

**Hauptseminar  
Summer Semester 2015**

**Natural Language Processing for Tutoring Systems**

**Abstract:**

In this Hauptseminar we will explore how Natural Language Processing tools are used to obtain interactivity and adaptivity in Tutoring Systems. The course is designed to include both an overview of the relevant issues and hands-on practical aspects (which also motivates the fact that it meets for six hours a week). As background for the discussion of NLP in the tutoring system context, the course will include sessions introducing Tutoring Systems and their components: a) the domain module containing the knowledge of the area being taught, b) the user module, which includes a student model that tracks the student's activity and progression; and c) the pedagogical module, which includes the teaching strategies. The course will cover those three parts for a language learning context: the computational linguistic modeling of learner language, the learner modeling, and modeling of language learning tasks. The course will include group projects designing, implementing and presenting components of a tutoring system, which will be completed in a final project.

**Instructors:**

- Detmar Meurers
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  - *Office hours:* Tuesdays, 11:45-12:30 (please arrange a slot by email beforehand)
- Martí Quixal
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  - *Office hours:* Wednesdays, 9:30–10:30

**Course meets:**

- Tuesdays, 10:15–11:45 in 1.13 (SfS, Blochbau, Wilhelmstr. 19)
- Thursdays, 10:15–13:45 in 1.13 (or 2.26 as needed) (SfS, Blochbau, Wilhelmstr. 19)
  - Note: Following the standard rules, missing more than two meetings unexcused, automatically results in failing the class. If you have to miss class for a valid reason, let the instructors know by email **before** class.

**Language:**

- The course language is English, but may be switched to German if desired by all.

**Credits:** 15 CP in MA ISCL

**Moodle page:** <https://moodle02.zdv.uni-tuebingen.de/course/view.php?id=1130>

## Syllabus (this file):

- html-Version (<http://purl.org/dm/15/ss/hs>)
- pdf-Version (<http://purl.org/dm/15/ss/hs/syllabus.pdf>)

**Nature of course and our expectations:** This Hauptseminar intends to provide an overview of the concepts and issues involved in research in this domain. Participants are expected to

1. regularly and actively participate in class, read the papers assigned by any of the presenters and post a question on Moodle to the “Reading Discussion Forum” on each reading *at the latest on the day before it is discussed* in class. (10% of grade)
2. explore and present a topic (30% of grade):
  - select one of the sub-topics
  - thoroughly research the topic, taking our literature pointers as a starting point
  - prepare the presentation with slides and discuss the presentation with one of the instructors in the week before the presentation
  - start a new Moodle thread on the “Reading Discussion Forum” specifying what every course participant should read to prepare for your presentation a week before your presentation
  - present the topic in class
3. actively participate in and complete the hands-on projects, documenting your work in Moodle (30% of grade)
4. write and submit a term paper in Moodle (30% of grade). For computational linguistics students, term papers will be written in LaTeX using the standard CL journal template (<http://cljournal.org/style.html>) with the fullname citation style.

**Academic conduct and misconduct:** Research is driven by discussion and free exchange of ideas, motivations, and perspectives. So you are encouraged to work in groups, discuss, and exchange ideas. At the same time, the foundation of the free exchange of ideas is that everyone is open about where they obtained which information. Concretely, this means you are expected to always make explicit when you’ve worked on something as a team – and keep in mind that being part of a team always means sharing the work.

For text you write, you always have to provide explicit references for any ideas or passages you reuse from somewhere else. Note that this includes text “found” on the web, where you should cite the URL of the web site in case no more official publication is available.

## Topics:

- **Week 1 & 2: Introduction**

- Tue, Apr 21: Syllabus and Introduction
- Thu, Apr 23: Why is NLP relevant in a language learning context?
  - \* reading: Meurers (2012)
- Thu, Apr 23 Practical:
  - \* explore: WERTi/VIEW, Spanish Grammar Exercise site
- Tue, Apr 28: Intelligent Language Tutoring Systems: Overview and Issues
- Thu, Apr 30: (cont.)
  - \* reading: (Amaral & Meurers 2011)
- Thu, Apr 30 Practical:
  - \* Trude Heift's E-Tutor, TAGARELA
- Tue May 5: (cont.)
  - \* reading: (Heift 2001; Nagata 2009; Chapelle 1998)

