# 1b: Information Theory lecture 1

COMSM0075 Information Processing and Brain

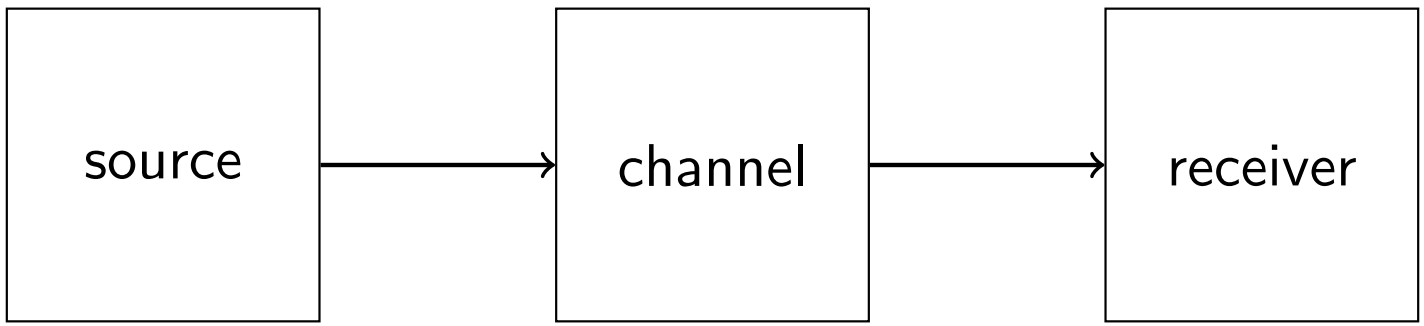
comsm0075.github.io

September 2020

# Information Theory

*The theory of information is a theory of communication.*

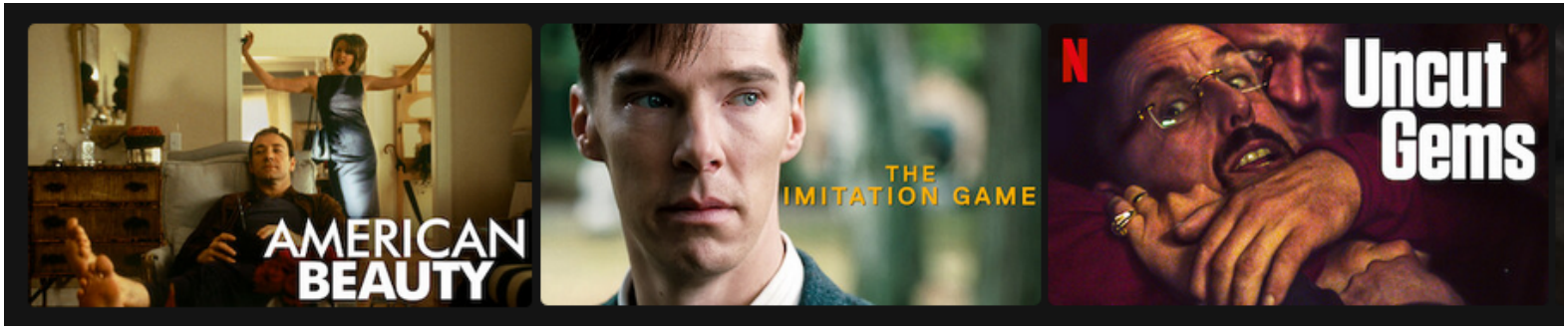
