

- Claude Shannon Information Theory
- Transmit message from sender to recipient reliably

Bit = 0 or 1

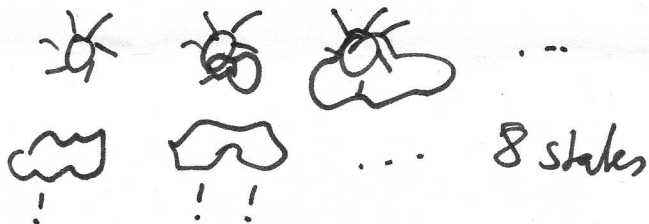


Uncertainty reduction by a factor of two when the info gets transmitted

$$\frac{1}{p} = \frac{1}{0.5} = 2$$

1 Bit of information, $\log_2(2)$

$$\log_2(1/0.5) = \log_2(1) - \log_2(0.5)$$



$$2^3 = 8$$

$$\log_2(8) = 3 \text{ Bit}$$



$$- \log_2(0.25) = 2 \text{ Bit}$$

$$- \log_2(0.75) = 0.41 \text{ Bit}$$

Cross Entropy =
Entropy - KL Div

On average $0.25 \cdot 2 \text{ Bit} + 0.75 \cdot 0.41 \text{ Bit} = 0.81 \text{ Bit}$

Entropy: A measure how uncertain the events are
On avg.

$$H(p) = - \sum_i p_i \log_2(p_i)$$

$$\begin{array}{cccc} 35\% & 35\% & 10\% & 10\% \\ 4\% & 4\% & 1\% & 1\% \end{array} - 0.35 \log_2(0.35) + \dots \approx 2.31 \text{ Bit}$$