Artificial Intelligence

Lecture 23

Uncertainty

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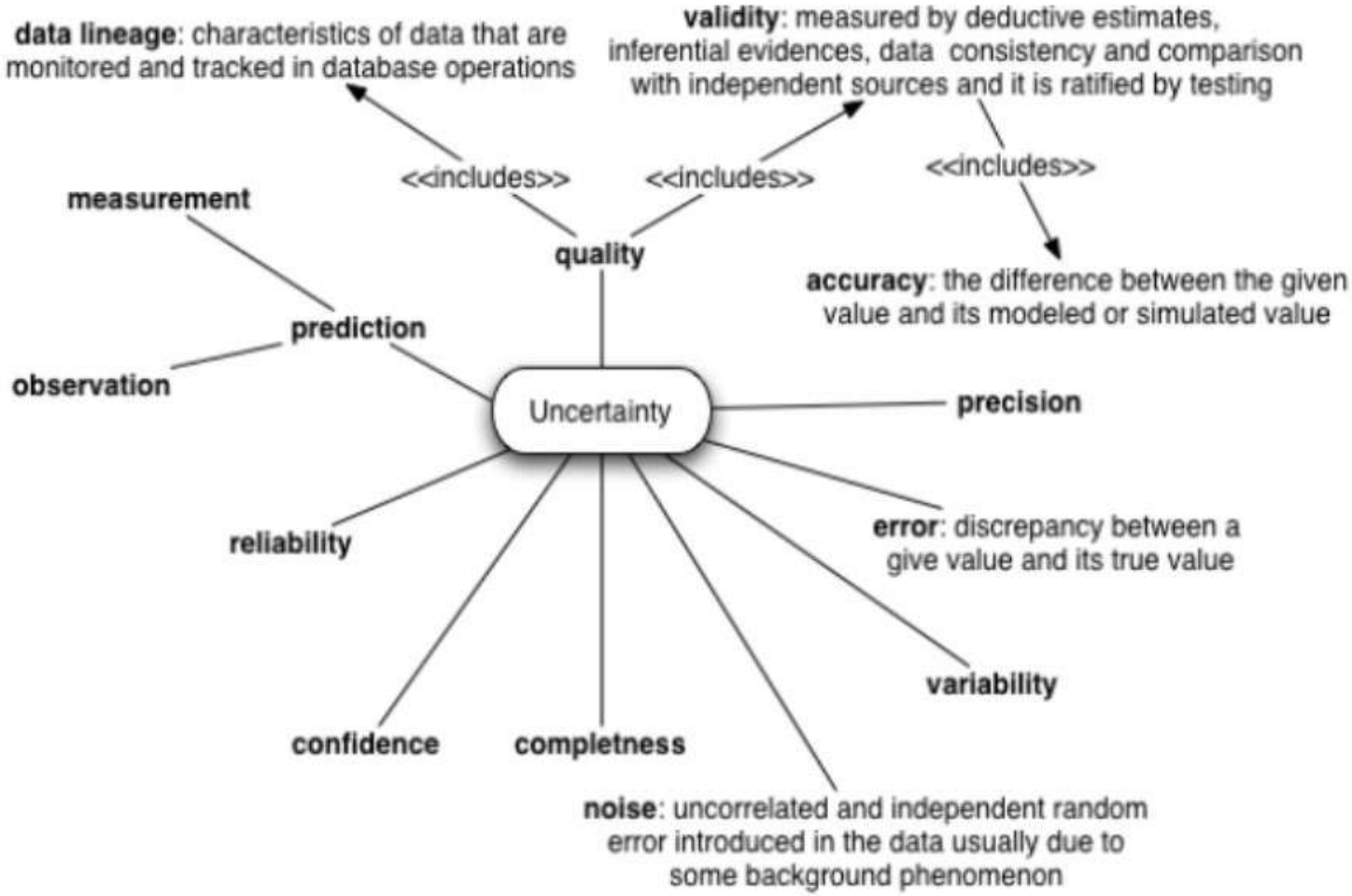
Outlines

- …
- Source of Uncertainty
- How to classify uncertainty?
- Making Decision: Uncertainty
- Uncertainty Analysis/Handling Techniques
- …

Uncertainty

- The world is not a well-defined place. There are many challenges that occur due to uncertainty.



