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**Course Plan: Psycholinguistic Theories of Parsing**

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Total number of lectures: 14 (1st Nov 2011 - 11 Feb 2012)

**Total class lectures:** 12

**Total labs:** 2

**Total number of assignments:** 5

**Course Description:**

The course has the following goals:

- It will provide an introduction to dependency grammar and discuss the three major dependency parsing paradigms.
- It will introduce some sentence processing models that are grounded in psycholinguistics.

Additionally, the course will conduct some hands-on lab sessions to familiarize the students with some freely available dependency parsers.

**Prerequisites:**

Some basic knowledge of Linguistics will be assumed during the lectures. Proficiency in a programming/scripting language will be useful (but is not compulsory).

**Evaluation:**

*Assignments: 40%*

*Final exam: 60%*

<b>Lecture no.</b>	<b>Topic</b>
1	<p>Introduction to Dependency Grammar</p> <ul style="list-style-type: none"><li>● Motivations, etc</li><li>● Basic comparison to Phrase Structure</li><li>● Issues</li></ul> <p>[Provide links to different resources (tools and data); Reading list] <b>HA:</b> Analysis of basic German/English constructions using dependency grammar</p>
2	<p>Introduction to Dependency Parsing</p> <ul style="list-style-type: none"><li>● Model</li><li>● Inference and Algorithm</li><li>● Formal properties</li><li>● Evaluation Metrics for dependency parsing</li><li>● CoNLL-X shared tasks, ICON tools contest.</li></ul>

3	<p>Constraint based parsing</p> <ul style="list-style-type: none"> <li>● Constraint propagation</li> <li>● Transformations</li> <li>● Constraint satisfaction</li> <li>● Integer programming</li> </ul>
4	<p>Transition based parsing : Introduction</p> <ul style="list-style-type: none"> <li>● Algorithm, Oracle, Features, etc.</li> <li>● Arc Standard</li> <li>● Basics of inference model</li> </ul>
5	<p>Transition based parsing (<i>contd.</i>)</p> <ul style="list-style-type: none"> <li>● Arc earger</li> <li>● Attardi, 2006</li> <li>● Nivre, 2008</li> <li>● Pseudo-projective parsing</li> <li>● Nivre, 2009</li> </ul> <p><b>HA:</b> Parsing sentence with Arc eager vs. Arc standard assuming an oracle. Issues.</p>
6	<p><b>Lab:</b> MaltParser</p> <ul style="list-style-type: none"> <li>● Training, Testing</li> <li>● Evaluation</li> <li>● Experiments <ul style="list-style-type: none"> <li>○ Training data size</li> <li>○ Dependency tagset size</li> <li>○ Feature model</li> <li>○ Linguistic features</li> </ul> </li> </ul> <p><b>HA:</b> Error analysis of test data using MaltParser</p>
7	<p>Graph based parsing</p> <ul style="list-style-type: none"> <li>● Chu-Lui-Edmonds Algorithm</li> <li>● Basics of inference model: Arc factored</li> </ul>

8	<p><b>Lab</b></p> <p><i>MSTParser</i></p> <ul style="list-style-type: none"> <li>● Training, Testing</li> <li>● Evaluation</li> <li>● Experiments <ul style="list-style-type: none"> <li>○ Training data size</li> <li>○ Dependency tagset size</li> <li>○ Feature model</li> <li>○ Linguistic features</li> </ul> </li> </ul> <p><i>MaltEval</i></p> <ul style="list-style-type: none"> <li>● Tree viewer</li> <li>● Multiple tree comparison</li> <li>● Basic search</li> <li>● Computing statistical significance</li> </ul> <p><b>HA:</b> Error analysis of test data using MSTParser</p>
9	<p>Graph properties and parsing</p> <ul style="list-style-type: none"> <li>● Distance</li> <li>● Depth</li> <li>● Well-nestedness</li> <li>● Projectivity</li> <li>● Non-projectivity: Edge degree, Gap degree, block degree</li> <li>● Dependency labels</li> </ul> <p>Present trends and Future directions in dependency parsing</p> <ul style="list-style-type: none"> <li>● Ensemble systems</li> <li>● Hybrid systems</li> <li>● Joint parsing</li> <li>● ...</li> </ul> <p><b>HA:</b> Analysis of sample sentence w.r.t to the graph properties. (Automatic?)</p>
10	Boston et al. 2008

11	Lewis and Vasishth, 2005
12	Demberg and Keller, 2008
13	TBA

14	Final exam
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[**Note:** *The additional/optional readings listed below are not compulsory. Sometime the additional references will explain the ideas presented in the class more formally/extensively. While others are related papers that are not necessarily covered in class, but can be nevertheless read by interested students. The questions in the exams and the assignments will stick to the material covered (using the primary references) in the class/lab.*]

**Primary reference:**

Dependency Parsing. 2009. Sandra Kubler, Ryan McDonald, Joakim Nivre. Morgan and Claypool. [[Link](#)]

Marisa Ferrara Boston, John T. Hale, Umesh Patil, Reinhold Kliegl, and Shravan Vasishth. [Parsing costs as predictors of reading difficulty: An evaluation using the Potsdam Sentence Corpus](#). *Journal of Eye Movement Research*, 2(1):1-12, 2008.

R. L. Lewis and S. Vasishth. [An activation-based model of sentence processing as skilled memory retrieval](#). *Cognitive Science*, 29:1-45, May 2005.