# a theory of communication



# we start by understanding randomness

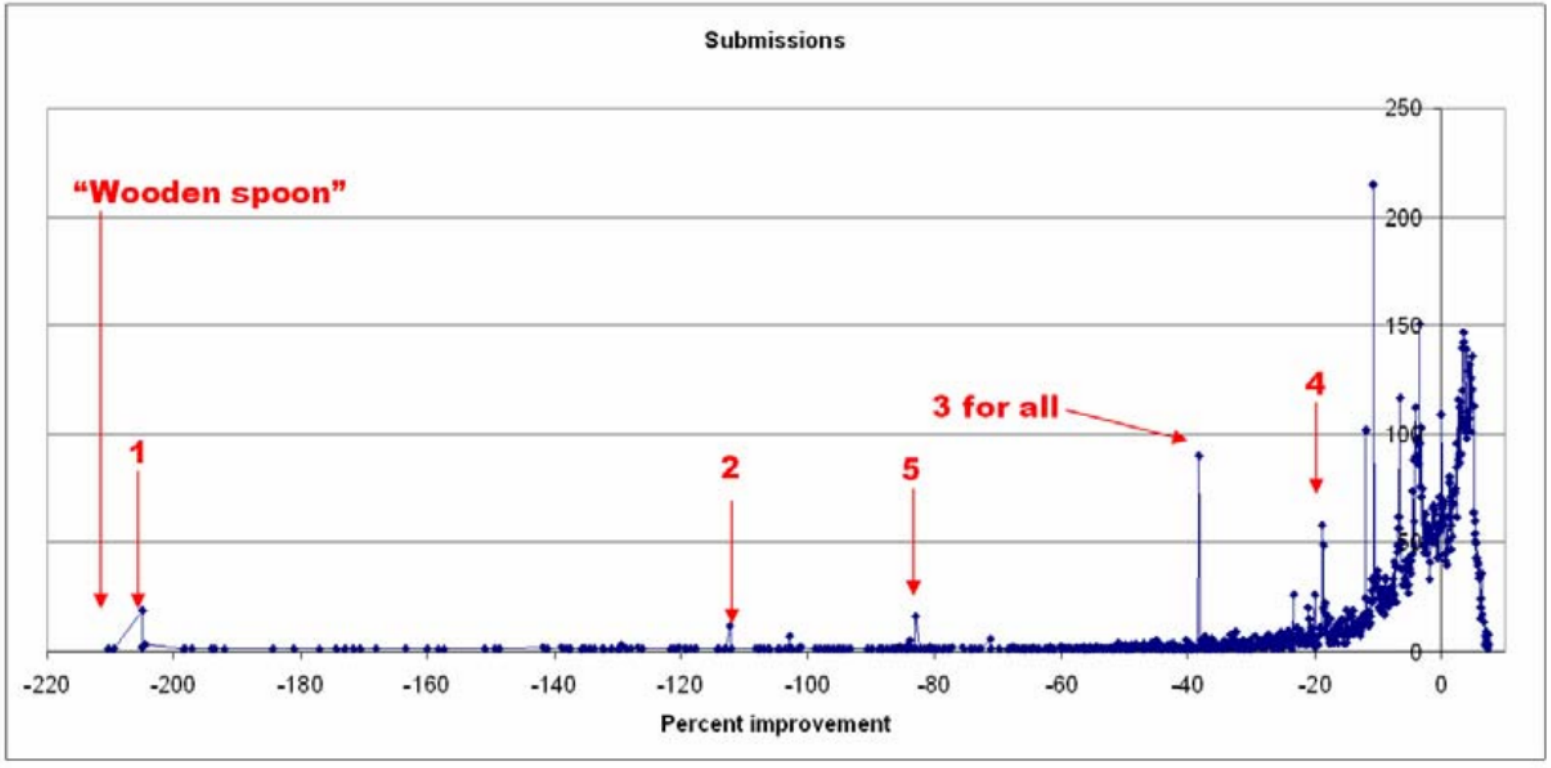

Image from wikipedia.

# film recommendations are bad



# film recommendations

# Netflix Prize



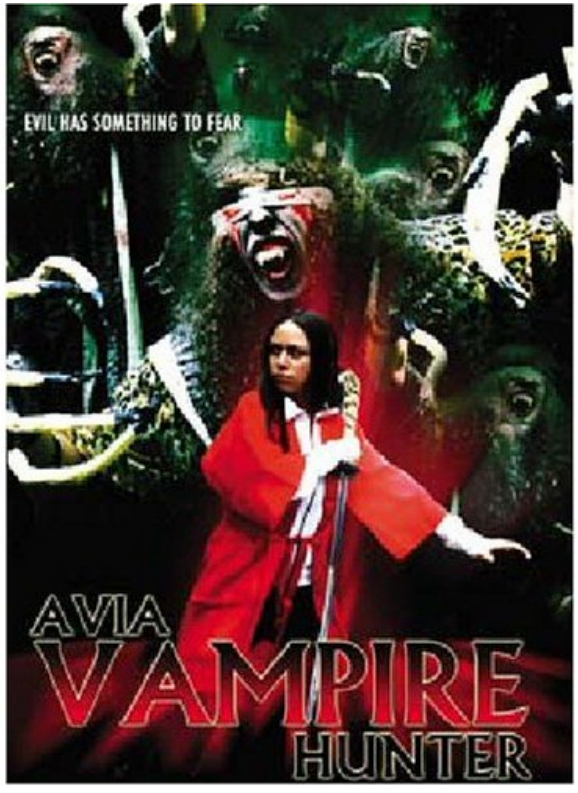

Bennett, James, and Stan Lanning. "The netflix prize." Proceedings of KDD cup and workshop. Vol. 2007. 2007.