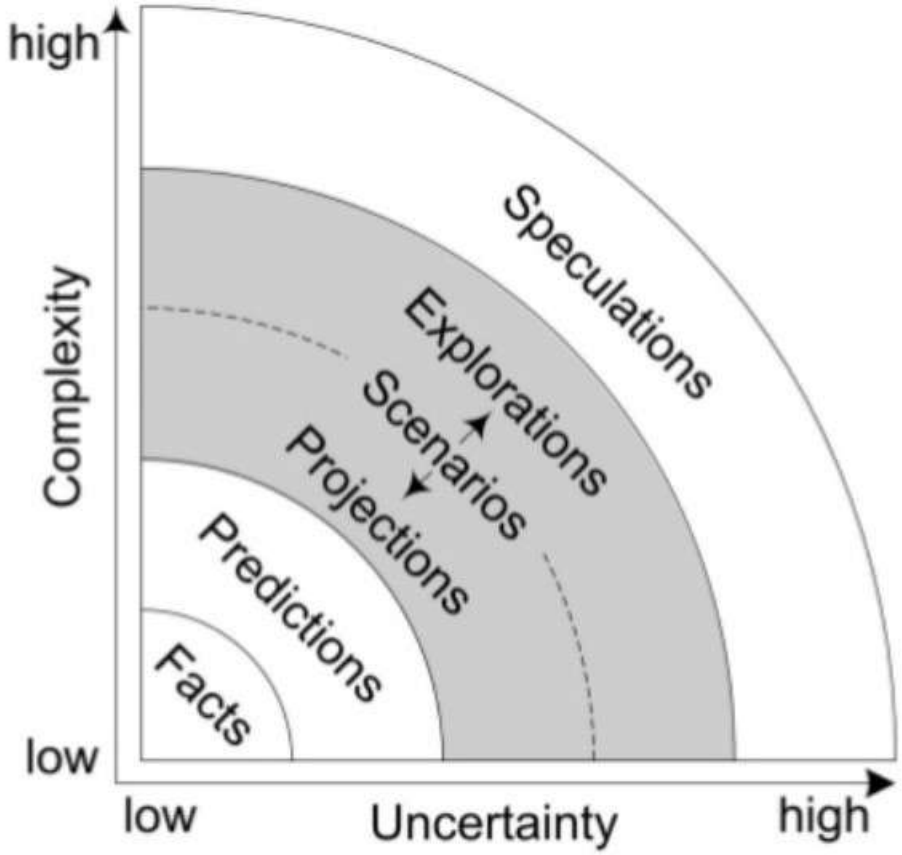
Source of Uncertainty

- **Uncertain data**
  - missing data, unreliable, ambiguous, imprecise representation, inconsistent, subjective, derived from defaults, noisy, etc.
- **Uncertain knowledge**
  - multiple causes lead to multiple effects
  - incomplete knowledge of causality in the domain
  - probabilistic/stochastic effects
- **Uncertain knowledge representation**
  - restricted model of the real system
  - limited expressiveness of the representation mechanism
- **Inference process**
  - derived result is formally correct, but wrong in the real world
  - new conclusions are not well-founded (e.g., inductive reasoning)
  - incomplete, default reasoning methods

How to classify uncertainty?

- The term **Uncertainty** covers a lot of concepts. It can be due to lack of knowledge or insufficient information, due to vagueness, no specificity and conflict in the information.
- It can be defined as a situation where the information available to the decision makers is imprecise to be summarized by a probabilistic measure.
- Uncertainty can be classified into four classes, namely:
  1) **Epistemic (Inter and Intra and models)**
  2) **Linguistic (Word Perception)**
  3) **Ambiguity (Word Perception)**
  4) **Variability (Stationary and Dynamic Situation)**

Making Decision: Uncertainty



Uncertainty Analysis/Handling

- Uncertainty analysis is a process that measures, recognizes, identifies and minimizes the all types of uncertainty in a risk estimates.
- The uncertainty analysis includes many statistical problems such as:
  - Uncertainty factor.
  - Decision making with uncertain information.
  - Estimation of uncertainty in complex models of risk.
  - Structural uncertainty and model specification.
  - Monitoring methods to reduce uncertainty.

Techniques to analysis/handle Uncertainty

- Various methods or techniques are available for analyzing or handling uncertainty.
- Some of the uncertainty analysis techniques are:
  - Probabilistic Analysis
  - Fuzzy Analysis
  - Bayesian Analysis
  - Soft Computing Techniques, including: Data Mining, Signal Processing, Pattern Recognition, Neural Networks, Hidden Markov Models, etc.

Uncertainty

TO BE CONTINUED…