

## Natural Language Interaction

## TA Language Technology

University of Lisbon

Faculty of Sciences, Department of Informatics

2024/2025

ILN: Master in Computer Science, Master in Computer Engineering,  
Master in Data Science, Master in Computer Security

TA/TL: PhD/MSc in Cognitive Science

### Goals

Acquire core concepts and methods for computational modeling of knowledge, with a focus on linguistic knowledge. Acquire introductory but effective experience in knowledge modeling and, through this focus, in computational processing of natural language.

Introduction to the applications of computational modeling of natural language.

Understand its contextualization within the scope of Artificial Intelligence (AI) and Cognitive Science as well as its relevance to the epistemological foundations of the latter.

### Topics

Knowledge representation based on inference. Syntactic analysis and parsing. Semantic representation and logical form.

Applications. Language models. Vector representation of knowledge, distributional semantics and word embeddings. Neural networks, deep learning and Transformers. Applications. AI, Cognition and open challenges.

## Bibliography

### Manuals

Jurafsky and Martin, 2025, *Speech and Language Processing*, Prentice Hall.

[https://web.stanford.edu/~jurafsky/slp3/ed3book\\_Jan25.pdf](https://web.stanford.edu/~jurafsky/slp3/ed3book_Jan25.pdf)

Tunstall, Werra and Wolf, 2022, *Natural Language Processing with Transformers: Building Language Applications with Hugging Face*, O'Reilly.

Goldberg, 2017, *Neural Network Methods for Natural Language Processing*, Morgan & Claypool Publishers.

Blackburn e Bos, 2006, *Learn Prolog Now!*, College Publications. <http://www.learnprolognow.org/>

Covington, 1994, *Natural Language Processing for Prolog Programmers*, Prentice-Hall.

### Remaining bibliography

Raschka, 2025, *Building LLMS from Scratch*, Manning.

Paass and Giesselbach, 2023, *Foundation Models for Natural Language Processing*, Springer and arXiv:2302.08575v1

Mitkov, 2022, *The Oxford Handbook of Computational Linguistics*.

Manning and Schuetze, 1999, *Foundations of Statistical Natural Language Processing*, MIT Press.

Branco, António, João Rodrigues, Małgorzata Salawa, Ruben Branco, Chakaveh Saedi, 2020, "Comparative Probing of Lexical Semantics Theories for Cognitive Plausibility and Technological Usefulness", In Proceedings, 28th International Conference on Computational Linguistics (COLING2020), International Committee on Computational Linguistics (ICCL), pp.4004-4019.

Branco, António, 2018, "Computational Complexity of Natural Languages: A Reasoned Overview", In Proceedings, The 27th International Conference on Computational Linguistics (COLING2018), Workshop on Linguistic Complexity and Natural Language Processing (LC&NLP2018), pp.10-19..

Newell, 1973, "You Can't Play 20 Questions with Nature and Win", In Chase (ed.) *Visual Information Processing*, Academic Press.

## Software

SWI Prolog Interpreter:

<http://www.swi-prolog.org/>

<https://swish.swi-prolog.org/>

## Slides

**The slides are NOT study aids or elements for students.** The slides ARE only teaching aids to guide the presentation and discussion of the subjects in class.

Due to their purpose, the slides are fragmentary, synoptic and incomplete notes on the subjects presented and discussed in class. They do not approximate, equal or even replace the study elements contained in the bibliography, nor do they intend to do so.

Therefore, slides should not be used by students as study aids, and even less as aids to prepare for assessments.

However, copies of the slides used by teachers each week are made available on the eLearning Platform in the corresponding summary due to the very insistent request from students.

In these summaries, for the subjects covered each week, the elements of the bibliography that correspond to them are indicated and these are the ones that should be used by students as study elements and preparation for assessment.

## Prerequisites

This subject does not have any other subject in the course syllabus as direct precedence.

It is aimed at students who will have their first contact with natural language processing through it. Assume that your students have no prior knowledge of these subjects.

## Workload

The workload to successfully complete this course is estimated at 6 ECTS-European Credit Transfer and Accumulation System credits, approximately **170 hours of work** by the student.

Of that time, about 50 hours, or about 30%, correspond to the time of participation in classes. The **remaining 120 hours (70%) are dedicated to independent work outside of classes**, including preparation and completion of assessment elements.

For guidance throughout the semester: on average **for 1 hour of class there should be 1 hour of independent study** of the subjects covered in that hour, leaving 70 hours for solving the project and preparing for the final exam and other assessment elements.

