

Entropy

Information Entrophy

We use logarithms to base 2. The entropy will then be measured in bits. The entropy is a measure of the average uncertainty in the random variable. It is the number of bits on average required to describe the random variable.

Entropy

Information Entropy Entropy is the uncertainty of a single random variable.

Information entropy is a measure of the uncertainty associated with a random variable. The term by itself in this context usually refers to the Shannon entropy, which quantifies, in the sense of an expected value, the information contained in a message, usually in units such as bits.

Entropy

We can define conditional entropy $H(X|Y)$, which is the entropy of a random variable conditional on the knowledge of another random variable. The reduction in uncertainty due to another random variable is called the **mutual information**.

Entropy

The Shannon entropy is denoted by $H(X)$ and is defined as

$$H(X) = - \sum_{i=1}^n p(x_i) \log_b p(x_i). \quad (1)$$

Entropy

Example

A source language has 5 symbols A, B, C, D and E. The associated probabilities of these symbols are 0.35, 0.25, 0.20, 0.10 and 0.10, respectively.

- ▶ Calculate the entropy of the source language.
- ▶ Define a Huffman binary code for the source language.
- ▶ Calculate the efficiency of this code.