

Information theory

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0.1 Preliminary definitions

Definition 1 *Entropy(H): The entropy of a random variable X with probability distribution $p : X \rightarrow \mathbb{R}$ is defined as:*

$$H(X) \equiv - \sum_{x \in X} p(x) \log p(x) = \mathbb{E}[-\log \circ p]$$

Definition 2 *Conditional entropy($H(X|Y)$): The conditional entropy of a random variable X with respect to another variable Y is defined as:*

$$\begin{aligned} H(X|Y) &\equiv - \sum_{y \in Y} p(y) H(X|Y = y) \\ &= \sum_{y \in Y} p(y) \sum_{x \in X} -p(x|y) \log p(x|y) \\ &= \sum_{y \in Y} \sum_{x \in X} -p(y)p(x|y) \log p(x|y) \\ &= \sum_{y \in Y} \sum_{x \in X} -p(y \wedge x) \log p(x|y) \end{aligned}$$

In this chapter we introduce a number of basic concepts including influences and noise stability.