

# Annual Research Meeting 2005

## International Post-Graduate College *Language Technology & Cognitive Systems*

July 6 – July 15

### Hotel Weingut Weis, Mertesdorf

#### *Wednesday, July 6*

10.00 Departure from Saarbrücken

11.30 Arrival in Mertesdorf

#### **12.00 Lunch**

13.45 Opening

14.00 OANA POSTOLACHE *Experimenting with transferring information structure from Czech to English*

14.40 LÜBOMIRA SPASSOVA *Product associated displays and SearchLight - new developments based on the fluid beam application*

#### **15.20 Coffee Break**

15.50 GARANCE PARIS *Lexico-syntactic influences in spoken-word recognition*

16.30 HARALD HAMMARSTRÖM *Unsupervised learning of morphology*

#### **17.10 Coffee Break**

17.20 SEBASTIAN PADÓ *Cross-lingual bootstrapping of semantic lexica: the case of FrameNet*

#### **18.00 Dinner**

19.00 Games

#### *Thursday, July 8*

#### **08.00 Breakfast**

09.00 KERSTIN HADELICH *Simultaneous tracking of interlocutors in dialogue: evidence for alignment*

09.40 CLARE HUXLEY *An investigation of word order effects on syntactic priming in dialogue*

**10.20 Coffee Break**

10.50 ROBIN COOPER *Does (Gothenburg) dialogue system technology have anything to say about cognitive systems?*

**12.00 Lunch**

13.00 Projects

**18.00 Dinner**

***Friday, July 8***

**08.00 Breakfast**

09.00 DAN SHEN *Studying feature generation from various data representations for answer extraction*

09.40 NURIA BERTOMEU *Towards handling discourse phenomena in question answering: data and implementation*

**10.20 Coffee Break**

10.50 JULIANE STEINBERG *Some thoughts on the connection between vision and language*

11.30 SABRINA HSUEH *In search of lost time: a case study on multimodal meeting records*

**12.10 Lunch**

13.30 ABISHEK ARUN *Lexicalisation in cross-linguistic parsing: the case of French*

14.10 YI ZHANG *Statistical approach towards deep lexical acquisition*

**14.50 Coffee Break**

15.20 DAVID VADAS *Natural language programming*

16.00 Vineyard Tour

**18.00 Dinner**

***Saturday, July 9***

**08.00 Breakfast**

09.00 IVAN MEZA-RUIZ *Dialogue system parsing with context information*

09.40 MARK BUCKLEY *Agent-based dialogue management*

**10.20 Coffee Break**

10.50 IVANA KRUIJFF-KORBAYOVÁ *The Talk Project*

**12.00 Lunch**

13.00 Trip to Trier

***Sunday, July 10***

**08.00 Breakfast**

09.00 DOMINIK HECKMANN *Ubiquitous user modeling*

09.40 ANDI WINTERBOER *Evaluating the effect of information presentation strategies on cognitive load*

**10.20 Coffee Break**

10.50 GREGOR HOFER *Modelling behaviour in conversational agents*

11.30 MICHAEL KRUPPA *Towards explicit physical object referencing with virtual characters*

**12.10 Lunch**

13.00 Departure from Hotel Weis

14.00 Arrival at Lake Losheim

16.30 Departure from Lake Losheim

17.30 Arrival at Schloss Dagstuhl

**18.00 Dinner**

## **Schloss Dagstuhl, Wadern**

***Monday, July 11***

**08.00 Breakfast**

09.00 CHRIS BREW *The breadth and depth of the computational lexicon*

10.10 Projects

**12.00 Lunch**

13.30 Projects

**18.00 Dinner**

19.00 Student Round Table

## ***Tuesday, July 12***

### **08.00 Breakfast**

09.00 ALISSA MELINGER & SABINE SCHULTE IM WALDE *Identifying semantic relations and functional properties of human verb associations*

