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| --- | --- | --- | --- |
| **School of Computing and Information Sciences**   |  |  | | --- | --- | | **Course Title:** Natural Language Processing | **Date:** September 22, 2015 | | |
|  | |
| **Course Number:** CAP-4641  **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-4641**

**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-4641**

**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-4641**

**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-4641**

**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-4641**

**Natural Language Processing**

**The Coverage of Knowledge Units within Computer Science  
Body of Knowledge[[1]](#footnote-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> [↑](#footnote-ref-1)