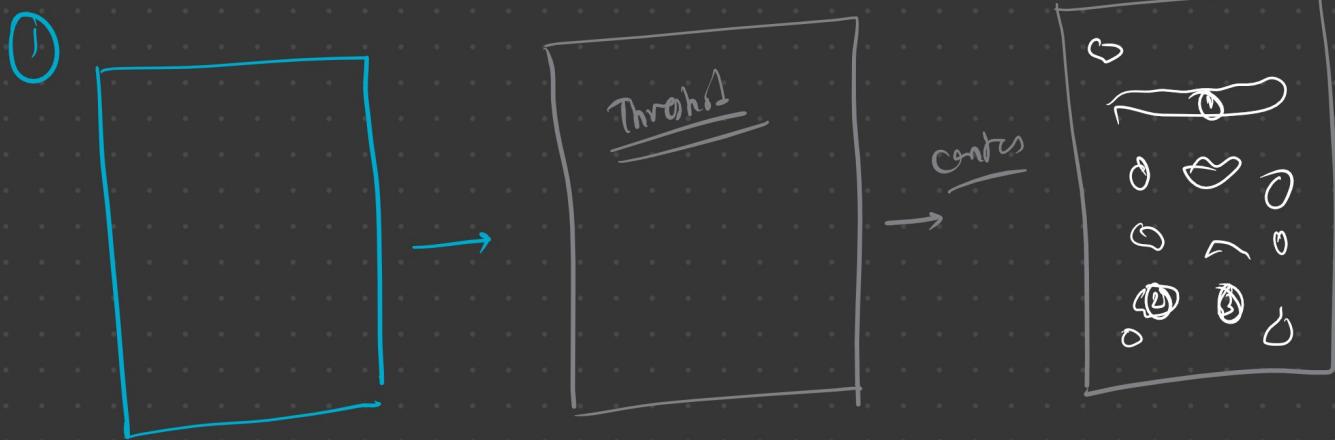


object →



$$\begin{matrix} a, b, c \\ \textcircled{a}, -c \end{matrix} = \begin{pmatrix} 100 & 250 & 60 \\ r & g & b \\ 1 & 1 & 1 \end{pmatrix}$$

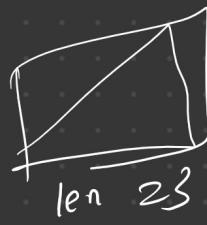
Contain



$x_i, y_i \rightarrow$
 $x_{i+1}, y_{i+1} \rightarrow$
 $x_{i+2}, y_{i+2} \rightarrow$



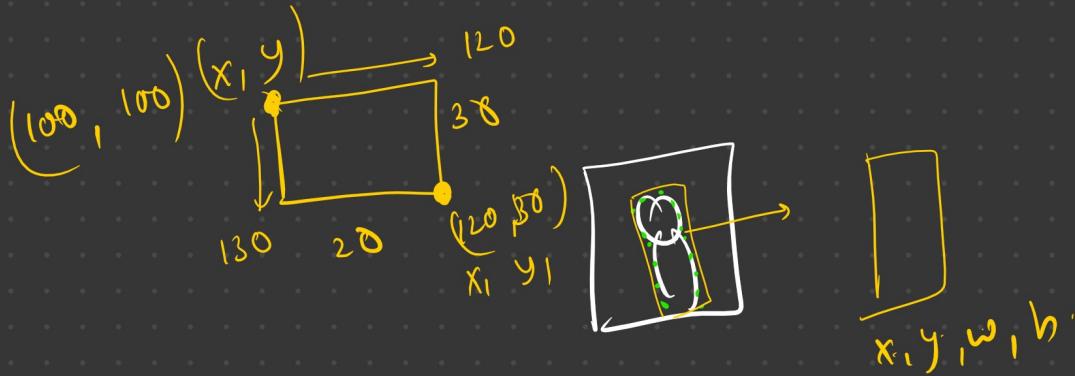
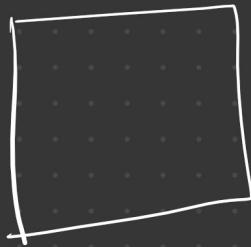
3