10.10 Projects

### **12.00 Lunch**

13.30 Projects

### **18.00 Dinner**

19.30 Sports

## ***Wednesday, July 13***

### **08.00 Breakfast**

09.00 SANJEEV KHUDANPUR *Maximum likelihood set for estimating a probability mass function*

### **10.10 Coffee Break**

10.40 ULRIKE PADÓ *Modeling plausibility in human sentence processing*

11.20 SEBASTIAN RIEDEL *Collective relation extraction and named entity recognition with relational graphical models*

### **12.00 Lunch**

13.30 CIPRIAN GERSTENBERGER *Output generation for dialogue systems*

14.10 VERENA RIESER *A corpus collection and annotation framework for learning multimodal clarification strategies*

14.50 Projects

### **18.00 Dinner**

19.30 Projects

## ***Thursday, July 14***

### **08.00 Breakfast**

09.00 MILES OSBORNE *Some progress in conditional random fields*

### **10.10 Coffee Break**

10.40 BARBARA RAUCH *The use of visual information in automatic speech recognition*

11.20 IRENE CRAMER *Semi-supervised entity extraction: initial results*

**12.00 Lunch**

13.30 JOCHEN LEIDNER

*Applying toponym resolution to geographic information retrieval*

14.10 INGMAR STEINER

*Rhythm in speech synthesis: problems in duration modeling*

14.50 Projects

**18.00 BBQ**

***Friday, July 15***

**08.00 Breakfast**

09.00 Projects

**12.00 Lunch**

13.30 Project Presentations

**17.30** Departure

## Invited Talks – Titles and Abstracts

### **CHRIS BREW: *The breadth and depth of the computational lexicon***

What should computational lexical resources be like? If resources were no constraint, what aspects of the syntax, semantics, phonetics, pragmatics and sociolinguistics of language would be encoded in the lexicon? Going beyond subcategorization, diathesis alternations, selectional preferences, lexical/semantic classes, qualia structure, lexical ontologies, semantic roles and word senses, all of which are well studied in computational lexical semantics, what else should there be? Topics addressed will include Greek babies, German verbs, English swearwords and spoken language morphology, all from a computational perspective.

### **JUSTINE CASSELL: *Making (Virtual) Friends and Influencing (Virtual) People***

Harmony or rapport between people is essential for relationships as diverse as seller-buyer and teacher-learner. In this talk I describe the kinds of verbal behaviors -- such as common interactional structures and narrative resonance -- and non-verbal behaviors—such as attention, positivity, and coordination -- that function together to establish a sense of rapport between two people in conversation. These studies are used as the basis for the implementation of virtual peers - adults, but also more recently embodied conversational virtual children who are capable of acting as friends and learning partners with real children from different ethnic traditions, collaborating to tell stories from the child's own cultural context, and aiding children in making the transition between home and school language.

### **JUSTINE CASSELL: *Gesture Morphology and Semantics in Humans and Virtual Humans***

It is a commonly held belief in the gesture research community that gestures differ from language in that they have no syntax (meaning structure over the individual gesture) nor morphology (meaning structure within the individual gesture). In this talk I challenge that belief with data from a study on the sub-parts of gesture, and multi-part gestures, during direction-giving. On the basis of these data, I propose a framework to analyze gestural images into semantic units (image description features), and to link these units to morphological features (hand shape, trajectory, etc.). Such a feature-based framework has an additional benefit, which is to allow one to generate gestures and language together in a virtual human. I will describe work on an integrated computational microplanner for multimodal descriptions that derives the form of both natural language and gesture directly from communicative goals. One outcome of this approach is that gesture and language can also both be considered on an equal footing for other parts of the dialogue system, such as updating the discourse model.

The outcome of the empirical work and the computational modeling is a direction-giving virtual human - an embodied conversational agent that can perform appropriate speech and novel gestures in direction-giving conversation with real humans.

**ROBIN COOPER: *Does (Gothenburg) dialogue system technology have anything to say about cognitive systems?***

In this talk I will present some work going on in the Göteborg University Dialogue Systems Lab (<http://www.ling.gu.se/grupper/dialoglab/>) partly conducted within the EU project TALK (<http://www.talk-project.org/>). We will look at aspects of the work which may have relevance for cognitive systems and will try to suggest some preliminary hypotheses that could be tested experimentally.

There are two main areas of inquiry. The first relates to the information state update approach to dialogue and in particular issue based dialogue management. One relevant question here concerns the cognitive load associated with the accommodation of questions and plans. Another concerns the timing and coordination of feedback utterances. The second area of inquiry relates to the formulation and use of grammar in dialogue systems. Some issues here concern the use of families of grammars (as opposed to a single monolithic grammar for a single language), for example distinct grammars for production and recognition, or for different activity domains. This leads to a view of semantics as being local to domains. Another issue concerns the coordination of speech with other modalities. It appears that some gestures are more tightly coordinated with speech than others.

**SANJEEV KHUDANPUR: *Maximum Likelihood Set for Estimating a Probability Mass Function***

A novel solution is presented to a recurring problem in statistical modeling of natural language -- the estimation of a probability mass function (pmf) for a discrete random variable from a small training sample. The solution naturally leads to smooth pmf estimates, requires no held out data, nor makes any prior assumptions about the unknown pmf, while still providing a way to incorporate certain kinds of prior knowledge when available. A pmf is deemed admissible as an estimate if it assigns merely a higher likelihood to the observed value of a sufficient statistic than to any other value possible for the same sample size. The maximum likelihood estimate is trivially admissible by this definition, but so are many other pmfs. An estimate is selected from this admissible family via criteria such as maximum entropy or minimum K-L divergence. Empirical results in statistical language modeling are presented to demonstrate that estimates obtained in this manner have performance that is competitive with state-of-the-art estimates, and have additional desirable properties not found in the state-of-the-art. The method itself applies to many other problems in natural language processing.

**MILES OSBORNE: *Some progress in Conditional Random Fields***

Conditional Random Fields (CRFs) are state-of-the-art models for predicting labels sequences over example sequences. For example, they can be used for Part-of-Speech taggers, named entity extraction or even parsing (when the labels are trees and not chains). Unfortunately, CRFs have a number of practical problems: they tend to overfit and also do not scale-well in terms of the number of possible labels.