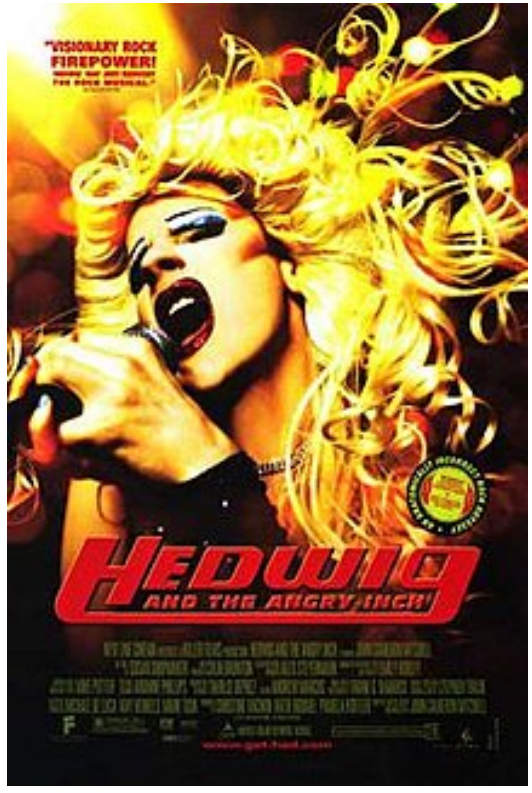
# Netflix Prize

# average star ratings

| | |
|---|---|
| 1 star | 0.016 |
| 2 star | 0.310 |
| 3 star | 0.627 |
| 4 star | 0.057 |

# the average star ratings mean something

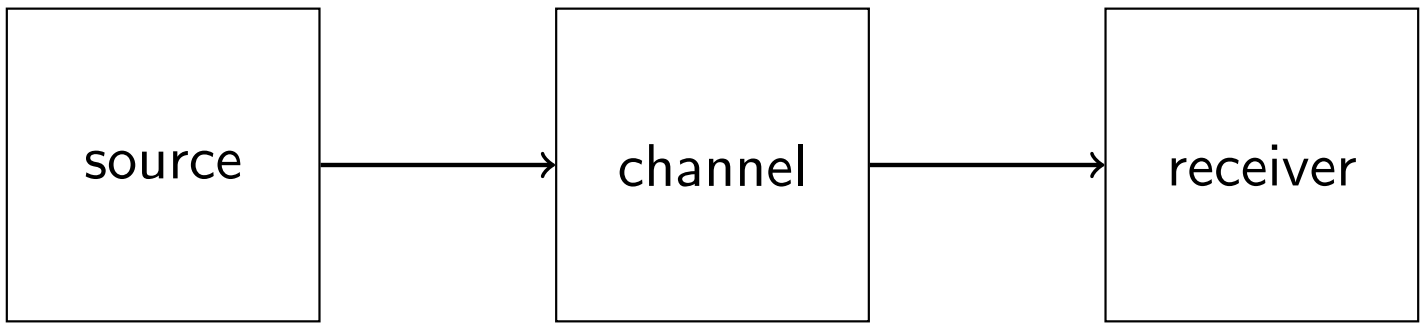


mostly though they tell you its an ‘ok’ filmm

| | |
|---|---|
| 1 star | 0.016 |
| 2 star | 0.310 |
| **3 star** | **0.627** |
| 4 star | 0.057 |