$$h = 200$$

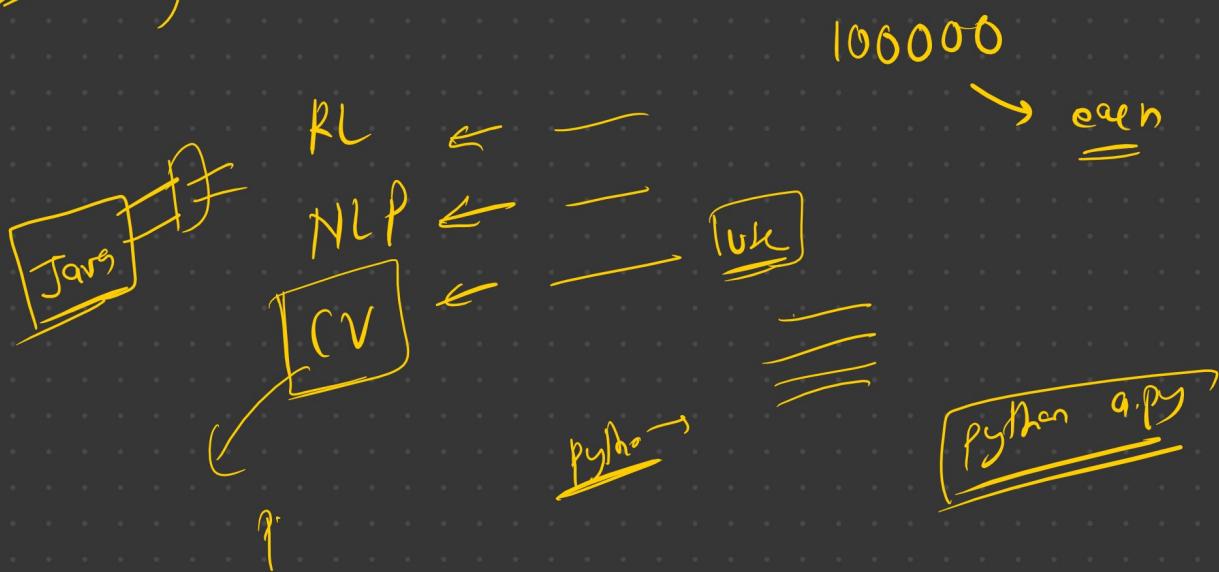
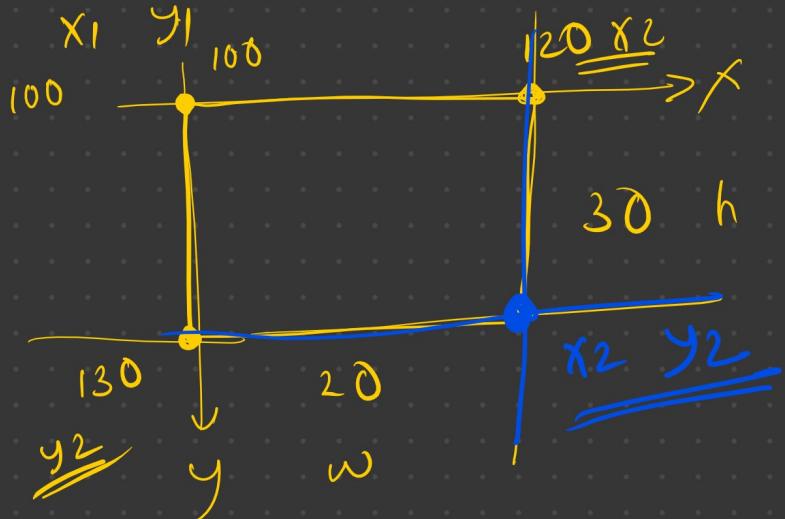
$$w = 20$$

$$20 / 20 = 1$$



$x + w$

$$\begin{array}{c} x_2 \quad y_2 \\ \hline (x_1 \quad y_1) \quad (\omega \quad b) \\ (x_1 \quad y_1) \quad (x_2 \quad y_2) \end{array} \rightarrow \omega^b$$



Engineer

→ ↗