

**CSE6339 3.0 Introduction to Computational Linguistics**  
**Instructor: Nick Cercone – 3050 LAS – [nick@cse.yorku.ca](mailto:nick@cse.yorku.ca)**  
**Mondays, Wednesdays 10:00-11:20 – South Ross 156 (new)**  
 LAS 2002 on Jan 6, 8, 13, 15, 20; Feb 10, 12, 24, 26;  
 Mar 3, 5, 10, 12, 17, 19, 24, 26, 31; Apr 2  
**Winter Semester, 2014**

**CSE6339 Course Calendar (6 Jan 2014)**

#	Date	Title	Asgn's
<b>Part I: Computational Linguistics, Language, Natural Language Processing, Theory and Applications</b>			
1	6 Jan 14	<b>Course Introduction</b> Course information: overview of course; logistics and administrative, 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  Handouts: <a href="#">course description</a> ; <a href="#">active reading</a> ; <a href="#">paper writing</a> ; <a href="#">resources</a> ; <a href="#">adjectives and adverbs</a> ; <a href="#">knowledge representation</a> ; <a href="#">assignment initial</a> ; <a href="#">assignment big</a> ; <a href="#">assignment big grading</a> ; <a href="#">course calendar</a>  Files: <a href="#">Lecture 1 notes (ppt)</a> .	A0 out A0 due
2	8 Jan 14	<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.  Handouts: <a href="#">whatisCL?</a> ; <a href="#">semantic nets</a> ; <a href="#">updated course calendar</a>  Files: <a href="#">Lecture 2 notes (ppt)</a> .	
3	13 Jan 14	<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).  Handouts: <a href="#">updated course calendar</a> ; <a href="#">word sense disambiguation</a> ; <a href="#">sketch of word sense disambiguation</a> ; <a href="#">Yarowsky algorithm</a> ; <a href="#">machine learning introduction</a> ; <a href="#">machine learning book</a>  Files: <a href="#">Lecture 3 notes (ppt)</a> .	
<b>Part II: Linguistic Background - Unification-based approach to NLP</b>			
4	15 Jan 14	<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	20 Jan 14	<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: <a href="#">assignment small</a>; <a href="#">assignment small grading</a>; <a href="#">project suggestions</a>; <a href="#">project grading</a>; <a href="#">heuristics</a>; <a href="#">lexical category</a>; <a href="#">early syntax theory</a>; <a href="#">logic and resolution</a>; <a href="#">chapter 3 (parsing) and chapter 18 (annotated bibliography) of Grune &amp; Jacob's book on Parsing Techniques (second edition)</a>; <a href="#">papers – Earley CFG parser, Kaplan's lexical function grammar, Shieber's non CFGness of NL</a>,</p> <p>Files: <a href="#">Lecture 5 notes (ppt)</a>.</p>	<b>A1 out</b>
6	22 Jan 14	<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: <a href="#">updated course calendar</a>; <a href="#">In-class exercise</a>; <a href="#">Regular expressions, finite state machines and the pumping lemma</a>; <a href="#">Markov algorithms</a>; <a href="#">Carlo Strapparava's handout on FSA and regular expressions</a>; <a href="#">Tutorial book – Picking up Perl</a>; <a href="#">Practical Earley Parsing</a></p> <p>Files: <a href="#">Lecture 6 notes (ppt)</a>.</p>	<b>A2 out</b>
7	27 Jan 14	<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: <a href="#">Lisp materials – Quickie Lisp, Good Lisp Style, Cooper's Book, Getting started in GNU Common Lisp</a>. <a href="#">McCarthy's paper</a>, <a href="#">Graham's book</a>; <a href="#">Left corner parsing</a>; <a href="#">BNF grammars</a>;</p> <p>Files: <a href="#">Lecture 7 notes (ppt)</a>.</p>	
8	29 Jan 14	<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: <a href="#">Subcategorization</a>; <a href="#">Sample projects – ugproject1, ugproject2, bronislova</a>; <a href="#">Presentation</a>; <a href="#">Communications</a>; <a href="#">Student projects documentation</a>; <a href="#">student projects revised</a>; <a href="#">updated course calendar</a>; <a href="#">Regular expressions and finite state automata</a>; <a href="#">Ratnaparkhi's statistical parser</a></p> <p>Files: <a href="#">Lecture 8 notes (ppt)</a>.</p>	
	<b>15-21 Feb</b>	<b>Reading Week</b>	
9	3 Feb 14	<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, Resolution-based inference system by Robinson; Unification</p>	<b>A1 Due</b>

		Handouts: Prolog material – Learn Prolog now, Logic programming and Prolog, Prolog book; Lisp code for regular expression parser; Representational typology Files: Lecture 9 notes (ppt).	
10	5 Feb 14	<b>HPSGs</b> Unification review, HPSG Introduction, Principles, Rules, Examples, Modularity Handouts: Intro to HPSG; ALE manual; Elementary principles of HPSG; Encyclopaedia HPSG; HPSG Linguistic approach; Foundations of HPSG; Flickinger's thesis Files: Lecture 10 notes (ppt).	
11	10 Feb 14	<b>HPSGs</b> How its done, Examples, Examples, Examples 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 Files: Lecture 11 notes (ppt).	
12	12 Feb 14	<b>Final HPSG, Statistical Approach to NLP</b>  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; Files: Lecture 12 notes (ppt).	
<b>Part III: Statistical Approach to NLP - Statistical Methods in NL Processing and Data Analysis and Part V (1st part) Student Presentations</b>			
13	24 Feb 14	<b>Information Retrieval and the Vector Space Model (student)</b> 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 Handouts: nlp09.pdf; VectorSpaceImplementation-6per.pdf; 07Models-VSM.pdf; E09-3009.pdf; ieee-sw-rank.pdf; ir4up.pdf; p613-salton.pdf; Poletini Information Retrieval.pdf; 2.doc; Vector space model.doc Files: Lecture 13 IR and VSM notes (ppt).	
14	26 Feb 14	<b>Text Classification (student)</b> 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 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; Text classification and Naive Bayes.doc; http.doc Files: Lecture 14 Text Classification (ppt); Lecture 14 – cohen (ppt); lecture 14 -	

