CS 224N / Ling 284 — Natural Language Processing

Calendar

Mon	Tue	Wed	Thu	Fri
Sep 21	**Sep 22** Lecture 1: Introduction	**Sep 23**	**Sep 24** Lecture 2: Word Alignment Models for Statistical MT PA1 out	**Sep 25**
Sep 28	**Sep 29** Lecture 3: Machine Translation: Word Alignment, Parallel Corpora, Decoding, Evaluation	**Sept 30**	**Oct 1** Lecture 4: Modern MT Systems (Phrase-based, Syntactic)	**Oct 2**
Oct 5	**Oct 6** Lecture 5: N-Grams, Final Project Discussion	**Oct 7**	**Oct 8** PA2 out Lecture 6: Syntax and parsing PA1 due	**Oct 9**
Oct 12	**Oct 13** Lecture 7: Competitive Grammar Writing I	**Oct 14**	**Oct 15** Lecture 8: Competitive Grammar Writing II	**Oct 16**
Oct 19	**Oct 20** Lecture 9: Dependency Parsing Final project proposal due	**Oct 21**	**Oct 22** PA2 due Lecture 10: Coreference Resolution PA3 out	**Oct 23**
Oct 26	**Oct 27** Lecture 11: Coreference Resolution II / Classifiers	**Oct 28**	**Oct 29** Lecture 12: Softmax / MaxEnt (Sequence) Classifiers	**Oct 30**
Nov 2	**Nov 3** Lecture 13: Sequence Classifiers for POS & NER / Deep Learning for NLP: Motivations	**Nov 4**	**Nov 5** PA3 due Lecture 14: Deep Learning for NLP: Word Representations & NER PA4 out	**Nov 6**
Nov 9	**Nov 10** Lecture 15: Deep Learning for NLP: Strategy and Tree Recursive Neural Networks	**Nov 11**	**Nov 12** Lecture 16: Deep Learning for NLP: Recurrent Neural Networks	**Nov 13**
Nov 16	**Nov 17** Lecture 17: Computational Semantics	**Nov 18**	**Nov 19** Lecture 18: Computational Semantics	**Nov 20**
Nov 23	**Nov 24** Thanksgiving	**Nov 25**	**Nov 26** Thanksgiving	**Nov 27**
Nov 30	**Dec 1** Final project presentations	**Dec 2**	**Dec 3** Final project presentations	**Dec 4**

PA 4 due: **Dec 4**.
Final project report due: **Dec 6**.

Syllabus

Lecture 1
Tue
9/22/15

Course Introduction and Administration. Overview of NLP. Statistical Machine Translation.

Lecture Slides: (1-up) (6-up)

Required:

- If your knowledge of probability theory is limited, please read M&S 2.0-2.1.7. If that's too condensed, read the probability chapter of an intro statistics textbook, e.g. Rice, Mathematical Statistics and Data Analysis, ch. 1.

Optional:

- Good background reading: J&M Ch. 1; M&S 1.0-1.3, 4.1-4.2.
- Unix text manipulation (useful skill!): Ken Church's tutorial Unix for Poets or the (more up-to-date!) CS124 version.

Lecture 2
Thu
9/24/15

Word Alignment Models for Statistical MT

Assignments:

- PA1 (Word Alignment and MT System) Out. (Find it on OpenEdX under Courseware.)

Lecture Slides: (1-up) (6-up)

Tutorial reading:

- Michael Collins. 2011. Statistical Machine Translation: IBM Models 1 and 2.
- Kevin Knight. 1999. A Statistical MT Tutorial Workbook. MS., August 1999. Sections 1-14.

Background:

- The IBM 701 translator (1954)

Advanced:

- Robert C. Moore. 2004. Improving IBM Word Alignment Model 1. In ACL.
- Robert C. Moore. 2005. Association-Based Bilingual Word Alignment. In ACL Workshop on Building and Using Parallel Texts.
- Kristina Toutanova and Michael Galley. 2011. Why Initialization Matters for IBM Model 1: Multiple Optima and Non-Strict Convexity. In ACL.
- Chris Dyer, Victor Chahuneau, and Noah A. Smith. 2013. A Simple, Fast, and Effective Reparameterization of IBM Model 2. In NAACL.
- Andrei Simion, Michael Collins, and Cliff Stein. 2013. A Convex Alternative to IBM Model 2. In EMNLP.
- Douwe Gelling and Trevor Cohn. 2014. Simple extensions for a reparameterised IBM Model 2. In ACL.
- Andrei Simion, Michael Collins, and Cliff Stein. 2015. On a Strictly Convex IBM Model 1. In EMNLP.

Lecture 3
Tue
9/29/15

Machine Translation: Word Alignment, Parallel Corpora, Decoding, Evaluation

Lecture Slides: (1-up) (6-up)

Required:

- J&M chapter 25

Tutorial reading:

- Kevin Knight. A Statistical MT Tutorial Workbook. MS., August 1999. Sections 15-37.
- Knight workbook FAQ

Optional:

- Ulrich Germann, Michael Jahr, Kevin Knight, Daniel Marcu, and Kenji Yamada. 2001. Fast Decoding and Optimal Decoding for Machine Translation. In ACL.
- Adam Lopez. 2008. Statistical Machine Translation. In *ACM Computing Surveys* 40(3).

Lecture 4 Thu 10/1/15 **Modern MT Systems (Phrase-based, Syntactic)**

Lecture Slides: (1-up) (6-up)

Optional:

- Franz Josef Och and Hermann Ney. 2004. The alignment template approach to statistical machine translation. In *Computational Linguistics* 30(4).
- Kenji Yamada and Kevin Knight. 2002. A Decoder for Syntax-Based Statistical MT. In ACL.
- David Chiang. 2005. A hierarchical phrase-based model for statistical machine translation. In ACL.