## Learning attitude

### Theoretical classes

Theoretical classes serve to frame and motivate the subjects, challenges and their solutions, clarifying their most complex aspects and emphasizing more subtle cognitive learning issues.

They prepare for an easier understanding of the material, but they are not an exhaustive presentation of the material: the material must be acquired through careful self-study outside of class.

### Practical and laboratory classes

Practical classes serve to support the acquisition and consolidation of knowledge through the resolution of exercises and problems, but they are not sufficient to master the subject to be learned: learning of the subject must be consolidated through the individual resolution of many other exercises and problems in independent study outside of classes.

They are used to solve exercises and typical problems, but they are not exhaustive presentations of all exercises or problems admissible in tests, exams or projects.

## Support instruments

### Theoretical classes

Theoretical classes are used to interactively understand with the teacher the subjects presented.

They should not be used only to take exhaustive notes and only later, outside of class, read them to try to understand the material taught.

Manuals and other bibliographic elements exist precisely to: (i) relieve students of this unnecessary manual task **and** free their attention for the presentation of the subject matter and interaction with the teacher; (ii) help with consolidation work after class.

For occasional small notes, you will only need a notebook, pencil and eraser.

### Laboratory classes

Laboratory classes are mainly used to consolidate the material presented in theoretical classes through the development of program fragments by students with the support of teachers.

For laboratory classes it is necessary:

- **statements of the problems** to be solved, available on the subject page on the eLearning platform;
- **computer** (more about this in class)

## Learning progression

The presentation of subjects in classes is organized to allow students to progressively advance in their learning.

**Articulation of independent work outside of classes with work in classes:** \_\_\_\_\_

In a given week S-1, the student studies independently outside of classes the topic that will be presented in theoretical classes in the following week S.

In this week S, the student advances in understanding this topic and clarifies doubts through their participation in classes.

#### Summaries on the course website:

To support these articulations, in a given week, the summary on the eLearning platform (i) records the topics that are covered in classes that week and (ii) announces the topic for the following week, to be worked on autonomously outside of classes until then.

### Smoke

Smoking in the classroom is not welcome or acceptable.

### Cell Phones & Ca

Being unnecessary, intrusive and harmful in this Curricular Unit for cognitive learning work in classes, both individually and jointly, **the use of data exchange devices during classes (theoretical or practical) is neither welcome nor acceptable**

**Before classes begin, they should be muted, stored away from the desk inside bags/backpacks, and will remain there from the beginning until the end of classes**

GAPSI-FCUL's Psychopedagogical Support Office provides free Clinical Psychology consultations for therapeutic support, including behavioral disorders and addiction problems, including so-called *screen addiction*.

<https://ciencias.ulisboa.pt/pt/gabinete-de-apoio-psicopedagógico>

### Privacy

In order to respect the privacy of those involved in the discipline's activities inside or outside the classroom, it is not permitted to capture, record or transmit sound and/or images during these activities, whether by the individual or by others, by any means and through any channel, without the express authorization of the discipline coordinator.

## Academic integrity

In the academic sphere, students caught committing fraud, including plagiarism (both plagiarists and plagiarists), in any test will have the test canceled and will be subject to disciplinary proceedings, which will result in a record of this incident in the student's academic record.

You don't want to have to show your diploma to a future employer with such an incident on record.

## Time

### **Theoretical and Laboratory Classes**

Thursday, 1:00pm-4:30pm, room 8.2.13

## Student-worker status

### **Law n.o 116/97, of 4 November**

<https://diariodarepublica.pt/dr/detalhe/lei/116-1997-675641>

## Teaching

### **Antonio White**

Cabinet 6.3.24

217500606

## Support and service

### **For specific learning topics**

Deal at the end of classes.

**For matters of general interest and mutual assistance between students**

Use the discipline's mutual help forum.

**For personalized individual pedagogical support and clarification of doubts**

Use the student service hours indicated below:

Antonio White

Cabinet 6.3.24

Wednesday, 2:00pm-3:00pm

**For other matters:**

Contact by phone:

217500606 (from outside FCUL)

26324 (from inside FCUL)

Please remember that, according to labor legislation, teachers are not available on weekends, holidays and vacations, and that on other working days, they are available to be contacted during regular daytime hours when they are not carrying out other professional duties.

## Pedagogical resources

**Website of this subject**

This subject has a website on the FCUL eLearning platform <http://moodle.fc.ul.pt>. This is the focal point for the circulation of information in the subject. This is where, for example, the current description of the subject, the assessment plan, project statements, etc. are made available.