		Rosen-Zvi (ppt)	
15	3 Mar 14	<p><b>Parser Evaluation, Text Clustering and CNG Classification (student)</b></p> <p>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</p> <p>Handouts: nlp11.pdf; 10e-eval-2x3.pdf; 0712.3705.pdf; 774_paper.pdf; ac107parseval.pdf; D07-1066.pdf; getPDF.jsp.pdf; lre98.pdf; p9-clark.pdf; p37-lewis.pdf; p60-simov-ranlp03.pdf; pe08rimell_constructing.pdf; syntax.pdf; versley-tt05.pdf; 13.doc</p> <p>Files: <a href="#">Lecture 15 6390E_Mee_Parser_Clustering_CNG(ppt)</a>.</p>	
16	5 Mar 14	<p><b>Probabilistic Modeling and Joint Distribution Model (student)</b></p> <p>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</p> <p>Handouts: nlp12.pdf; nlp13.pdf; 08Models-Prob.pdf; 10[1].1.1.23.9849.pdf; ECIR2008TutorialHemstra-new.pdf; Fuhr_92.pdf; IR-Probabilistic-strategy.pdf; lecture20.pdf; Model_challenges1.doc; Please check the on.doc</p> <p>Files: <a href="#">Lecture 16 haluk-presentationn (pdf)</a>.</p>	
17	10 Mar 14	<p><b>Fully Independent Model and Naive Bayes Model (student)</b></p> <p>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</p> <p>Handouts: nlp14.pdf; nlp15.pdf; 10[1].1.1.48.529.pdf; 10[1].1.1.65.9324.pdf; 10[1].1.1.73.5412.pdf; 10[1].1.1.112.8246.pdf; KDD96-061.pdf; AA28.txt</p> <p>Files: <a href="#">Lecture 17 FullyIndependentAndNaiveBayesModels-NY (pdf)</a>.</p>	
18	12 Mar 14	<p><b>N-gram Model (student)</b></p> <p>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</p> <p>Handouts: nlp16.pdf; 10[1].1.1.87.754.pdf; 01342667.pdf; aaac.pdf; D07-1045.pdf; DalTREC05spam.pdf; fulltext.pdf; IJCAI09-252.pdf; J92-4003.pdf; N03-1020.pdf; pacling05a.pdf; pst04.pdf; N-Grams.html; henke-ch6.ppt; Lecture4N-Grams.ppt</p> <p>Files: <a href="#">Lecture 18 Ngram Models (pps)</a>.</p>	
19	17 Mar 14	<p><b>Hidden Markov Model (student)</b></p> <p>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.</p> <p>Handouts: nlp17.pdf; C96-2141.pdf; hmm14.pdf; hmm tutorial; For a tutorial on HMM's see.doc</p> <p>Files: <a href="#">Lecture 19 (ppt)</a>.</p>	

20	19 Mar 14	<b>Bayesian Networks (student)</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: <a href="#">nlp18.pdf</a> ; <a href="#">bayesinf05.pdf</a> ; <a href="#">bayesnet09.pdf</a> ; <a href="#">bayesstruct05.pdf</a> ; <a href="#">BN.pdf</a> ; <a href="#">gaussbc12.pdf</a> ; <a href="#">naive02.pdf</a> ; <a href="#">tr-95-06.pdf</a> ; <a href="#">shortbayes03.pdf</a> ; <a href="#">prob18.pdf</a>  Files: <a href="#">Lecture 20 (ppt)</a> .	
21	24 Mar 14	<b>Probabilistic Parsing (student)</b> PCFG as a probabilistic model; Computational tasks for PCFG model: Evaluation, Learning, Simulation, proper PCFG, Probabilistic inference: marginalization, efficient inference, CYK algorithm  Handouts: <a href="#">nlp21.pdf</a> ; <a href="#">nlp22.pdf</a> ; <a href="#">1104.pdf</a> ; <a href="#">acl2003-chinese.pdf</a> ; <a href="#">C00-1017.pdf</a> ; <a href="#">DOlecture.pdf</a> ; <a href="#">iicall06.pdf</a> ; <a href="#">lex-parser.pdf</a> ; <a href="#">P04-1069.pdf</a> ; <a href="#">p406-nederhof.pdf</a> ; <a href="#">unlexicalized-parsing.pdf</a> ; <a href="#">Sampson/ Probabilistic Parsing</a> ; <a href="#">The Stanford NLP (Natural Language Processing) Group</a> ; <a href="#">Probabilistic parsers on the web.doc</a> ; <a href="#">thadh-meissnem-1-PA3report.doc</a>  Files: <a href="#">Lecture 21 (ppt)</a> .	<b>A2 Due</b>
<b>Part V (2<sup>nd</sup> part): Student Project Presentations</b>			
22	26 Mar 14	<b>Student Project Presentations</b>	
23	31 Mar 14	<b>Student Project Presentations</b>	
24	2 Apr 14	<b>Wrap-up and Course Review – classes end 4 April</b>	
	<b>14 Apr 14</b>	<b>Projects Due</b>	