

# Knowledge Representation & Processing

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**Practical Information**

# Mark your attendance with PedagogySquare (PS)

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## 课程邀请码

教学立方公众号二维码



课程邀请码: **DS295UH8**

# Aims of the Course

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## In general

- ▶ The course provide students with a theoretical and practical understanding of cutting edge solutions for Knowledge Representation and Processing.

## In particular

- ▶ It introduces students to the W3C standard Web Ontology Language (OWL), its underlying Description Logics (DLs), and several reasoning algorithms over DLs.
- ▶ It provides students with experience using a set of established patterns for developing OWL ontologies and help them to learn to avoid the major pitfalls in using OWL.
- ▶ It gives students an opportunity to become familiar with a widely used environment for developing and an API for applying OWL ontologies, and making use of reasoning services accessible via both.

# Organizational

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## This course is taught by:

- ▶ **Yizheng Zhao** (zhaoyz@nju.edu.cn)
- ▶ Teaching Assistants (SYF Bld. A504):
  - Zhao Liu** (liuzhao4420@smail.nju.edu.com)
  - Xuan Wu** (wuxuan@smail.nju.edu.cn)
  - Shuni Xu** (mg20370050@smail.nju.edu.cn)
  - Xinhao Zhu** (zhuxinhao@gmail.com)

## Prerequisites: some familiarity with

- ▶ Mathematical logics (esp. first-order logics)
- ▶ Programming with Java

## Teaching mode:

- ▶ lectures (online via Bilibili this week; onsite at YI-B 105 afterwards)

## Teaching period:

- ▶ Monday 5-6 Sessions of Week 1-16, unless otherwise notified

# Organizational

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## Assessment:

- ▶ Assignment (50%)
- ▶ Examination (50%)

## Assignments released via PS

- ▶ Right after the lecture

## Solutions submitted via PS

- ▶ Due 3 weeks after assignment distribution, e.g., 1st due on 29th March at 14:00
- ▶ Late submission: capped at 60%, unless you have mitigating circumstances
- ▶ Always retain a copy of your work elsewhere!

## Marks & feedback released via PS:

- ▶ 10 marks per assignment

# Assignments

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## **Small, short questions, often multiple choices:**

- ▶ to ensure you grasp the basic concepts of KR&P

## **Modelling tasks**

- ▶ to build an ontology from given source data
- ▶ to get your hands dirty
- ▶ to appreciate the numerous ways in which things can be done

## **Short essays of 200 - 300 words:**

- ▶ about an average blog post
- ▶ to make you think & practice academic writing

## **Programming tasks:**

- ▶ require an entry level of Java programming
- ▶ directed step by step by TAs and myself

# Examination

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Two hours

EXAM PAPER MUST NOT BE REMOVED FROM THE EXAM ROOM

**NANJING UNIVERSITY  
SCHOOL OF ARTIFICIAL INTELLIGENCE**

Knowledge Representation & Processing

Date: Tuesday 23rd June 2020

Time: 14:00 - 16:00

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**This is an online examination. Please answer ALL Questions**  
**The exam contains MULTIPLE CHOICE, TRUE/FALSE and SHORT ESSAY QUESTIONS.**  
**Be sure to answer ALL Questions**

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This is a CLOSED book examination

The use of electronic calculators is NOT permitted

2. Consider the following ontology, which is used in an earlier question

```
ObjectProperty: hasColour
Characteristics: functional
ObjectProperty: eats
Class: Grey
Class: White
DisjointClasses: Grey, White
Class: Animal
SubClassOf: eats some Thing
Class: Seal
SubClassOf: Animal
Class: Shark
SubClassOf: Animal
Class: GreyShark
EquivalentTo: Shark and (hasColour some Grey)
Class: WhiteShark
EquivalentTo: Shark and (hasColour some White)
SubClassOf: eats only Seal
Individual: Jaws
Types: Shark,
hasColour some (Grey or White)
```

For each of the Competency Questions below, consider whether the ontology is able to answer the question. If so, show how this can be done. If not, provide a brief discussion as to why not, and how you might extend or edit the ontology to address the problem.

- What kinds of animals are there?
- Are sharks dangerous?
- What colours can animals be?

(8 marks)

# Expectations

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## After studying this course, you should be able to:

- ▶ discuss/explain the role of ontology languages in applications, in particular OWL
- ▶ understand the syntax and semantics of OWL, and the decision procedures that underpin the use of reasoning
- ▶ create an ontology for a particular domain to enhance an application
- ▶ understand how and which applications can be enhanced through the use of an ontology
- ▶ apply patterns in the design of ontologies
- ▶ design/build ontologies in OWL using the de facto standard editor, Protege, justify/evaluate their design and explain their behaviour



# Roadmap

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## Week 1 - 2

- ▶ Motivation; Intro to KR; Practical introduction to OWL and Protégé

## Week 3 - 5

- ▶ Knowledge Acquisition; Formalizing Definitions. Formal Semantics.

## Week 6 - 8

- ▶ Patterns; Modeling using roles; Reasoning.

## Week 9 - 11

- ▶ Programmatic manipulation of ontologies with the OWL API.

## Week 12 - 14 (labs)

- ▶ Case studies; Linked Data.

## Week 15 - 16

- ▶ Revision of the above

# Protégé

Downloadable at <https://protege.stanford.edu/>

The screenshot displays the Protégé ontology editor interface. The top bar shows the active ontology: 'bad-chromosome (http://purl.obolibrary.org/obo/owl-tutorial/bad-chromosome.owl)'. The left pane shows the 'Class hierarchy: chromosome' with a tree structure. The 'chromosome' class is highlighted in purple. The right pane shows the 'Annotations: chromosome' tab, which includes a list of annotations such as 'rdfs:label', 'id', 'has\_obo\_namespace', and 'definition'. The 'Definition' tab is also visible, showing a logical definition for 'chromosome' as a disjunction of several conditions. A red circle highlights the 'Disjoint With' button in the bottom right corner of the interface.

Active Ontology: bad-chromosome (http://purl.obolibrary.org/obo/owl-tutorial/bad-chromosome.owl)

Class hierarchy: chromosome

- owl:Thing
  - cellular\_component
    - cell
      - 'cell part'
      - 'cytoplasmic part'
      - 'intracellular part'
      - cytoplasm
        - 'cytoplasmic part'
        - 'mitochondrial part'
          - chromosome
          - mitochondrion
        - 'intracellular organelle part'
      - 'membrane part'
      - 'mitochondrial part'
        - chromosome
      - 'nuclear part'
        - chromosome
      - organelle
        - 'organelle part'
      - 'plasma membrane part'

Annotations: chromosome

- rdfs:label [type: xsd:string] chromosome
- id [type: xsd:string] GO:0005694
- has\_obo\_namespace [type: xsd:string] cellular\_component
- definition [type: xsd:string] A structure composed of a very long molecule of DNA and associated proteins (e.g. histones) that carries hereditary information.
- database\_cross\_reference [type: xsd:string] ISBN:0198547684

Description: chromosome

- cellular\_component and (part\_of some mitochondrion)
- part\_of some nucleus
- cellular\_component and (part\_of some nucleus)
- part\_of some cell
- cellular\_component and (part\_of some cell)

Instances: +

Target for Key: +

Disjoint With: +

Disjoint Union Of: +

Reasoner active ☒ Show Inferences