# a theory of communication



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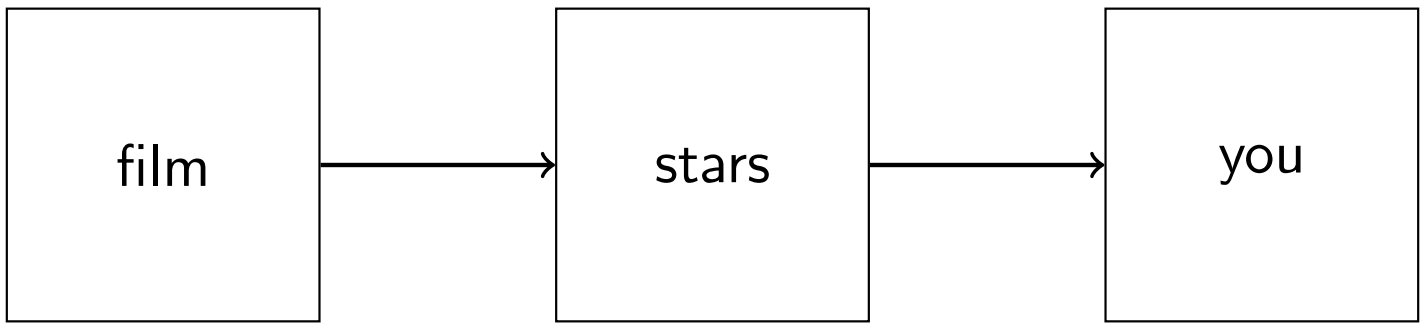
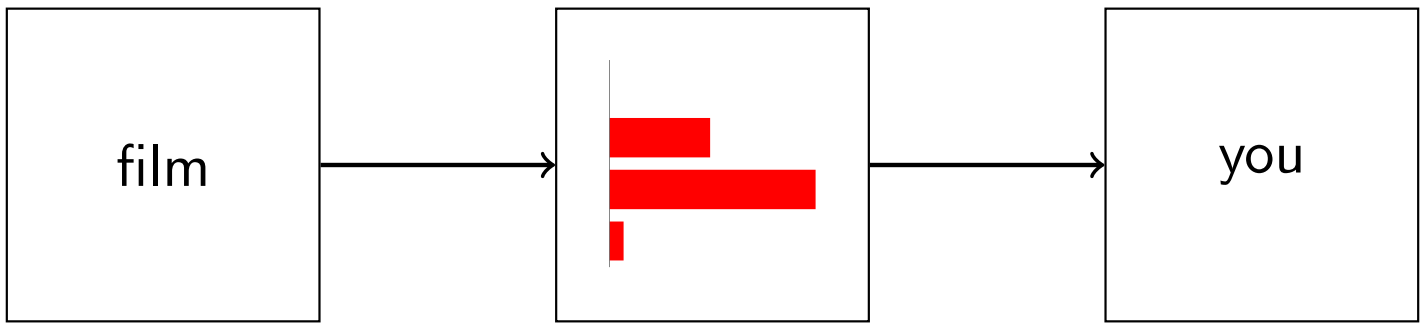
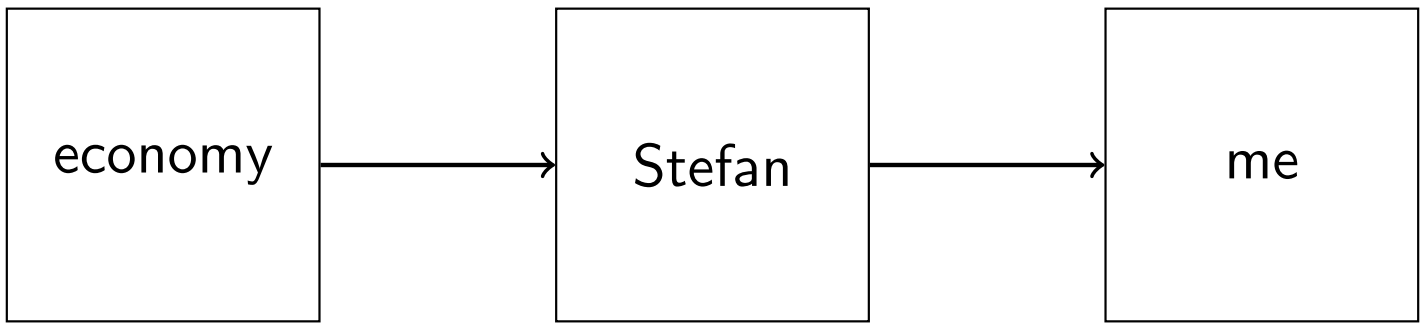


# a theory of communication



# the fable of Stefan

# a theory of communication



# a theory of communication

*The theory of information starts with an attempt to allow us to quantify the informativeness of information, but not its salience or validity.*

# Shannon's entropy

For a finite discrete distribution with random variable $X$, possible outcomes $\{x_1, x_2, \ldots x_n\} \in \mathcal{X}$ and a probability mass function $p_X$ giving probabilities $p_X(x_i)$, the entropy is

$$H(X) = -\sum_{x_i \in \mathcal{X}} p_X(x_i) \log_2 p_X(x_i)$$