

CSE6390 3.0 Special Topics in AI & Interactive Systems II  
 Introduction to Computational Linguistics  
 Instructor: Nick Cercone – 3050 CSEB – [nick@cse.yorku.ca](mailto:nick@cse.yorku.ca)  
 Tuesdays,Thursdays 10:00-11:30 – South Ross 104  
 Fall Semester, 2010

**CSE6390 Course Calendar (8 November 2010 update)**

#	Date	Title	Asgn's
<b>Part I: Computational Linguistics, Language, Natural Language Processing, Theory and Applications</b>			
1	14 Sept 10	<b>Course Introduction</b> Course information: overview of course; logistics and administrivia, textbook and other main references, evaluation scheme, academic honesty policy, tentative course schedule; resources  Introduction to computational linguistics and natural language processing (NLP); what is a natural language and other kinds of languages; challenges for language processing; what is Computational Linguistics; short history of CL/NLP; example applications  <a href="#">Handouts: course description; active reading; paper writing; resources; adjectives and adverbs; knowledge representation; assignment initial; assignment big; assignment big grading; course calendar</a>  <a href="#">Files: Lecture 1 notes (ppt).</a>	<b>A0 out</b>
2	16 Sept 10	<b>Introduction to CL &amp; NLP</b> Some reasons why NLP is hard; ambiguities at all levels of NLP, examples of ambiguities; domain knowledge is useful: to interpret questions, to answer questions, to model the user. Some philosophy of language – representation, interpretation of adjectives and adverbs.  <a href="#">Handouts: whatisCL?; semantic nets; updated course calendar</a>  <a href="#">Files: Lecture 2 notes (ppt).</a>	<b>A0 due</b>
3	21 Sept 10	<b>Introduction to CL &amp; NLP</b> Some example NLP applications: NL interfaces to databases (SystemX), NL interfaces to internet search engines (NLAISE & EMATISE), machine translation (GRMT).  <a href="#">Handouts: updated course calendar; word sense disambiguation; sketch of word sense disambiguation; Yarowsky algorithm; machine learning introduction; machine learning book</a>  <a href="#">Files: Lecture 3 notes (ppt).</a>	
<b>Part II: Linguistic Background - Unification-based approach to NLP</b>			
4	23 Sept 10	<b>Words and Morphology</b> Words, words, words; morphemes, stems, affixes, stemming, morphological processes: inflection, derivation, compounding, clitics; Parts-of-speech (POS), POS	

