

Cross-Entropy

$$H(P, Q) = - \sum_x P(x) \lg Q(x)$$

KL Divergence

$$D_{kl}(P \parallel Q) = - \sum_x P(x) \lg \left(\frac{Q(x)}{P(x)} \right)$$

Entropy

$$H(P) = - \sum_x P(x) \lg(P(x))$$

Ex: Write ~~the~~ cross-entropy as function of entropy & KL-Divergence.

Sol'n :

$$H(P, Q) = - \sum_x P(x) \cdot \lg \left(Q(x) \cdot \frac{P(x)}{P(x)} \right)$$

$$= - \sum_x P(x) \lg \left(\frac{Q(x)}{P(x)} \right) - \sum_x P(x) \lg(P(x))$$

$$= D_{kl}(P \parallel Q) + H(P)$$