- **Week 3–8: Domain Module: Analyzing Learner Language**

*Characteristics of learner language*

- Thu May 7: Interpreting learner responses
  - \* Target hypotheses: Meurers (2015), Reznicek, Lüdeling & Hirschmann (2013) [Sabrina Galasso]
  - \* Spelling errors: Flor et al. (2014) [Tabea Sanwald]
- Thu, May 7 Practical: Analyze learner language
  - \* Annotation of texts
  - \* Determining target hypotheses
- Tue May 12: Developmental path of language learners
  - \* SLA perspective: Ortega (2003) [Christian Adam]
  - \* Syntactic complexity: Ai & Lu (2013), Lu (2010) [Deniz Cevher]
- Thu, May 14 NO CLASS – *Himmelfahrt / Ascension Day*

*Automatic analysis of learner language*

- Tue, May 19: Part-of-speech tagging and parsing [Björn Rudzewitz]
  - \* Part-of-speech tagging: Díaz Negrillo et al. (2010); Ragheb & Dickinson (2012)
  - \* Mal-rule and constraint-relaxation approach [David Bausch]:
    - General introduction: Heift & Schulze (2007)
    - Relaxation: Heift & Nicholson (2001); Nagata (2002)
    - Mal-rules: Weischedel & Sondheimer (1983); Fortmann & Forst (2004)
    - Additional papers: Vandeventer Faltin (2003); L'Haire & Faltin (2003)

- Thu, May 21: Error annotation [Alina Ladygina]
  - \* Error annotation: Díaz Negrillo & Fernández Domínguez (2006); Granger (1998)
- Thu, May 21 Practical:
  - \* Behaviour and performance of NLP tools on learner data
- Tue, May 26 NO CLASS – *Pfingsten / Pentecost*
- Thu, May 28 NO CLASS – *Pfingsten / Pentecost*
- Tue, Jun 2: Error detection
  - \* Group project **KICK-OFF**
- Thu, Jun 4: NO CLASS – *Fronleichnam / Corpus Christi*
- Tue, Jun 9: Error detection
  - \* Corpus-based error detection and correction [Ben Campbell & Yevgen]: Leacock et al. (2014, Chs. 5–6) Gamon et al. (2013)

• **Week 8-10: User Module: Modeling Learners**

- Thu, Jun 11: Learner language and learner proficiency [Eran & Eyal]
  - \* SLALOM: (Michaud & McCoy 1998; Michaud et al. 2001; Michaud & McCoy 2004)
  - \* Learner model influencing language processing: (Heift & McFetridge 1999)
- Thu, Jun 11: Open Learner Models [Maja]
  - \* Heift (2008); Jones et al. (2013)
- Thu, Jun 11 Practical: Group Project
- Tue, Jun 16: User modeling beyond linguistic performance
  - \* Bull et al. (1995) [Alex]
  - \* Amaral & Meurers (2008) [Eduard]
  - \* Lea’s Box [Sabine]

• **Week 9–11: Pedagogy Module: Modeling Tasks, Activity Progression, and Feedback**

*Tasks*

- Thu, Jun 18: NLP to the task
  - \* Task-based ICALL: Schulze (2010) [Natalia]
  - \* Task design framework: Quixal (2012) [Quixal]
- Thu, Jun 18 Practical: Group Project
- Tue, Jun 23: Dialog tasks
  - \* Dialog Tasks Wilske & Wolska (2011); Wilske (2014)
- Thu, Jun 25: An SLA intervention study [Melika]
  - \* Information Gap Activities (Petersen 2010)
- Thu, Jun 25 Practical: Group Project

