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Essential of Information Theory

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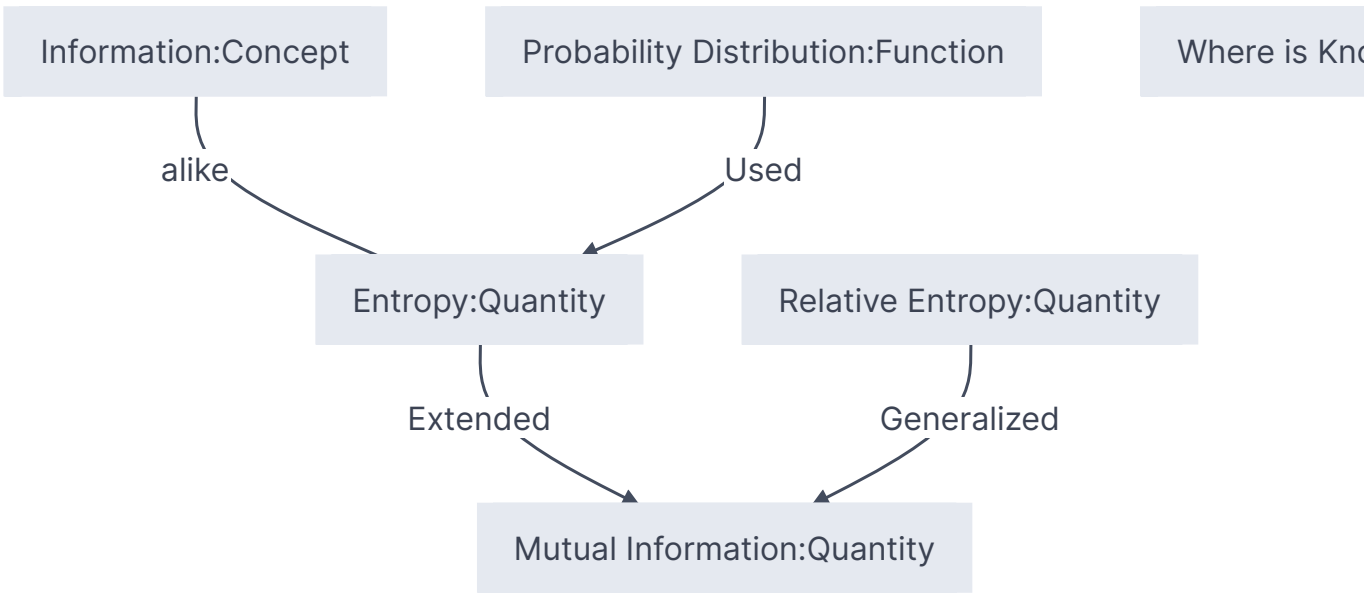
Тэги: #edu #infotheory #lec1

Agenda

- Conditional probability
- Bayes rule
- Information
- Mutual Information
- Entropy
- Relative Entropy
- Chain rule



Notation

- random variable (r.v.): X
- sample value of a random variable: x
- set of possible samples values x of the r.v. X : χ
- Probability mass function (PMF) of a a discrete r.v. X : $P_X(x)$

- Probability density function (pdf) of a continous r.v. : $p_X(x)$

Bayes rule

Let X is an event and Y is the hypothesis.
In such a manner,

- $P(X)$ is a prior probability of event X
- $P(Y)$ is prob that Y is true
- $P(X|Y)$ is prob of X under hypothesis Y
- $P(Y|X)$ is prob of Y if prove event X occur

Bayes rule

$$P(X,Y) = P(X|Y)P(Y) = P(Y|X)P(X)$$

Entropy

$$H(X) = -\sum_{x \in X} p(x) log(p(x))$$

Joint Entropy

$$H(Y,X) - \sum_{x \in X, y \in Y} p(y|x) log(p(y|x))$$

Conditional Entropy

$$H(Y|X) = -\sum_{x \in X, y \in Y} p(x,y) log(p(y|x))$$

Chain rule for Entropy of 2 r.v.

$$H(X,Y) = H(Y|X) + H(X)$$

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$$P(X,Y) = P(X|Y)P(Y)$$

Relative Entropy

$$D(p||q) = \sum_{x \in X} p(x) log \frac{p(x)}{q(x)}$$

Mutual Information

$$I(X,Y) = \sum_{x \in X, y \in Y} p(x,y) log \frac{p(x,y)}{p(x)p(y)} = D(p(x,y)||p(x)p(y))$$

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$$I(X,Y) = H(X) - H(X|Y)$$

against

$$H(X,Y) = H(Y|X) + H(X)$$

Examples of Project Topic

- Towards a Theory of Semantic Communication
- Seq2Sick: Evaluating the Robustness of Sequence-to-Sequence Models with Adversarial Examples
- Adversarial Attacks on Deep-learning Models in Natural Language Processing: A Survey
- Generating Textual Adversarial Examples for Deep Learning Models: A Survey
- PEGASUS: Pre-training with Extracted Gap-sentences for Abstractive Summarization
- A PRETRAINED UNSUPERVISED SUMMARIZATION MODEL WITH THEME MODELING AND DENOISING
- Sentence Piece
- Automatically constructing semantic link network on documents
- Summarization of Scientific Paper through Reinforcement Ranking on Semantic Link Network
- Faithful to the Original: Fact Aware Neural Abstractive Summarization
- BioLemmatizer: a lemmatization tool for morphological processing of biomedical text
- Using Pointwise Mutual Information to Identify Implicit Features in Customer Reviews
- Two Multivariate Generalizations of Pointwise Mutual Information
- Recognising Affect in Text using Pointwise-Mutual Information
- Improving Pointwise Mutual Information (PMI) by Incorporating Significant Co-occurrence

- Weighted Average Pointwise Mutual Information for Feature Selection in Text Categorization

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How to choose project topic?

- Scholar
- SciHub
- Connected Papers
