29/8/23   Deep Learning

- Recap ✓
- Cross Entropy ✓
- HW discussion ✓
- Project discussion

- Recap: • $H(x) = -E_x \log_2 p_x(x)$ (Entropy)

  • $H(x, y) = -E_{xy} \log_2 p_{xy}(x,y)$ (Joint Ent)

  • $H(y|x) = -E_{xy} \log_2 p_{y|x}(y|x)$ (Conditional)

  • $H(x, y) = \underline{H(x)} + \underline{H(y|x)}$ (Joint)

  • $D(p||q) = \sum_x p(x) \cdot \log_2 \frac{p(x)}{q(x)}$ (KL divergence) : $D(p||q) \geq 0$

  • $H(p,q) = \underbrace{H(p)}_{\substack{\text{Entropy} \\ \text{of the} \\ \text{ground} \\ \text{truth}}} + \underbrace{D(p||q)}_{\substack{\text{Extra bits} \\ \text{required to represent } p \\ \text{when we observe} \\ q \text{ as a proxy of } p.}}$

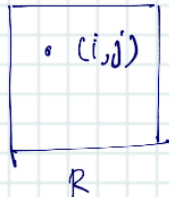 $= -\sum p(x) \log p(x) + \sum p(x) \log \frac{p(x)}{q(x)}$

  $= -\sum p(x) \log p(x) + \sum p(x) \log p(x) - \sum p(x) \log q(x)$

$$\boxed{H(p,q) = -\sum p(x) \log q(x)} \quad - \text{①}$$

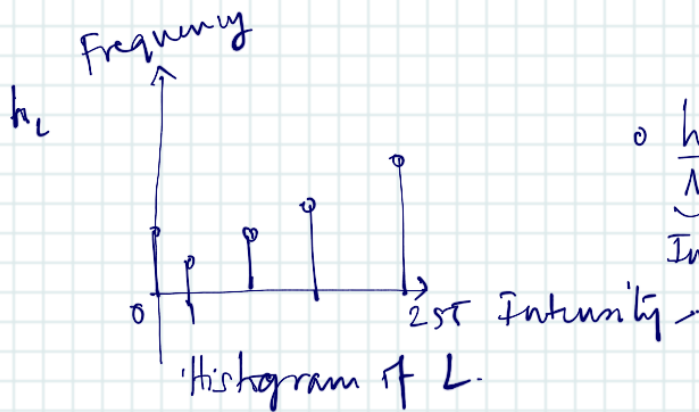Binary Cross entropy: $p(0) = p$; $p(1) = (1-p)$

$q(0) = q$; $q(1) = (1-p)$

Find the extremism for BCE: $H(p,q) = -[p \log q + (1-p) \log (1-q)]$

L: $\cdot (i,j)$

R: $\cdot (i,j)$

$L(i,j)$: pixel intensity at location (i,j) in the left image L

$R(i,j)$: pixel intensity at location (i,j) in the right image R.

$$J(i,j) = [\,\underbrace{L(i,j)}_{\in\,[0,255]},\ \underbrace{R(i,j)}_{\in\,[0,255)}\,]$$

h_L

Frequency

255 Intensity

Histogram of L.

$\circ$ $\dfrac{h_L}{\underbrace{M\times N}_{\text{Image dim.}}}$ gives us the normalized histogram

h_J

(Joint histogram)

$(2,2)$

1 2   25   L

R

255