



# ARTIFICIAL INTELLIGENCE

REASONING

# GOAL FOR TODAY

- Quality of the work to be submitted
- How will this online course look like?
- Knowledge representation
- Reasoning
- Propositional logic

# COURSE DESCRIPTION

**One-hour synchronous communication, readings, discussions, and evaluation**

**Lesson 1.** Introduction

**Lesson 2.** Knowledge representation; Reasoning; Propositional Logic

**Lesson 3.** Predicate Logic

**Lessons 4-5** Search Strategies; Prolog (I and II)

**Lesson 6.** Expert Systems

**Lesson 7.** Natural Language Processing

**Lesson 8-9.** Learning; Machine Learning; Python; Deep Learning (I and II)

**Lesson 10.** Catch-up; Presentations

- Regular readings and discussions in Slack (10%)
  - Individual
- Homeworks (30%)
  - Course notes
  - Exercises – Propositional logic / Predicate logic / Prolog / Grammars
  - To be provided in a shareable file
  - Individual
- (Directed) Labs and project (Python) (40%)
  - Deep learning example
    - To be explained in a 2-minute video
    - Individual
  - Project
    - To be presented (5 minutes per team)
    - Team of 2-3 students
- Exam (20%)
  - Quiz (only)

Tentative ! Done by June 19nd



# LESSON II – REASONING



# WHAT IS REASONING?

- Reasoning is the ability to draw new conclusions from knowledge we have or infer something new about a domain of interest
- Types of reasoning
  - Induction – Generalize from seen cases to unseen cases
  - Abduction – Reasoning back to events or situations; best guess given the available evidence
  - Deduction – Logic reasoning; deduction by contradiction
- Think about the reasoning you use everyday and provide examples
- We need to be able to reason with uncertainty as knowledge is often incomplete

# MORE CLASSIFICATION OF REASONING

- Forward reasoning – start with facts and move to the goal
- Backward reasoning – setup the goal and move back to subgoals that needs to be solved (Prolog)
- Reasoning by analogy – compare a problem with an existing one and look at the similarities
- Case-based reasoning – compare with existing database of cases encountered
- Reasoning with certainty is called monotonic reasoning
- We need however to be able to reason with uncertainty – knowledge may come with changes, incomplete and inconsistent
- Reasoning with uncertainty
  - Non-monotonic reasoning – new knowledge can delete or alter the existing language; abduction is an example of non-monotonic reasoning
  - Probabilistic reasoning – required to deal with incomplete data; likelihood of situations