## Feedback

- Tue, Jun 30: Types of feedback and feedback in F2F
  - \* Types of feedback and uses in ICALL: (Lyster & Ranta 1997; Ferreira et al. 2007) [Daniela]
- Thu, Jul 2: Learner reaction to feedback in CALL/ICALL
  - \* (Pujolà 2001; Heift 2001) [Anastasiia & Johanna]
- Thu, Jul 2 Practical: Group Project
- **Week 12 & 13: Evaluation**
  - Tue, Jul 7: The SLA/FLTL perspective
    - \* Chapelle & Chung (2010); Golonka et al. (2014) [Vivian]
  - Thu, Jul 9: A cross-disciplinary perspective of ILTSs
    - \* Oxford (1995); MacWhinney (1995); Bailin (1995) [Roshanak]
  - Thu, Jul 9 Practical: Group Project – Peer evaluation
  - Tue, Jul 14: Evaluation of NLP components Leacock et al. (2014, Ch. 4) and evaluation chapters of Wilske and Petersen [Zarah]
  - Thu, Jul 16: Group Project – Presentations
- **Week 14: Make-up days**
  - Tue, Jul 21:
  - Thu, Jul 23:

Note: The syllabus is subject to change, as we progress through the semester. So check the online version regularly.

## References

- Ai, H. & X. Lu (2013). A corpus-based comparison of syntactic complexity in NNS and NS university students' writing. In A. Díaz-Negrillo, N. Ballier & P. Thompson (eds.), *Automatic Treatment and Analysis of Learner Corpus Data*, John Benjamins, pp. 249–264.
- Amaral, L. & D. Meurers (2008). From Recording Linguistic Competence to Supporting Inferences about Language Acquisition in Context: Extending the Conceptualization of Student Models for Intelligent Computer-Assisted Language Learning. *Computer-Assisted Language Learning* 21(4), 323–338. URL <http://purl.org/dm/papers/amaral-meurers-call08.html>.
- Amaral, L. & D. Meurers (2011). On Using Intelligent Computer-Assisted Language Learning in Real-Life Foreign Language Teaching and Learning. *ReCALL* 23(1), 4–24. URL <http://dx.doi.org/10.1017/S0958344010000261>.
- Bailin, A. (1995). AI and Language Learning: Theory and Evaluation. In Holland et al. (1995), pp. 327–343.

- Bull, S., P. Brna & H. Pain (1995). Extending the Scope of the Student Model. *User Modeling and User-Adapted Interaction* 5, 45–65. URL <http://www.eee.bham.ac.uk/bull/papers-pdf/UMUAI-95.pdf>.
- Chapelle, C. (1998). Multimedia CALL: Lessons to be Learned from Research on Instructed SLA. *Language Learning & Technology* 2(1), 21–39. URL <http://llt.msu.edu/vol2num1/pdf/article1.pdf>.
- Chapelle, C. & Y.-R. Chung (2010). The promise of NLP and speech processing technologies in language assessment. *Language Testing* 27(3), 301–315. URL <http://ltj.sagepub.com/content/early/2010/06/17/0265532210364405.abstract>.
- Díaz Negrillo, A. & J. Fernández Domínguez (2006). Error Tagging Systems for Learner Corpora. *Revista Española de Lingüística Aplicada (RESLA)* 19, 83–102. URL <http://purl.org/net/DiazNegrillo.FernandezDominguez-06.pdf>.
- Díaz Negrillo, A., D. Meurers, S. Valera & H. Wunsch (2010). Towards interlanguage POS annotation for effective learner corpora in SLA and FLT. *Language Forum* 36(1–2), 139–154. URL <http://purl.org/dm/papers/diaz-negrillo-et-al-09.html>.
- Ferreira, A., J. Moore & C. Mellish (2007). A Study of Feedback Strategies in Foreign Language Classrooms and Tutorials with Implications for Intelligent Computer-Assisted Language Learning Systems. *International Journal of Artificial Intelligence in Education* 17.
- Flor, M., Y. Futagi, M. Lopez & M. Mulholland (2014). Patterns of misspellings in L2 and L1 English: a view from the ETS Spelling Corpus. In A.-K. Helland Gujord (ed.), *Proceedings of the Learner Corpus Research Conference (LCR 2013)*. University of Bergen, Bergen Language and Linguistic Studies (BeLLS). To appear.
- Fortmann, C. & M. Forst (2004). An LFG grammar checker for CALL. In R. Delmonte (ed.), *InSTIL/ICALL 2004 Symposium on Computer Assisted Learning, NLP and speech technologies in advanced language learning systems*. Venice, Italy: International Speech Communication Association (ISCA). URL <http://purl.org/net/Fortmann.Forst-04.pdf>.
- Gamon, M., M. Chodorow, C. Leacock & J. Tetreault (2013). Using learner corpora for automatic error detection and correction. In A. Díaz-Negrillo, N. Ballier & P. Thompson (eds.), *Automatic Treatment and Analysis of Learner Corpus Data*, John Benjamins, pp. 127–150.
- Golonka, E. M., A. R. Bowles, V. M. Frank, D. L. Richardson & S. Freynik (2014). Technologies for foreign language learning: a review of technology types and their effectiveness. *Computer Assisted Language Learning* 27(1), 70–105. URL <http://dx.doi.org/10.1080/09588221.2012.700315>.
- Granger, S. (ed.) (1998). *Learner English on Computer*. London; New York: Longman.
- Heift, T. (2001). Error-Specific and Individualized Feedback in a Web-based Language Tutoring System: Do They Read It? *ReCALL* 13(2), 129–142.
- Heift, T. (2008). Modeling Learner Variability in CALL. *Computer-Assisted Language Learning* 21(4), 305–321. URL <http://www.informaworld.com/smpp/content~content=a903255013~db=all>.
- Heift, T. & P. McFetridge (1999). Exploiting the Student Model to Emphasize Language Teaching Pedagogy. In *Natural Language Processing. Computer-Mediated Language Assessment and Evaluation in Natural Language Processing, ACL/IALL*. pp. 55–62.