Lecture 5 Tue 10/6/15 **N-Grams, Final Project Discussion**

Lecture Slides: (1-up) (6-up)

Required:

- J&M Chapter 4 (EdX link) (or M&S 1.4, 2.2, 6)
- Week 3 Language Modeling Videos

Resources:

- MegaHAL
- Shannon experiment for the entropy of English: Java applet. Results spreadsheet: gdoc

Optional:

- (advanced) Joshua Goodman (2001), A Bit of Progress in Language Modeling, Extended Version.
- (advanced) Stanley Chen and Joshua Goodman (1998), An empirical study of smoothing techniques for language modeling.
- (very advanced) Yee Whye Teh. 2006. A Hierarchical Bayesian Language Model based on Pitman-Yor Processes. In EMNLP.

Lecture 6 Thu 10/8/15 **Syntax and parsing**

Lecture Slides: (1-up) (6-up)

Assignments:

- PA1 due
- PA2 (CYK-Parser) out

Required:

- Week 3 Parsing Videos
- J&M ch. 13, secs. 13.0-13.3.

Background:

- J&M ch. 12 (or M&S ch. 3). This is especially if you haven't done any linguistics courses, but even if you have, there's useful information on treebanks and part-of-speech tag sets used in NLP.

Lecture 7 Tue 10/13/15 **Competitive Grammar Writing I**

Lecture Slides: (pdf)
Instructions: (pdf)

Required:

- Week 4 Parsing Videos
- J&M sec 13.4

Background:

- Dan Klein and Christopher D. Manning. 2003. Accurate Unlexicalized Parsing. In ACL.

Lecture 8 Thu 10/15/15 **Competitive Grammar Writing II**

Required:

- Week 4 Parsing Videos

Optional:

- Eugene Charniak. 1997. Statistical techniques for natural language parsing. In *AI Magazine*.
- Eugene Charniak. 1997. Statistical parsing with a context-free grammar and word statistics. In AAAI.
- Eugene Charniak. 2000. A Maximum-Entropy-Inspired Parser. In NAACL.
- Slav Petrov, Leon Barrett, Romain Thibaux and Dan Klein. 2006. Learning Accurate, Compact, and Interpretable Tree Annotation. In COLING/ACL.

Lecture 9 Tue 10/20/15 **Dependency Parsing**

Lecture Slides: (1-up) (6-up)

Assignments:

- Final Project Proposal Due.

Lecture 10 Thu 10/22/15 **Coreference Resolution**

Lecture Slides: (1-up) (6-up)

Assignments:

- PA2 Due
- PA3 (Coreference System) out

Required:

- J&M 21.3-21.8 (or all of Chapter 21 if you wish!)

Optional:

- Ng, Vincent (2005). Supervised Noun Phrase Coreference Research: The First Fifteen Years.
- Raghunathan, Karthik et al. (2010). A Multi-Pass Sieve for Coreference Resolution. In Proceedings of the 2010 Conference on Empirical Methods in Natural Language Processing (EMNLP 2010).

Lecture 11 Tue 10/27/15 **Coreference Resolution II**

Lecture Slides: (1-up) (6-up)
Intro to feature-based classifiers: (1-up) (6-up)

Lecture 12 Thu 10/29/15 **Softmax / MaxEnt (Sequence) Classifiers**

Lecture Slides: (1-up) (6-up)

Optional:

- J&M sections 6.6-6.8, 22.1
- Adam Berger, A Brief Maxent Tutorial

Lecture 13 Tue 11/3/15 **Sequence Classifiers for POS & NER / Deep Learning for NLP: Motivations**

Lecture Slides:

- Maxent models continuation:(1-up) (6-up)
- Intro to deep learning and word representations: (1-up) (6-up)

Lecture 14 Thu 11/5/15 **Deep Learning for NLP: Word representations & NER**

Lecture Slides: (1-up) (6-up)

Assignments:

- PA3 Due
- PA4 (Deep Learning Sequence Model or Dependency Parsing) out

Lecture 15 Tue 11/10/15 **Deep Learning for NLP: Strategy & Tree Recursive Neural Networks**

Lecture Slides: (1-up) (6-up)

Optional reading (from easiest to hardest!):

- M. Nielsen. 2015. Neural Networks and Deep Learning. Online.
- C. Olah. 2014-2015. colah's blog. Online blog.
- D. Britz. 2015. Wild ML: Recurrent Neural Networks Tutorial. Online blog.
- Y. Goldberg. 2015. A Primer on Neural Network Models for Natural Language Processing. ms., Bar-Ilan University.
- Y. Bengio, I. J. Goodfellow and A. Courville. in press. Deep Learning. ms., MIT Press.

Lecture 16 Thu 11/12/15	**Deep Learning for NLP: Recurrent Neural Networks** *Lecture Slides:* (1-up) (6-up)
Lecture 17 Tue 11/17/15	**Computational Semantics** *Lecture Slides:* [1-up] [6-up] *Background links:* [Background on knowledge navigator] [SHRDLU] [Google app 2015]
Lecture 18 Thu 11/19/15	**Computational Semantics** *Lecture Slides:* first part (1-up) (6-up); second part (1-up). *Required:* • An Introduction to Formal Computational Semantics *Lecture Slides:* third part (1-up). **Thanksgiving Break**
Lecture 19 Tue 12/1/15	**Final project presentations** Schedule
Lecture 20 Tue 12/3/15	**Final project presentations** Schedule

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Site design by Bill MacCartney