21. - Hog is using machine learning
- faster-rcnn is using deep learning
- Hog is hand engineered with no learning algorithms
- Rcnn is using supervised deeplearning models.

22) Equalization tries to linearize instead of flattening the cumulative frequency distribution, where the number of pixel in each intensity level is distributed close to equal which could be mistaken as a flattening procers.

22)

a) $G(u,v) = (2e^{0} - e^{2\pi j \frac{u}{M}} - e^{2\pi j \frac{v}{m}}) F(u,v)$

$= 2 - e^{2\pi j \frac{u}{M}} - e^{2\pi j \frac{v}{m}}$

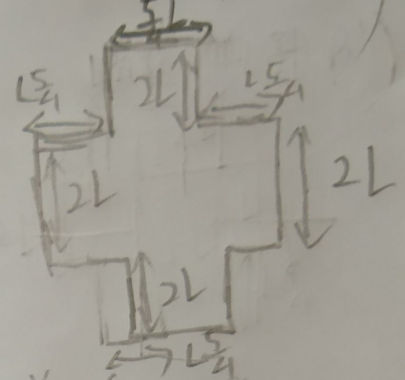
$G(u,v) = H(u,v) F(u,v)$

$H(u,v) = 2 - e^{2\pi j \frac{u}{M}} - e^{2\pi j \frac{v}{m}}$

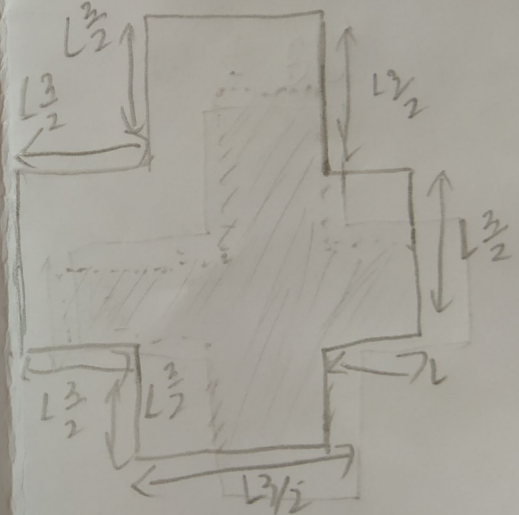
b) The range goes from 0 to 1 and we can see that the amplitude of the filter increases as a function of distance from the origin, similar to highpass characteristics.

24)