		<p>tagging, open and closed categories, corpus linguistics</p> <p>Handouts: Yawowsky paper; Synder &amp; Palmer paper;</p> <p>Files: <a href="#">Lecture 4 notes (ppt)</a>.</p>	
5	28 Sept 10	<p><b>Lexical Categories, Logic, Syntax, Grammar</b></p> <p>Explain handouts; Lexical categories; POS tagging examples; Logic and resolution principle theorem proving and its role in NLU; Syntax: phrase structure, phrases, clauses, sentences; parsing, parse tree examples; Context-Free Grammars (CFG); Are NLS context-free? review: examples, parse trees,</p> <p>Handouts: assignment small; assignment small grading; project suggestions; project grading; heuristics; lexical category; early syntax theory; logic and resolution; chapter 3 (parsing) and chapter 18 (annotated bibliography) of Grune &amp; Jacob's book on Parsing Techniques (second edition); papers – Earley CFG parser, Kaplan's lexical function grammar, Shieber's non CFGness of NL,</p> <p>Files: <a href="#">Lecture 5 notes (ppt)</a>.</p>	<b>A1 out</b>
6	30 Sept 10	<p><b>NL Grammar Hierarchies</b></p> <p>Class exercise; More notes on regular expressions, finite state automata, Markov algorithms, CFG, Typical phrase structure rules in English: Sentence (S), Noun Phrase (NP), Verb Phrase (VP), Prepositional Phrase (PP), Adjective Phrase (ADJP), Adverbial Phrase (ADVP);</p> <p>Handouts: updated course calendar; In-class exercise; Regular expressions, finite state machines and the pumping lemma; Markov algorithms; Carlo Strapparava's handout on FSA and regular expressions; Tutorial book – Picking up Perl; Practical Earley Parsing</p> <p>Files: <a href="#">Lecture 6 notes (ppt)</a>.</p>	<b>A2 out</b>
7	5 Oct 10	<p><b>Parsing and Context Free Grammars</b></p> <p>CFG; derivations, language generated by a CFG, left-most and right-most derivations, ambiguous sentences, bracketed representation of parse trees; Natural Language Phenomena: agreement, movement, subcategorization;</p> <p>Handouts: Lisp materials – Quickie Lisp, Good Lisp Style, Cooper's Book, Getting started in GNU Common Lisp. McCarthy's paper, Graham's book; Left corner parsing; BNF grammars;</p> <p>Files: <a href="#">Lecture 7 notes (ppt)</a>.</p>	
8	7 Oct 10	<p><b>Semantics and Pragmatics</b></p> <p>Heads and dependency; head-feature principle, dependency trees, arguments and adjuncts; Elements of semantics: semantic analysis, lexical semantics: word senses</p> <p>Handouts: Subcategorization; Sample projects – ugproject1, ugproject2, bronislova; Presentation; Communications; Student projects documentation; student projects revised; updated course calendar; Regular expressions and finite state automata; Ratnaparkhi's statistical parser</p> <p>Files: <a href="#">Lecture 8 notes (ppt)</a>.</p>	
	<b>10-16 Oct</b>	<b>Reading Week</b>	
9	19 Oct10	<p><b>Unification-based approach to NLP</b></p> <p>Some final parsing and semantics examples; Unification-based approach to NLP; bits of history, First-order predicate logic: constants, variables, functions, terms, predicates, formulae, sentences, axioms, theorems, inference rules; examples,</p>	<b>A1 Due</b>

		<p>Resolution-based inference system by Robinson; Unification</p> <p>Handouts: Prolog material – Learn Prolog now, Logic programming and Prolog, Prolog book; Lisp code for regular expression parser; Representational typology</p> <p>Files: Lecture 9 notes (ppt).</p>	
10	21 Oct 10	<p><b>HPSGs</b></p> <p>Unification review, HPSG Introduction, Principles, Rules, Examples, Modularity</p> <p>Handouts: Intro to HPSG; ALE manual; Elementary principles of HPSG; Encyclopaedia HPSG; HPSG Linguistic approach; Foundations of HPSG; Flickinger's thesis</p> <p>Files: Lecture 10 notes (ppt).</p>	
11	26 Oct 10	<p><b>HPSGs</b></p> <p>How its done, Examples, Examples, Examples</p> <p>Handouts: Hermes NL access; Hermes grammar and lexicon; Lexical rules; Prolog and NL analysis; review of Prolog and NL analysis; Charniak's edge based chart parser; Logic-Based Implementation of Head-Driven Phrase Structure Grammar; HPSG grammars in ALE; Prolog compared to Lisp; Python tutorial; Categorical grammar</p> <p>Files: Lecture 11 notes (ppt).</p>	
12	28 Oct 10	<p><b>Final HPSG, Statistical Approach to NLP</b></p> <p>Handouts: Chapter 1 of Manning's book; Chapter 1 of Jurafsky's book; common n-gram method; Shannon's 1948 paper; Shannon's 1951 paper; Statistical NLP paper; Probability for linguists; Using Python book;</p> <p>Files: Lecture 12 notes (ppt).</p>	
<p><b>Part III: Statistical Approach to NLP - Statistical Methods in NL Processing and Data Analysis and</b></p> <p><b>Part V (1st part) Student Presentations</b></p>			
13	2 Nov 10	<p><b>Information Retrieval and the Vector Space Model (Razieh Niazi)</b></p> <p>Typical IR system architecture, steps in document and query processing in IR, vector space model, tfidf - term frequency inverse document frequency weights, term weighting formula, cosine similarity measure, term-by-document matrix, reducing the number of dimensions, Latent Semantic Analysis, IR evaluation</p> <p>Handouts: nlp09.pdf; VectorSpaceImplementation-6per.pdf; 07Models-VSM.pdf; E09-3009.pdf; ieee-sw-rank.pdf; ir4up.pdf; p613-salton.pdf; Poletti Information Retrieval.pdf; 2.doc; Vector space model.doc</p> <p>Files: Lecture 13 IR and VSM notes (ppt).</p>	
14	4 Nov 10	<p><b>Text Classification (Elnaz Delpisheh)</b></p> <p>Text classification and text clustering, Types of text classification, evaluation measures in text classification, F-measure, Evaluation methods for classification: general issues - over fitting and under fitting, methods: 1. training error, 2. train and test, 3. n-fold cross-validation</p> <p>Handouts: nlp10.pdf; 10[1].1.1.4.4417.pdf; chap16.pdf; IG-Mercer-Kernel-Performance-2006.pdf; joachims_98a.pdf; lodhi02a.pdf; Text categorization.doc;</p>	

