Information Theory

The Shannon Entropy H **measures how uncertain an uncertain event is:**

$$H[X] \equiv \sum_x -\Pr(x) \log_2 \Pr(x) \ .$$

Examples:

- A **Fair Coin**: (Probability of heads $= \frac{1}{2}$) has an unpredictability of 1.
- A **Biased Coin**: (Probability of heads $= 0.9$) has an unpredictability of 0.47.

Mutual Information

The **Mutual Information** of two random events X and Y is defined by:

$$I[X;Y] \equiv \text{Uncertainty of } X$$

$$- \text{Average Uncertainty of} X \text{ after } Y \text{ is Known} \ .$$