

Information

Experience shows that the **information value** of certain *news* depends on their probability.

$$I_{E_i} = f(P_i)$$

in which I_{E_i} means the information value. In this aspect the more unexpected or unlikely (rumour) a *news* is the bigger its *news* value.

So the $f()$ function was selected according to Shannon's suggestion:

$$I_E = \log_2 \frac{1}{p_E} = -\log_2(p_E) \text{ [bit]}$$

The properties of a logarithm function play an important role in the modeling procedure of the quantitative properties of a given information.

If an event space consists of two equal-probability events ($p(E_1) = p(E_2) = 0.5$) then,

$$I_{E_1} = I_{E_2} = \log_2 \frac{1}{0.5} = -\log_2 0.5 = 1 \text{ [bit]}$$

So the unit of the information means the news value which is connected to the simple, less likely, same probability choice.

If the event system consists of 'n' number of events and all these events have the same probability then the probability of any event is the following:

$$p_E = \frac{1}{n}$$

In these cases, the news value which is connected to these events will be the following:

$$I_E = \log_2 \frac{1}{p_E} = \log_2(n) \text{ [bit]}$$

Entropy

If the events in the event space are not equally likely, then the set of messages can be well characterized by the average information content of the messages.

The average information content of the set of messages is called the *entropy* of the message set.

$$H_E = \sum_{i=1}^n p_i \cdot I_{E_i} = \sum_{i=1}^n p_i \cdot \log_2 \frac{1}{p_i} = - \sum_{i=1}^n p_i \cdot \log_2 p_i$$

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