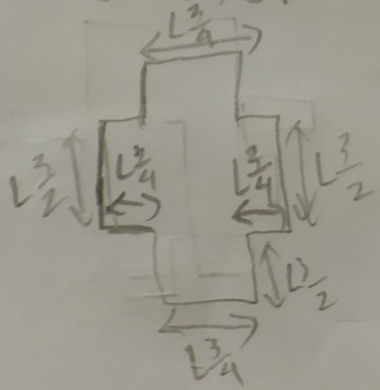
Y_1: $(A \oplus B^1)$



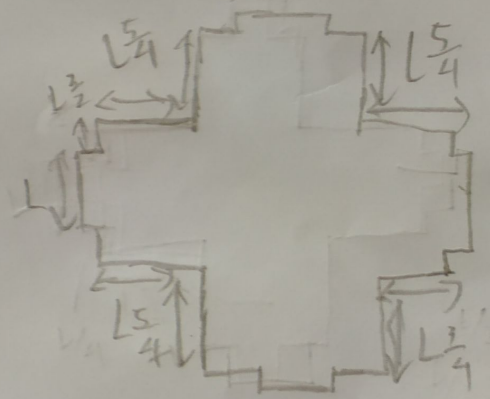
Y_2: $(A \oplus B^3)$



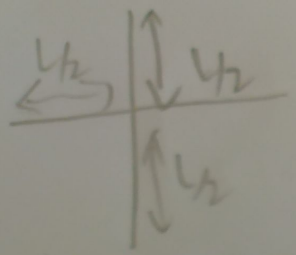
$(A \oplus B^1) \oplus B^3$

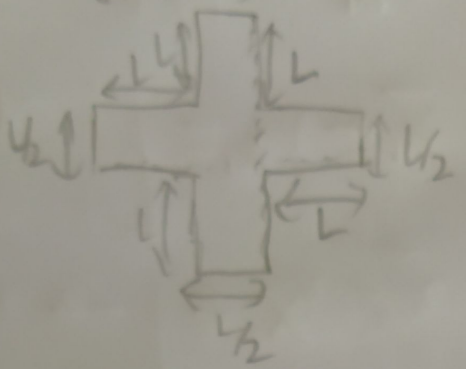


$(A \oplus B^3) \oplus B^2$



24) V_3: $(A \ominus B^{-1})$ $(A \ominus B^{-1}) \oplus B^3$

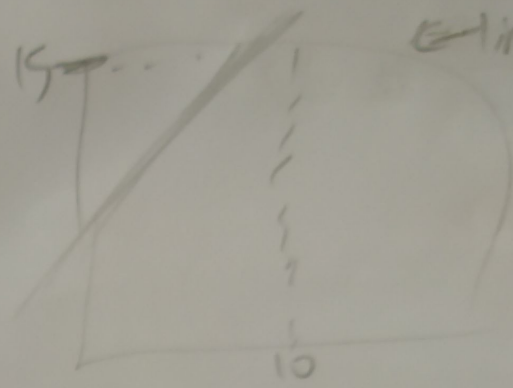




25) a) It is identical as 'd' has same value count as 'b' as they are half white and half black

b)

26) 15



a) $m = \frac{15-5}{10-0} = 1$

$b = 5$

b) max num = 10

$\rho = \frac{5}{\sqrt{2}} = 3.536$

$\theta = \text{abs}(\tan^{-1}(m)) = 135°$

c) $\rho = \frac{1}{\sqrt{4}} = 0.5$

$\theta = \text{abs}(\tan^{-1}(2)) = 153.43°$

27) $w_b = \frac{6}{6+4+2+8} = 0.3$

$\mu_b = \frac{0 \times 6}{6} = 0$

$\sigma_b^2 = 0$

$w_f = \frac{14}{20} = 0.7$

$\mu_f = \frac{1\times4 + 3\times2 + 3\times8}{14} = 2.286$

$\sigma_f^2 = \frac{(1-2.29)\times4 + (2-2.29)\times2 + (3-2.29)\times8}{14}$

$= 0.776$

$\sigma^2_w = w_b \sigma_b^2 + w_f \sigma_f^2$

$= 0.5432$

28) $\mu_{x_1} = \begin{vmatrix} 3 \\ 4 \end{vmatrix}$ $\mu_{x_2} = \begin{vmatrix} 8 \\ 7 \end{vmatrix}$

$\overline{x_1} - \mu_{x_1} = \begin{vmatrix} 1 & -1 & -1 & 1 \\ -1 & 0 & -1 & 2 \end{vmatrix}$

$\overline{x_2} - \mu_{x_2} = \begin{vmatrix} -2 & 1 & 0 & 1 \\ 1 & -2 & 0 & 1 \end{vmatrix}$

$cov(x_1) = \begin{vmatrix} 1.33 & 0.6667 \\ 0.6667 & 2 \end{vmatrix}$ $cov(x_2) = \begin{vmatrix} 2 & -1 \\ -1 & 2 \end{vmatrix}$

$S_w = \begin{vmatrix} 3.33 & -0.33 \\ -0.333 & 4 \end{vmatrix}$ // $= cov(x_1) + cov(x_2)$

$S_B = \begin{vmatrix} 25 & 15 \\ 15 & 9 \end{vmatrix}$ // $= (\mu_{x_1} - \mu_{x_2}) \times (\mu_{x_1} - \mu_{x_2})^T$

$S_w^{-1} S_B = \begin{vmatrix} 7.9412 & 4.7647 \\ 4.4118 & 2.65 \end{vmatrix}$

29)

a) 1 matches B

- It is using a low frequency filter

2 matches C

- Using a high frequency filter

3 matches A

- Using band pass filter

b) - cut the image to 4 equal parts

- Use ~~[illegible]~~ gaussian blur on top left, sharpen on top right, Canny or edge filter on bottom left, and ~~low pass~~ Smooth on bottom right

Smoothing

c) 1 matches C

- low contrast image has narrow and centred histogram to the middle.

2 matches D

- Histogram is more equalized and has high contrast to cover a broad grayscale.

3 matches A

- Bright images has values concentrated on high side of the gray scale.

4 matches B

- Dark images concentrate on the low side of the gray scale