Module 7

Reasoning Systems and Logic

- ▼ What is a reasoning system?

  any type of system that uses logical rules to organize information and make decisions, usually classification decisions

- ▼ Most reasoning systems use what kind of logic?

  propositional or predicate logic, such as First Order Logic (FOL)

- ▼ What is deductive reasoning?

  - Top-down reasoning, is a form of propositional logic that uses known information to deduce new facts.
  - Starting from the general and using rules to filter facts down to the specifics, the accuracy of the output depends on the accuracy of the premises used to build the rules and assumptions.

- ▼ What is inductive reasoning?

  - Bottom-up reasoning
  - In other words, specific but limited facts are used to draw generalizations.
  - However, unlike in deductive reasoning, the truth of the original premises does not guarantee the truth of the output.

- ▼ What is abductive reasoning?

  it tries to find "most likely" or "best answer" type outputs using more basic and generalized rulesets rather than known expert information

▼ What is first-order logic (FOL)?

- any of a variety of formalized logic systems in a range of fields from computer science, mathematics, philosophy, and linguistics
- deductive systems that use FOL can be both sound and complete
- FOL is also called predicate logic because it uses predicates or functions as arguments, in the form of axioms

▼ What is a constraint satisfaction problem (CSP)?

- a mathematical problem whose end state is required to satisfy limitations, or constraints
- these problems are of high complexity and require powerful heuristics or other ML methods
- **python-constraint** is a module commonly used for constraint programming in Python

▼ What are theorem provers?

- automated deduction systems that formalize mathematical rules in order to prove theorems or verify existing ones, replacing long manual proofs
- **PyLogic** is a a theorem prover in Python

▼ What are logic programs?

- Logic programs directly represent constructs built from mathematical logic.
- **Prolog** is an example of a logical programming language. prolog is a declarative language built using FOL predicate logic, and is built in the form of a rule engine, where queries are passed over a set of rules.
- **Kanren** is an example of logic programming in Python.
- **PyKnow** is a time-tested rules engine in Python.
- **PyKe** is a logical programming framework in Python based on Prolog.

▼ What are deductive classifiers?

- They use what is known as a frame language to organize categories of objects into classes, subclasses, and relations among them.
- They use formalized semantics based on FOL
- e.g. **Naive-Bayes Classifier**

▼ What are case-based reasoning (CBR) methods?

- They offer problem-solving approaches by identifying parallels to other problems that established approaches already exist for.
- Using case histories, these systems utilize analogy rules to parse previous cases to identify previously successful solutions.

▼ What do procedural reasoning (PBR) systems offer?

structured procedures for each logical operation to ensure consistency based on predefined parameters

▼ What is fuzzy logic?

it considers truth to be a real number value between 0 and 1