		Text classification and Naive Bayes.doc; <a href="#">http.doc</a> Files: <a href="#">Lecture 14 Text Classification (ppt)</a> ; <a href="#">Lecture 14 – cohen (ppt)</a> ; <a href="#">lecture 14 - Rosen-Zvi (ppt)</a>	
15	9 Nov 10	<b>Parser Evaluation, Text Clustering and CNG Classification (Ameeta Agrawal's notes)</b>  Parser evaluation: PARSEVAL measures, labeled and unlabeled precision and recall, F-measure; Text clustering: task definition, the simple k-means method, hierarchical clustering, divisive and agglomerative clustering; evaluation of clustering: inter-cluster similarity, cluster purity, use of entropy or information gain; CNG -- Common N-Grams classification method  Handouts: <a href="#">nlp11.pdf</a> ; <a href="#">10e-eval-2x3.pdf</a> ; <a href="#">0712.3705.pdf</a> ; <a href="#">774_paper.pdf</a> ; <a href="#">acl07parseval.pdf</a> ; <a href="#">D07-1066.pdf</a> ; <a href="#">getPDF.jsp.pdf</a> ; <a href="#">lre98.pdf</a> ; <a href="#">p9-clark.pdf</a> ; <a href="#">p37-lewis.pdf</a> ; <a href="#">p60-simov-ranlp03.pdf</a> ; <a href="#">pe08rimell_constructing.pdf</a> ; <a href="#">syntax.pdf</a> ; <a href="#">versley-tlt05.pdf</a> ; <a href="#">13.doc</a>  Files: <a href="#">Lecture 15 6390E_Mee_Parser_Clustering_CNG(ppt)</a> .	
16	11 Nov 10	<b>Probabilistic Modeling and Joint Distribution Model (Haluk Madencloglu's notes)</b>  Elements of probability theory, Generative models, Bayesian inference, Probabilistic modeling: random variables, random configurations, computational tasks in probabilistic modeling, spam detection example, joint distribution model, drawbacks of joint distribution model  Handouts: <a href="#">nlp12.pdf</a> ; <a href="#">nlp13.pdf</a> ; <a href="#">08Models-Prob.pdf</a> ; <a href="#">10[1].1.1.23.9849.pdf</a> ; <a href="#">ECIR2008TutorialHemstra-new.pdf</a> ; <a href="#">Fuhr_92.pdf</a> ; <a href="#">IR-Probabilistic-strategy.pdf</a> ; <a href="#">lecture20.pdf</a> ; <a href="#">Model_challenges1.doc</a> ; <a href="#">Please check the on.doc</a>  Files: <a href="#">Lecture 16 haluk-presentatinn (pdf)</a> .	
17	16 Nov 10	<b>Fully Independent Model and Naive Bayes Model (Nikolay Yakovets's notes)</b>  Fully independent model, example, computational tasks, sum-product formula; Naive Bayes model: motivation, assumption, computational tasks, example, number of parameters, pros and cons; N-gram model, language modeling in speech recognition  Handouts: <a href="#">nlp14.pdf</a> ; <a href="#">nlp15.pdf</a> ; <a href="#">10[1].1.1.48.529.pdf</a> ; <a href="#">10[1].1.1.65.9324.pdf</a> ; <a href="#">10[1].1.1.73.5412.pdf</a> ; <a href="#">10[1].1.1.112.8246.pdf</a> ; <a href="#">KDD96-061.pdf</a> ; <a href="#">AA28.txt</a>  Files: <a href="#">Lecture 17 FullyIndependentAndNaiveBayesModels-NY (pdf)</a> .	
18	18 Nov 10	<b>N-gram Model (Razieh Niazi – 2<sup>nd</sup> lecture)</b>  N-gram model: n-gram model assumption, graphical representation, use of log probabilities; Markov chain: stochastic process, Markov process, Markov chain; Perplexity and evaluation of N-gram models, Text classification using language models  Handouts: <a href="#">nlp16.pdf</a> ; <a href="#">10[1].1.1.87.754.pdf</a> ; <a href="#">01342667.pdf</a> ; <a href="#">aaac.pdf</a> ; <a href="#">D07-1045.pdf</a> ; <a href="#">DalTREC05spam.pdf</a> ; <a href="#">fulltext.pdf</a> ; <a href="#">IJCAI09-252.pdf</a> ; <a href="#">J92-4003.pdf</a> ; <a href="#">N03-1020.pdf</a> ; <a href="#">pacling05a.pdf</a> ; <a href="#">pst04.pdf</a> ; <a href="#">N-Grams.html</a> ; <a href="#">henke-ch6.ppt</a> ; <a href="#">Lecture4N-Grams.ppt</a>  Files: <a href="#">Lecture 18 Ngram Models (pps)</a> .	
19	23 Nov 10	<b>Hidden Markov Model (Leah Spotaneo)</b>  Smoothing: Add-one (Laplace) smoothing, Bell-Witten smoothing; Hidden Markov Model, graphical representations, assumption, HMM POS example, Viterbi algorithm -- use of dynamic programming in HMMs.	

