

## SYLLABUS

### 1. Information regarding the programme

1.1 Higher education institution	<b>Babeş-Bolyai University</b>
1.2 Faculty	<b>Faculty of Mathematics and Computer Science</b>
1.3 Department	<b>Department of Computer Science</b>
1.4 Field of study	<b>Computer Science</b>
1.5 Study cycle	<b>Bachelor</b>
1.6 Study programme / Qualification	<b>Computer Science/ Applied Computational Intelligence</b>

### 2. Information regarding the discipline

2.1 Name of the discipline	<b>Introduction to Natural Language Processing</b>						
2.2 Course coordinator	<b>Lecturer Ph.D. Lupea Mihaiela-Ana</b>						
2.3 Seminar coordinator	<b>Lecturer Ph.D. Lupea Mihaiela-Ana</b>						
2.4. Year of study	<b>3</b>	2.5 Semester	<b>2</b>	2.6. Type of evaluation	<b>C</b>	2.7 Type of discipline	<b>optional</b>

### 3. Total estimated time (hours/semester of didactic activities)

3.1 Hours per week	4	Of which: 3.2 course	2	3.3 seminar/laboratory	1 lab+1 pr
3.4 Total hours in the curriculum	48	Of which: 3.5 course	24	3.6 seminar/laboratory	24
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					30
Additional documentation (in libraries, on electronic platforms, field documentation)					20
Preparation for seminars/labs, homework, papers, portfolios and essays					30
Tutorship					10
Evaluations					10
Practical project					27
3.7 Total individual study hours	127				
3.8 Total hours per semester	175				
3.9 Number of ECTS credits	7				

### 4. Prerequisites (if necessary)

4.1. curriculum	Formal languages, Data structures, Graphs Algorithms
4.2. competencies	Programming skills in a high level programming language

### 5. Conditions (if necessary)

5.1. for the course	
5.2. for the seminar /lab activities	<ul style="list-style-type: none"> <li>Laboratory with computers; high level programming language environment (.NET or any Java environment a.s.o.)</li> </ul>

## 6. Specific competencies acquired

<b>Professional competencies</b>	<ul style="list-style-type: none"> <li>• Assimilation of mathematical concepts and formal models to understand, verify and validate software systems ;</li> <li>• Advanced ability to approach, model and solve phenomena and problems from natural language and economy using fundamental knowledge from mathematics and computer science;</li> <li>• Ability to approach and solve complex problems using various techniques of computational intelligence;</li> <li>• Proficient use of methodologies and tools specific to programming languages and software systems.</li> </ul>
<b>Transversal competencies</b>	<ul style="list-style-type: none"> <li>• Eitic and fair behavior, commitment to professional deontology</li> <li>• Team work capabilities; able to fulfill different roles</li> <li>• Professional communication skills; concise and precise description, both oral and written, of professional results , negotiation abilities;</li> <li>• Antepreneurial skills; working with economical knowledge; continuous learning</li> <li>• Good English communication skills</li> </ul>

## 7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	<ul style="list-style-type: none"> <li>• To introduce the basic principles, domains and tasks in Natural Language Processing (NLP)</li> <li>• To understand the current state of the art in order to realize an overview of a specific domain in NLP and to implement a NLP tool.</li> </ul>
7.2 Specific objective of the discipline	<ul style="list-style-type: none"> <li>• Apply and use formal models (logics, grammars, parsing), statistic models (HMM), artificial intelligence algorithms and techniques to solve different tasks at the syntactic level (POS-tagging, parsing, chunking), and semantic level (word sense disambiguation, document summarization, anaphora resolution) in Natural Language Processing domain.</li> </ul>

## 8. Content

8.1 Course	Teaching methods	Remarks
<b>Course 1.</b> Natural Language Processing (NLP): stages, domains, applications.	Exposure: description, explanation, examples, debate, dialogue	
<b>Course 2.</b> - WordNet and RoWordNet - knowledge structure, semantic relations, lexical relations. - WordNetSimilarity tool and similarity measures for words.	Exposure: description, explanation, examples, debate, dialogue	
<b>Course 3. Part of speech tagging.</b> - part-of-speech tagging in English. - part-of-speech tagging in Romanian	Exposure: description, explanation, examples, debate, dialogue	