- Heift, T. & D. Nicholson (2001). Web Delivery of Adaptive and Interactive Language Tutoring. *International Journal of Artificial Intelligence in Education* 12(4), 310–325. URL [http://aied.inf.ed.ac.uk/members01/archive/vol\\_12/heift/paper.pdf](http://aied.inf.ed.ac.uk/members01/archive/vol_12/heift/paper.pdf).
- Heift, T. & M. Schulze (2007). *Errors and Intelligence in Computer-Assisted Language Learning: Parsers and Pedagogues*. Routledge.
- Holland, V., J. Kaplan & M. Sams (eds.) (1995). *Intelligent Language Tutors. Theory Shaping Technology*. New Jersey: Lawrence Erlbaum Associates, Inc.
- Jones, A., S. Bull & G. Castellano (2013). Teacher Perspectives on the Potential for Scaffolding with an Open Learner Model and a Robotic Tutor. In G. Biswas, R. Azevedo, V. Shute & S. Bull (eds.), *Proceedings of Workshop on Scaffolding in Open-Ended Learning Environments*.
- Leacock, C., M. Chodorow, M. Gamon & J. Tetreault (2014). *Automated Grammatical Error Detection for Language Learners*, vol. 25. Morgan & Claypool Publishers, 2 ed.
- L’Haire, S. & A. V. Faltin (2003). Error diagnosis in the FreeText project. *CALICO Journal* 20(3), 481–495. URL <https://www.calico.org/a-290-ErrorDiagnosisintheFreeTextProject.html>.
- Lu, X. (2010). Automatic analysis of syntactic complexity in second language writing. *International Journal of Corpus Linguistics* 15(4), 474–496.
- Lyster, R. & L. Ranta (1997). Corrective Feedback and Learner Uptake: Negotiation of Form in Communicative Classrooms. *Studies in Second Language Acquisition* 19 n1, 37–66.
- MacWhinney, B. (1995). Evaluating foreign language tutoring systems. In Holland et al. (1995), pp. 317–326.
- Meurers, D. (2012). Natural Language Processing and Language Learning. In C. A. Chapelle (ed.), *Encyclopedia of Applied Linguistics*, Oxford: Wiley, pp. 4193–4205. URL <http://purl.org/dm/papers/meurers-12.html>.
- Meurers, D. (2015). Learner Corpora and Natural Language Processing. In S. Granger, G. Gilquin & F. Meunier (eds.), *The Cambridge Handbook of Learner Corpus Research*, Cambridge University Press.
- Michaud, L. N. & K. F. McCoy (1998). Planning Text in a System for Teaching English as a Second Language to Deaf Learners. In *Proceedings of Integrating Artificial Intelligence and Assistive Technology, an AAAI ‘98 Workshop*. Madison, Wisconsin. URL <http://aclweb.org/anthology/W99-0408>.
- Michaud, L. N. & K. F. McCoy (2004). Empirical Derivation of a Sequence of User Stereotypes for Language Learning. *User Modeling and User-Adapted Interaction* 14(4), 317–350. URL <http://www.springerlink.com/content/lp86123772372646/>.
- Michaud, L. N., K. F. McCoy & L. A. Stark (2001). Modeling the Acquisition of English: An Intelligent CALL Approach. In *Proceedings of The 8th International Conference on User Modeling*. Sonthofen, Germany, pp. 14–25. URL <http://www.eecis.udel.edu/research/icicle/pubs/MiMcSt01.ps>.
- Nagata, N. (2002). BANZAI: An Application of Natural Language Processing to Web based Language Learning. *CALICO Journal* 19(3), 583–599. URL <http://www.usfca.edu/japanese/CALIC002.pdf>.
- Nagata, N. (2009). Robo-Sensei’s NLP-Based Error Detection and Feedback Generation. *CALICO Journal* 26(3), 562–579. URL <https://www.calico.org/>

