

SYLLABUS

1. Data about the program of study

1.1 Institution	The Technical University of Cluj-Napoca
1.2 Faculty	Faculty of Automation and Computer Science
1.3 Department	Computer Science
1.4 Field of study	Computer Science and Information Technology
1.5 Cycle of study	Master of Science
1.6 Program of study/Qualification	Data Science
1.7 Form of education	Full time
1.8 Subject code	16.1

2. Data about the subject

2.1 Subject name	Natural language processing				
2.2 Course responsible/lecturer	Prof. dr. eng. Lemnaru Camelia - Camelia.Lemnaru@cs.utcluj.ro				
2.3 Teachers in charge of seminars/ laboratory/project	Prof. dr. eng. Lemnaru Camelia - Camelia.Lemnaru@cs.utcluj.ro Assist. drd. eng. Vlad-Andrei Negru - Vlad.Negru@cs.utcluj.ro				
2.4 Year of study	II	2.5 Semester	1	2.6 Type of assessment (E - exam, C - colloquium, V – verification)	E
2.7 Subject category	DF – fundamentală, DD – în domeniu, DS – de specialitate, DC – complementară				DS
	DI – Impusă, DOp – opțională, DFac – facultativă				DI

3. Estimated total time

3.1 Number of hours per week	3	of which:	Course	2	Seminars	1	Laboratory	-	Project	-
3.2 Number of hours per semester	42	of which:	Course	28	Seminars	14	Laboratory	-	Project	-
3.3 Individual study:										
(a) Manual, lecture material and notes, bibliography										25
(b) Supplementary study in the library, online and in the field										25
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays										23
(d) Tutoring										5
(e) Exams and tests										5
(f) Other activities:										-
3.4 Total hours of individual study (suma (3.3(a)...3.3(f)))						83				
3.5 Total hours per semester (3.2+3.4)						125				
3.6 Number of credit points										

4. Pre-requisites (where appropriate)

4.1 Curriculum	Machine Learning 1
4.2 Competence	Linear algebra, programming, logics, basic statistics

5. Requirements (where appropriate)

5.1. For the course	white/black-board, projector, PC/laptop
5.2. For the applications	white/black-board, projector, PC/laptop

6. Specific competence

6.1 Professional competences	- Working with advanced mathematical methods and models, engineering and computing specific techniques and technologies. - Development of advanced techniques, methods and methodologies in the domains of software design, programming systems and
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	environments and their applications . 3. Innovative design of machine learning systems and related software and hardware using the specific tools. 4. Contextual integration and exploitation of dedicated information systems. 5. Creative pooling of multidisciplinary knowledge in the field of computers and information technology for research, design, optimization, implementation and testing of theories, algorithms and original methods specific to artificial intelligence and computer vision systems.
6.2 Cross competences	1. Proof of knowledge for the economic, ethical, legal and social context associated with the profession, for correct task identification, schedule of activities, responsible decisions, with the final goal the design, preparation and presentation of a scientific paper. 2. Clear and concise description of professional activity flows, tasks and outcomes obtained by assuming the role of leader / project manager or as a member of a research team, as result of personal skills of domain specific information synthesis, global vision, communication skills with collaborators, ability of task stages identification. 3. Exercising the skill of continuous self-education and demonstrating critical, innovative and research abilities

7. Discipline objective (as results from the *key competences gained*)

7.1 General objective	Understanding basic concepts in natural language processing, the main types of architectures for solutions and challenges associated
7.2 Specific objectives	Understanding and being able to develop and utilize the most important algorithms in NLP. Operate with known frameworks and software tools for NLP.

8. Contents

8.1 Contents			
8.1 Lectures	Hours	Teaching methods	Notes
Introduction to NLP	2	presentations, discussions	
Text preprocessing	2		
Word Vectors	2		
Feed Forward Neural Networks	2		
Recurrent Neural Networks 1	2		
Recurrent Neural Networks 2	2		
Attention Mechanism	2		
Transformer-based NLP models 1	2		
Transformer-based NLP models 2	2		
Pre-training Objectives	2		
Reinforcement Learning from Human Feedback	2		
Prompt-based methods	2		
Bias and Ethics for NLP	2		
Explainable AI	2		
Bibliography			
1. Speech and Language Processing (3rd ed. draft) Dan Jurafsky and James H. Martin			
2. Mihai Surdeanu, & Marco A. Valenzuela-Escárcega (2023). Deep Learning for Natural Language Processing: A Gentle Introduction. Cambridge University Press.			
3. All Stanford NLP tools: http://nlp.stanford.edu/software/index.shtml			
8.2 Applications – Seminars/Laboratory/Project	Hours	Teaching methods	Notes
Tokenization Methods	2		

Text Classification	2	Presentations, laptop/PC	
Part-of-speech tagging	2		
Cross-lingual transfer in encoder-based language models	2		
Machine Translation	2		
Question Answering	2		
Explainable AI	2		
Bibliography			
1. Speech and Language Processing (3rd ed. draft) Dan Jurafsky and James H. Martin			
2. Mihai Surdeanu, & Marco A. Valenzuela-Escárcega (2023). Deep Learning for Natural Language Processing: A Gentle Introduction. Cambridge University Press.			
3. All Stanford NLP tools: http://nlp.stanford.edu/software/index.shtml			

**Se vor preciza, după caz: tematica seminariilor, lucrările de laborator, tematica și etapele proiectului.*

9. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

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10. Evaluation

Activity type	Assessment criteria	Assessment methods	Weight in the final grade
Course	The ability to solve problems specific to the domain. Course participation and involvement.	Final evaluation	60%
Seminar	The ability to implement and evaluate specific solutions for the proposed problems	Bi-weekly seminar assessments, final assignment	40%
Laboratory	-	-	-
Project	-	-	-
Minimum standard of performance: Minimum final grade: 5			

Date of filling in: 26.02.2025	Responsible	Title First name Last name	Signature
	Course	Prof.dr.eng. Camelia LEMNARU	
	Applications	Prof.dr.eng. Camelia LEMNARU	
		Assist. drd. eng. Vlad-Andrei NEGRU	

Date of approval in the department	Head of department, Prof.dr.eng. Rodica Potolea
Date of approval in the Faculty Council	Dean, Prof.dr.eng. Vlad Mureșan