<b>Course 4. Syntactic parsing</b> - grammar rules for English - sentence level construction; - Cocke-Kasami-Yonger (CKY) algorithm;	Exposure: description, explanation, examples, debate, dialogue	
<b>Course 5. Statistical parsing</b> - Probabilistic Context-Free Grammars (PCFG); - Probabilistic CKY (Cocke-Kasami-Yonger) parsing of PCFGs.	Exposure: description, explanation, examples, debate, dialogue	
<b>Course 6. Hidden Markov Model</b> - Markov chains, Hidden Markov Model(HMM); - three canonical problems associated with HMM - the forward algorithm; Viterbi algorithm.	Exposure: description, explanation, examples, debate, dialogue	
<b>Course 7. Word Sense Disambiguation</b> - dictionary and graph-based approaches.	Exposure: description, explanation, examples, debate, dialogue	
<b>Course 8. Document summarization</b> - approaches based on clustering, graphs.	Exposure: description, explanation, examples, debate, dialogue	
<b>Course 9. Anaphora resolution</b> - Lapin and Lease algorithm - Mitkov's algorithm	Exposure: description, explanation, examples, debate, dialogue	
<b>Course 10. Sentiment analysis</b> - opinion mining in social media - emotion analysis in literature	Exposure: description, explanation, examples, debate, dialogue	
<b>Course 11. Textual entailment</b>	Exposure: description, explanation, examples, debate, dialogue	
<b>Course 12.</b> <b>Students' presentations of the practical projects</b>	Debate, dialogue	

## Bibliography

1. J.ALLEN : Natural language understanding, Benjamin/Cummings Publisher, 2nd ed., 1995.
2. E. CHARNIAK: Statistical language learning, MIT press, 1996.
3. B.CARPENTER: ALE: The attribute logic engine. User's guide. Carnegie Mellon University,1994.
4. D.FEHRER et al: Description logics for natural language processing. In Proc. of the 1994 Description Logic Workshop (DL'94), 1994.
5. H. HELBIG: Knowledge Representation and the Semantics of Natural Language, Springer, 2006.
6. D.JURAFSKY, J.MARTIN: Speech and language processing, Prentice Hall, 2000.
7. C.MANNING, H.SCHUTZE: Foundation of statistical natural language processing, MIT, 1999.
8. R. MITKOV(ed): The Oxford Handbook of Computational Linguistics, Oxford University Press, 2003.
9. D.TATAR: Inteligența artificială: demonstrare automate de teoreme, prelucrarea limbajului natural, Editura Albastra, Microinformatica, 2001.
10. D. TATAR: Inteligența artificială. Aplicații în prelucrarea limbajului natural, Editura Albastra, Microinformatica, 2003, ISBN 973-650-100-01.

8.2 Seminar / laboratory	Teaching methods	Remarks
1. Working with WordNet, Romanian WordNet and WordNetSimilarity.	Explanation, dialogue, case studies	The seminar/lab is structured as 2 hours classes every second week
2. Working with dedicated parsers and taggers (Stanford, CST tools, Racai tools)	Explanation, dialogue, case studies	
3. Students' presentations of a NLP domain and a corresponding tool.	Dialogue, debate	
4. Students' presentations of a NLP domain and a corresponding tool.	Dialogue, debate	
5. Working with dedicated tools for summarization, anaphora resolution, sentiment analysis.	Explanation, dialogue, case studies	
6. Students' presentations of the practical projects.	Dialogue, debate	
<b>Bibliography</b>		
1. Rada Mihalcea: <a href="http://www.cs.unt.edu/~rada/downloads.html">www.cs.unt.edu/~rada/downloads.html</a>		
2. Resurse lingvistice in limba romana: <a href="http://www.racai.ro">www.racai.ro</a>		

### 9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

<ul style="list-style-type: none"> <li>• The course respects the IEEE and ACM Curricula Recommendations for Computer Science studies;</li> <li>• The course exists in the studying program of all major universities in Romania and abroad;</li> <li>• The optimization of the search on Web, the interfaces in natural language and the recent aspects of text mining need a good understanding of Natural Language Processing.</li> </ul>
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### 10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	- know to write an overview of a specific NLP task	Theoretical report – presentation of a NLP task.	35%
10.5 Seminar/lab activities	- be able to implement course algorithms	Practical project - implementation of a NLP tool.	35%
	- be able to apply theoretical concepts in practical tasks	Develop resources for Romanian NLP tasks	20%
10.6 Activity	- activity during courses and labs	Active attendance	10%
10.7 Minimum performance standards			
➤ The final grade to be at least 5 (from a scale of 1 to 10).			

Date

30.04.2022

Signature of course coordinator

Lect. Ph.D. Lupea Mihaiela

Signature of seminar coordinator

Lect. Ph.D. Lupea Mihaiela

Date of approval

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Signature of the head of department

Prof. Ph.D. Dioşan Laura