Vera Demberg and Frank Keller. 2008. [Data from Eye-tracking Corpora as Evidence for Theories of Syntactic Processing Complexity](#). *Cognition* 109:2, 193-210.

**Resources:**

*Parsers:*

[MaltParser](#), [MSTParser](#)

*Other tools/scripts:*

[CoNLL-X](#), [MaltEval](#)

*Data:*

[German dependency annotated data](#) (CoNLLX)

[Hindi dependency annotated data](#) (ICON10)

**Additional (optional) references:**

### **Lecture 1:**

Steven Abney. 1995. [Chunks and Dependencies and Human Sentence Processing](#). Viewgraphs for talk given at sentence processing workshop, Freiburg.

J. Nivre. 2005. [Dependency Grammar and Dependency Parsing](#). MSI report 05133. Växjö University: School of Mathematics and Systems Engineering.

### **Lecture 2:**

S. Buchholz and E. Marsi. 2006. [CoNLL-X shared task on multilingual dependency parsing](#). In Proc. of the Tenth Conf. on Computational Natural Language Learning (CoNLL).

Samar Husain, Prashanth Mannem, Bharat Ram Ambati, and Phani Gadde. 2010. [The ICON-2010 Tools Contest on Indian Language Dependency Parsing](#). In Proceedings of ICON-2010 Tools Contest on Indian Language Dependency Parsing. Kharagpur, India.

### **Lecture 3:**

Akshar Bharati, Samar Husain, Dipti Misra Sharma and Rajeev Sangal. 2009 [Two stage constraint based hybrid approach to free word order language dependency parsing](#). In Proceedings of the 11th International Conference on Parsing Technologies (IWPT09). Paris. 2009.

A. Martins, N. Smith and E. Xing. 2009. [Concise Integer Linear Programming Formulations for Dependency Parsing](#). Proceedings of the ACL-IJCNLP09.

R. Debusmann, D. Duchier and G. Kruijff. 2004. [Extensible dependency grammar: A new methodology](#). Proceedings of the Workshop on Recent Advances in Dependency Grammar, pp. 78–85.

### **Lecture 5:**

J. Nivre. 2008. [Algorithms for Deterministic Incremental Dependency Parsing](#). Computational Linguistics 34(4), 513-553.

G. Attardi. 2006. [Experiments with a multilanguage non-projective dependency parser](#). Proceedings of the 10th Conference on CoNLL. NewYork.

A. M. Covington. 2001. [A fundamental algorithm for dependency parsing](#). Proceedings of the 39th ACM Southeast Conference, Athens.

J. Nivre and J. Nilsson. 2005. [Pseudo-projective dependency parsing](#). Proceeding of the ACL, Ann Arbor.

J. Nivre. 2009. [Non-Projective Dependency Parsing in Expected Linear Time](#). In *Proc. of ACL-IJCNLP*.

### **Lecture 9:**

Prashanth Mannem, Himani Chaudhry and Akshar Bharati. 2009. [Insights into Non-projectivity in Hindi](#). Proceedings of ACL-IJCNLP Student Research Workshop. Singapore. 2009.

Marco Kuhlmann. 2007. [Dependency Structures and Lexicalized Grammars](#). Ph.D. thesis, Saarland University.

Marco Kuhlmann and Joakim Nivre. 2006. [Mildly nonprojective dependency structures](#). In Proceedings of the COLING/ACL 2006 Main Conference Poster Sessions, pages 507–514, Sydney, Australia, July. Association for Computational Linguistics.

Ryan McDonald and Joakim Nivre. 2007. [Characterizing the errors of data-driven dependency parsing models](#). In Proceedings of the 2007 Joint Conference on Empirical Methods in Natural Language Processing and Computational Natural Language Learning (EMNLP-CoNLL), pages 122–131, Prague, Czech Republic, June. Association for Computational Linguistics.

J. Nivre, and R. McDonald. 2008. [Integrating Graph-Based and Transition-Based Dependency Parsers](#). In Proceedings of the 46th Annual Meeting of the Association for Computational Linguistics: Human Language Technologies (ACL-08: HLT), 950--958.

Samar Husain, Phani Gadde, Joakim Nivre and Rajeev Sangal. 2011. [Clausal parsing helps data-driven dependency parsing: Experiments with Hindi](#). In Proceedings of IJCNLP 2011.

Bharat Ram Ambati. 2010. [Importance of linguistic constraints in statistical dependency parsing](#). In Proceedings of ACL 2010 Student Research Workshop (SRW), Uppsala, Sweden.

R. Tsarfaty, D. Seddah, Y. Goldberg, S. Kuebler, Y. Versley, M. Candito, J. Foster, I. Rehbein and L. Tounsi. 2010. [Statistical Parsing of Morphologically Rich Languages \(SPMRL\) What, How and Wither](#). In Proc of NAACL-HLT 2010 workshop on Statistical Parsing of Morphologically Rich Languages (SPMRL 2010), Los Angeles, CA.

Marco Kuhlmann and Joakim Nivre. [Transition-Based Techniques for Non-Projective Dependency Parsing](#). In Northern European Journal of Language Technology 2(1), pp. 1–19, 2010.

## **Lecture 10:**

Roger Levy. 2008. [Expectation-based syntactic comprehension](#). Cognition 106(3):1126-1177.

J. Hale. 2001. [A probabilistic Earley parser as a psycholinguistic model](#). In Proceedings of NAACL.

## **Lecture 11:**

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**Lecture 12:**

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**Lecture 13:**

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**Lecture 14:**

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