School of Computing and Information Sciences

Course Title: Natural Language Processing **Date:** September 22, 2015

Course Number: CAP-4993

Number of Credits: 3

Subject Area: Foundations	**Subject Area Coordinator:** Xudong He **email:** hex@cis.fiu.edu
Catalog Description: Topics will include the concepts, principles, and approaches of the computer processing of natural languages, including the relevant linguistics phenomena, formal methods, and end applications.	
Textbook: "Speech and Language Processing, 2nd Edition" by Daniel Jurafsky and James H. Martin, Pearson Prentice Hall, 2009 (ISBN-13: 978-0-13-187321-6).	
References: None	
Prerequisites Courses: COP3530 (Data Structures) or equivalent	
Corequisites Courses: None	

Type: Elective for the CS Major

Prerequisites Topics:

- Familiarity with basic techniques of algorithm analysis
- Familiarity with recursive methods
- Understand linked data structures (linked lists, binary trees)
- Understand advanced data structures (priority queues, disjoint set union/find)

Course Outcomes:

1. Explain key linguistic phenomena at the morphological, syntactic, semantic, and pragmatic levels of language.

2. Apply the formal approaches to representing these linguistic phenomena, such as formal models of grammar, HMMs, and frame semantics.

3. Explain the computational approaches to manipulating these formal representations, including rule-based and statistical classifier approaches.

4. Outline how existing techniques may be assembled to create end-to-end natural language applications such as question answering or machine translation systems.

School of Computing and Information Sciences
CAP-4XXX
Natural Language Processing

Relationship between Course Outcomes and Program Outcomes

BS in CS: Program Outcomes	Course Outcomes
a) Demonstrate proficiency in the foundation areas of Computer Science including mathematics, discrete structures, logic and the theory of algorithms	2,3
b) Demonstrate proficiency in various areas of Computer Science including data structures and algorithms, concepts of programming languages and computer systems.	2, 3, 4
c) Demonstrate proficiency in problem solving and application of software engineering techniques	1,4
d) Demonstrate mastery of at least one modern programming language and proficiency in at least one other.	
e) Demonstrate understanding of the social and ethical concerns of the practicing computer scientist.	
f) Demonstrate the ability to work cooperatively in teams.	
g) Demonstrate effective communication skills.	4

Assessment Plan for the Course & how Data in the Course are used to assess Program Outcomes

Student and Instructor Course Outcome Surveys are administered at the conclusion of each offering, and are evaluated as described in the School's Assessment Plan: http://www.cis.fiu.edu/programs/undergrad/cs/assessment/

School of Computing and Information Sciences
CAP-4XXX
Natural Language Processing

Outline

Topic	Lecture Hours	Outcome

• Linguistic Phenomena
  • Morphology
  • Parts of Speech
  • Syntax
  • Model-Theoretic Semantics
  • Lexical Semantics
  • Pragmatics
	10	1

• Formal Representations
  • Finite State Automata
  • Context-Free Grammars
  • First Order Logic
  • Frame Semantics
  • Other Structures
	10	2

• Formal Methods
  • Hidden Markov Models
  • Sequence Classification
  • Syntactic Parsing
  • Forward Algorithm, Viterbi Algorithm
  • Rule-Based Systems
  • Statistical Classifiers
	10	3

• End Applications
  • Question Answering
  • Machine Translation
  • Information Extraction
  • Conversational Agents
	6	4

Total	36	

School of Computing and Information Sciences
CAP-4XXX
Natural Language Processing

Course Outcomes Emphasized in Laboratory Projects / Assignments

Outcome	Number of Weeks
Homework problems addressing fundamental linguistic phenomena (Outcome 1)	3
Homework problems addressing formal representational issues (Outcome 2)	3
Homework problems addressing computational approaches to NLP (Outcome 3)	4
Homework problems addressing assembling end-to-end systems (Outcome 4)	2

Oral and Written Communication

No significant coverage

Written Reports		Oral Presentations	
Number Required	Approx. Number of pages	Number Required	Approx. Time for each
0	0	0	0

Social and Ethical Implications of Computing Topics

No significant coverage

Topic	Class time	Student Performance Measures

School of Computing and Information Sciences
CAP-4XXX
Natural Language Processing

Approximate Number of Credit Hours Devoted to Fundamental CS Topics

Fundamental CS Area	Core Hours	Advanced Hours
Algorithms	1	1
Software Design	0.5	-
Computer Organization and Architecture	-	-
Data Structures	0.5	-
Concepts of Programming Languages	-	-

Theoretical Contents

Topic	Class time
Natural Language Processing	12

Problem Analysis Experiences

None

Solution Design Experiences

None

School of Computing and Information Sciences
CAP-4XXX
Natural Language Processing

The Coverage of Knowledge Units within Computer Science Body of Knowledge[1]

Area	Topic	Type	Lecture Hours
AL	Basic Automata Computability & Complexity	Tier1	1
AL	Basic Automata Computability & Complexity	Tier2	1
AL	Advanced Automata Computability & Complexity	Elective	1
IS	Basic Knowledge Representation & Reasoning	Tier2	1
IS	Basic Machine Learning	Tier2	2
IS	Advanced Representation & Reasoning	Elective	1
IS	Reasoning Under Uncertainty	Elective	3
IS	Natural Language Processing	Elective	26
Total			**36**

[1]See Appendix A in *Computer Science Curricula 2013.* Final Report of the IEEE and ACM Joint Task Force on Computing Curricula, available at: http://www.acm.org/education/CS2013-final-report.pdf