		Handouts: nlp17.pdf; C96-2141.pdf; hmm14.pdf; hmm tutorial; For a tutorial on HMM's see.doc Files: Lecture 19 (ppt).	
20	25 Nov 10	<b>Bayesian Networks (Bartosz Bajer)</b> Bayesian Networks, definition, example, Evaluation tasks in Bayesian Networks: evaluation, sampling, inference in Bayesian Networks by brute force, general inference in Bayesian Networks is NP-hard, efficient inference in Bayesian Networks,  Handouts: nlp18.pdf; bayesinf05.pdf; bayesnet09.pdf; bayesstruct05.pdf; BN.pdf; gaussbc12.pdf; naive02.pdf; tr-95-06.pdf; shortbayes03.pdf; prob18.pdf Files: Lecture 20 (ppt).	
21	30 Nov 10	<b>Probabilistic Parsing (Dmitri Shuralyov's notes)</b> PCFG as a probabilistic model; Computational tasks for PCFG model: Evaluation, Learning, Simulation, proper PCFG, Probabilistic inference: marginalization, efficient inference, CYK algorithm  Handouts: nlp21.pdf; nlp22.pdf; 1104.pdf; acl2003-chinese.pdf; C00-1017.pdf; DOPlecture.pdf; iicall06.pdf; lex-parser.pdf; P04-1069.pdf; p406-nederhof.pdf; unlexicalized-parsing.pdf; Sampson/ Probabilistic Parsing; The Stanford NLP (Natural Language Processing) Group; Probabilistic parsers on the web.doc; thadh-meissnem-1-PA3report.doc Files: Lecture 21 (ppt).	<b>A2 Due</b>
<b>Part V (2<sup>nd</sup> part): Student Project Presentations</b>			
22	2 Dec 10	<b>Student Project Presentations</b>	
23	7 Dec 10	<b>Student Project Presentations</b> <b>Wrap-up and Course Review</b>	
	<b>23 Dec 10</b>	<b>Projects Due</b>	