



# Knowledge Representation & Processing

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**Yizheng Zhao**  
**School of Artificial Intelligence, NJU**

# Please mark your attendance with PedagogySquare

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## 课程邀请码

“教学立方”公众号二维码



课程邀请码: 504066

# I expect myself to show up like this

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**Hmm...this is the reality:**

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# 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, and its underlying Description Logics.
- ▶ 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 (TAs):  
    **Meng Cao** (njucaomeng@163.com)  
    **Yuxuan Huang** (huangyx@lamda.nju.edu.cn)

## Prerequisites: some familiarity with

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

## Teaching modes:

- ▶ lectures (online via Bilibili; onsite in Xian-I 207)
- ▶ labs (TBD, very likely in Xian-I 207)

## Teaching period:

- ▶ Tuesday afternoon of the next 17 weeks

# Organizational

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## **Assessment:**

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

## **Assignment distributed via QQ (tentatively)**

- ▶ Right after the lecture

## **Solution submitted via QQ (tentatively):**

- ▶ Due 3 weeks after each lecture, e.g., 3rd March at 14:00
- ▶ Late submission: capped at 60%, unless you have mitigating circumstances
- ▶ Always retain a copy of your work elsewhere!

## **Marks & feedback distributed via QQ (tentatively):**

- ▶ 100 marks per assignment

# Assignment

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## **A number of small, short questions, often multiple choice:**

- ▶ to ensure you grasp the basic concepts

## **A modeling task** (build an ontology from source data)

- ▶ to get your hands dirty
- ▶ to appreciate the numerous ways in which things can be done

## **A short essay of 200 - 300 words:**

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

## **A programming task:**

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



# 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 and SKOS
- ▶ explain 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 - 3

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

## Week 4 - 6

- ▶ Knowledge Acquisition; Formalizing Definitions. Formal Semantics.

## Week 7 - 9

- ▶ Patterns; Modeling using roles; Reasoning.

## Week 10 - 12 (labs)

- ▶ Programmatic manipulation of ontologies with the OWL API.

## Week 13 - 15 (labs)

- ▶ Case studies; SKOS; Linked Data.

## Week 16 - 17

- ▶ Revision of the above

# Protégé

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

The screenshot displays the Protégé ontology editor interface for the 'bad-chromosome' ontology. The top navigation bar shows the ontology's URI: <http://purl.obolibrary.org/obo/owl-tutorial/bad-chromosome.owl>. The left pane shows the 'Class hierarchy: chromosome' tree, with 'chromosome' highlighted under 'nuclear part'. The right pane shows the 'Class Annotations: chromosome' tab, displaying various annotations such as 'rdfs:label', 'id', 'has\_obo\_namespace', and 'definition'. The 'Description: chromosome' tab below it shows logical definitions using 'part\_of' and 'some' constructs. At the bottom of the right pane, the 'Disjoint With' button is circled in red. The bottom status bar indicates 'Reasoner active' and 'Show Inferences' is checked.