In this talk --which will not be that technical-- I will present novel techniques for dealing with both of these problems. For overfitting, instead of adding a prior to the CRF, we instead show how a prior-like effect can be obtained simply by using a set of CRFs and labelling examples using a weighted average of those CRFs. The resulting model is called a logarithmic opinion pool (LOP). LOPs have roots in management science and are related to Products of Experts. LOPs can have no hyperparameters to fix and so represent a non-parametric approach to smoothing.

The second part of the talk will deal with scaling CRFs. CRFs have a squared complexity in the number of labels and this means that to date, they have been restricted to tasks with only a few (for example five) labels. We show how CRFs can scale to predicting many labels by decomposing a CRF into a set of binary CRFs (those which predict just two labels) and then reconstructing the desired label using those binary CRFs. This process uses error-correcting coding as a robust way to use relatively few binary classifiers when encoding the true label. As a result, the complexity of CRF estimation can easily be cut in half with no significant loss in performance.

Joint work with Andrew Smith and Trevor Cohn.



# Student Projects

## **PROJECT 1: *Running language experiments on the web***

Participants: Dominik Heckmann, Clare Huxley, Ulrike Padó, Garance Paris

Description: This project will be a hands-on introduction to running language experiments on the web. The idea is to illustrate several research paradigms and some aspects of experimental design. The research question in the background will investigate how the level of bilingual/non-native participants can be best evaluated in psycholinguistic experiments, given that there are many approaches in the literature, but no consensus. We will use available tools or PHP scripts, and compare the results obtained with existing experimental materials, to see if their results correlate.

## **PROJECT 2: *An emotion tagger for German***

Participants: Kerstin Hadelich, Gregor Hofer, Michael Kruppa, Barbara Rauch, Verena Rieser, Lúbmira Spassova, Ingmar Steiner

Description: In this project we are investigating the use of lexical, syntactic, dialogue, prosodic and acoustic cues to enable a dialogue to automatically predict and respond to user emotions. We will use data gathered in a Wizard-of-Oz experiment in Saarbruecken. First we will manually annotate user emotions in these dialogues, identifying linguistic and paralinguistic cues to the annotations, and using machine learning to predict emotions from potential cues. Several models and techniques are possible and needs to be discussed.

These results can be used for deriving strategies for adapting the system's strategies based upon emotion identification. The major scientific contribution will be an understanding of whether cues available to spoken dialogue systems can be used to predict emotion, and ultimately to improve dialogue performance. The results will be of value to other applications that can benefit from monitoring emotional speech.

## **PROJECT 3: *Generating recipes using language modelling***

Participants: Irene Cramer, Ciprian Gerstenberger, Dan Shen

Description: In this project we are to investigate domain specific text generation using language modelling. The goal of our project is to implement a recipe generation system that allows the user to input the ingredients, and outputs a readable and cookable recipe. The system will have three basic components. The first is the text planning component, which defines the text constituting information bits and their relation based on the ingredients. The second is the sentence planning component; it combines the information bits into several sentences. Last but not

least the linguistic realiser generates morphological and syntactic correct surface structures of the sentences. The project will be data driven that is to say we will train two language models one for the text planning component and another for the sentence planning component.

#### **PROJECT 4: *'Breaking the pipeline': integrated parsing and spatial reference resolution***

Participants: Abishek Arun, Jochen Leidner, Ivan Meza-Ruiz, Sebastian Riedel, David Vadas, Yi Zhang

Description: The goal of this project to explore the resolution of spatial expressions while tightly integrating visual context into the parsing process. We will use information about the probable spatial expressions to to bias the parse and information about probable parses to bias the spatial expression resolution. Markov Networks are well known to deal with probabilistic information flowing in several directions. However, they can be hard to manually setup therefore we will use Markov Logic to define these networks with weighted first order logic formulae. The spatial context will be a 3D video game scene. For evaluation we plan to collect a corpus of spatial expressions which will be fed into our system to measure the impact of our approach. The baseline will be a pipeline architecture where the parser feeds the resolution process in uni-directional fashion.

#### **PROJECT 5: *The interplay between information structure and coreference***

Participants: Nuria Bertomeu, Mark Buckley, Sabrina Hsueh, Oana Postolache, Juliane Steinberg, Andi Winterboer

Description: This project aims to investigate the correlations between the Information Structure of the sentence and coreference. We intend to verify the hypothesis according to which, most of the times, coreferent entities belong to the topic/thematic part of the sentence and, when this is not the case, to detect phenomena that require (or lead to) the appurtenance of these entities to the focus/rhematic part of the sentence. We want to see whether there is a correlation between the choice of referential expression and the information status of the entity in the sentence, or if the choice of referential expression depends only on salience and ambiguity.

We also want to find out whether Information Structure and reference transition chains influence each other, e.g., if an abrupt shift between two utterances happens when the current utterance is all rheme or if a rhematic subject triggers a shift. Finally, we could also look at cases of ellipsis. We want to investigate whether remnants of ellipsis are always focus or they can also be topic, and in which circumstances.

In order to address all these questions we intend to build semi-automatically a small corpus annotated with aspects of Information Structure and coreference.