**Exercises and problems**

*To be made available on the subject website.*



## Advertisements

Announcements to students as well as other communications by email will only be sent to the students' **institutional email accounts** , which were assigned to them at the time of enrollment.

## Evaluation plan

### Assessment components

#### 4 Short Exercises (A to D)

0.5 + 0.5 + 0.5 + 0.5 values

written and individual test

in person and without consultation

10 minutes at the end of the class

material not covered by the previous short exercises

single dates, no improvement

[dates below, in the dates section](#)

#### Test 1 2

points written

and individual test

in person and without consultation

1 hour in class

all the material so far

single date, no improvement

[date below, in the dates section](#)

#### Test 2 2

points

written and individual test

in person and without consultation

1 hour in class

subject matter not covered by the previous test

single date, no improvement

[date below, in the dates section](#)

#### Project: 4

values

*Part A:*

program for individual computational problem solving

non-face-to-face test

3/5 weeks

Master's Degree (3 weeks)

PhD (5 weeks)

[dates below, in the dates section](#)

*Part B:*

calibration test if applicable

written and individual test

in person and without consultation

on topics of problem solving by the program

single date, no improvement

[dates below, in the dates section](#)

*classification:*

the grade for this assessment component (part A and part B) is the result of the program classification (0-6 points) weighted by the classification (0-100%) and other information in the assessment test; zero points in the assessment test implies zero points in this component

Exam 10

points written

and individual test

in person and without consultation

2 calls during exam period all course

material

unique dates

[dates below, in the dates section](#)

**Approval conditions**

Sum of the scores of the assessment components  $\geq 10$

(exam + project + tests + exercises)

[Exam score  \$\geq 5\$](#)

Students may be called for an extra oral exam, if teachers so decide.

### **Conditions for improvement**

Students who took the exam in the 1st period can try to improve their result in the 2nd period. The highest score of the two is valid.

The special final exam is worth a maximum of the same amount of points as the maximum grade of the normal exam.

Any partial results obtained in previous years, whether by failed or approved students, will not be carried over to this year.

Students approved in previous years and registered to improve their grades are subject to the same assessment plan as for all students, with all assessment components listed above and their value, including the exam worth 10 points (on a scale of 0-20).

### **Exclusion conditions: integrity**

Students detected in a situation of fraud, including partial or total plagiarism, plagiarists and plagiarists, with or without intermediaries, will have their exam canceled and disciplinary proceedings will be initiated concomitant.

### **Approval conditions for Cognitive Science students: attendance**

Class participation and interaction with teachers and peers is crucial for learning and scientific maturity, and is reflected in the overall assessment. For Cognitive Science students, attendance is considered as defined on the "Portal" page of the eLearning platform.

### **Final classification**

The final classification results from the following calculation:

$$\text{notaFinal} = \text{Round}(\text{notaExercicios} + \text{notaTestes} + \text{notaProject} + \text{notaExame}, 0)$$

## Troubleshooting

### **Matters to be addressed by the Services Directorate**

Computer scientists

**Matters relating to passwords, access to the eLearning platform, etc., etc., etc., are dealt with EXCLUSIVELY in IT Services Department:**

Internal extension: 21248

External number: +351 217500067

Email: [suporte@ciencias.ulisboa.pt](mailto:suporte@ciencias.ulisboa.pt)

Web: <https://ciencias.ulisboa.pt/pt/unidade>

In-person counter: room 1.2.10

## Dates

<https://ciencias.ulisboa.pt/pt/calendario-escolar>

### **School term**

February 20, Thursday

May 29, Thursday

### **Vacation**

Carnival, Monday 3 March to Wednesday 5 March

Easter, Thu 17th April to Thu 24th April

### **Coinciding holidays**

May 1st, Thursday

### **Labs**

**NB: bring laptops**

### **Short exercises**

February 27, March 13, April 10, May 15, 4:15-4:30 pm (single dates, and no improvement)

### **Testes**

Test 1: March 27, 3:30-4:30 pm (single date, and no improvement)

Test 2: May 29, 3:30pm-4:30pm (single date, and no improvement)

### **Project**

May 9, Friday, announcement

*Master's degree:* May 30, Friday, 11:00 p.m. (Lisbon time), submission

*Doctorate:* June 13, Friday, 11:00 p.m. (Lisbon time), submission

Assessment test (single date, and without improvement) at the time of the exam if applicable.

### **Exams**

According to FCUL exam calendar for ILN