a-762-RoboSenseis%20NLPBased%20Error%20Detection%20and%20Feedback%20Generation.html.

- Ortega, L. (2003). Syntactic complexity measures and their relationship to L2 proficiency: A research synthesis of college-level L2 writing. *Applied Linguistics* 24(4), 492–518.
- Oxford, R. L. (1995). Linking Theories of Learning with Intelligent Computer-Assisted Language Learning (ICALL). In Holland et al. (1995), pp. 359–369.
- Petersen, K. (2010). Implicit Corrective Feedback in Computer-Guided Interaction: Does Mode Matter? Ph.D. thesis, Georgetown University. URL <http://purl.org/net/Petersen-10.pdf>.
- Pujolà, J.-T. (2001). Did CALL Feedback Feed Back? Researching Learners' Use of Feedback. *ReCALL* 13(1), 79–98.
- Quixal, M. (2012). Language Learning Tasks and Automatic Analysis of Learner Language. Connecting FLTL and NLP in the design of ICALL materials supporting effective use in real-life instruction. Ph.D. thesis, Universitat Pompeu Fabra, Barcelona and Eberhard-Karls-Universität Tübingen.
- Ragheb, M. & M. Dickinson (2012). Defining Syntax for Learner Language Annotation. In *Proceedings of COLING 2012*. Mumbai, India, pp. 965–974. URL <http://cl.indiana.edu/~md7/papers/ragheb-dickinson12.html>.
- Reznicek, M., A. Lüdeling & H. Hirschmann (2013). Competing Target Hypotheses in the Falko Corpus: A Flexible Multi-Layer Corpus Architecture. In A. Díaz-Negrillo, N. Ballier & P. Thompson (eds.), *Automatic Treatment and Analysis of Learner Corpus Data*, John Benjamins, vol. 59, pp. 101–123.
- Schulze, M. (2010). Taking ICALL to Task. In M. Thomas & H. Reinders (eds.), *Task-Based Language Teaching and Technology*, Continuum Press, pp. 63–82.
- Vandeventer Faltn, A. (2003). Syntactic error diagnosis in the context of computer assisted language learning. Thèse de doctorat, Université de Genève, Genève. URL <http://doc.rero.ch/getfile.py?docid=215&name=VandeventerA-these&format=pdf&version=1>.
- Weischedel, R. M. & N. K. Sondheimer (1983). Meta-rules as a Basis for Processing Ill-formed Input. *Computational Linguistics* 9(3-4), 161–177. URL <http://aclweb.org/anthology/J83-3003>.
- Wilske, S. (2014). Form and meaning in dialogue-based computer-assisted language learning. Ph.D. thesis, Universität des Saarlandes, Saarbrücken. URL <http://purl.org/icall/wilske-thesis>.
- Wilske, S. & M. Wolska (2011). Meaning versus Form in Computer-assisted Task-based Language Learning: A Case Study on the German Dative. *Journal for Language Technology and Computational Linguistics* 26(1), 23–37. URL [http://media.dwds.de/jlcl/2011\\_Heft1/3.pdf](http://media.dwds.de/jlcl/2011_Heft1/3.pdf).