Report: ISCA Distinguished Lectures 2012 in Nov. and Dec. 2012

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Title and Abstract

Title:
The Statistical Approach to Speech Recognition and Natural Language Processing: Achievements and Open Problems

Abstract:
The last 25 years have seen a dramatic progress in statistical methods for recognizing speech signals and for translating spoken and written language. This lecture gives an overview of the underlying statistical methods. In particular, the lecture will focus on the remarkable fact that, for these tasks and similar tasks like handwriting recognition, the statistical approach makes use of the same four principles:

- Bayes decision rule for minimum error rate;

- probabilistic models, e.g. Hidden Markov models or conditional random fields for handling strings of observations (like acoustic vectors for speech recognition and written words for language translation);

- training criteria and algorithms for estimating the free model parameters from large amounts of data;

- the generation or search process that generates the recognition or translation result.

Most of these methods had originally been designed for speech recognition. However, it has turned out that, with suitable modifications, the same concepts carry over to language translation and other tasks in natural language processing. This lecture will summarize the achievements and the open problems in this field.

Visits and Lectures

Here is a summary of the visits and lectures I gave as an ISCA Distinguished Lecturer in November and December 2012. The four lectures were very similar to each other. The most extensive lecture was the lecture given at HKUST in Hong Kong. The slides are available as a separate pdf document.

Slovenia:

- **University of Maribor**
  Faculty of electrical engineering and computer science
  Date: 6-Nov-2012
  Host: Prof. Zdravko Kacic (kacic@uni-mb.si)
  audience: mainly students and scientists from electrical engineering and computer science

- **University of Ljubljana**
  Faculty of Electrical engineering
  Date: 9-Nov-2012
  Host: Prof. Petek Bojan (bojan.petek@ntf.uni-lj.si)
  audience: a wide range of students and scientists of the university including the linguistic departments

- topics of discussion during both lectures and during the subsequent lab visits:

  - renaissance of (deep) neural nets
  - limited resources for Slovenian, in particular problems with rich morphology
  - general concepts of the statistical approach vs. Chomsky's approach

Hong Kong:

- **CUST:** The Chinese University of Science and Technology
  Department of Systems Engineering and Engineering Management
  Date: 3-Dec-2012
  Host: Prof. Helen Meng (hmmeng@se.cuhk.edu.hk)
  audience: students and scientists from electrical engineering and computer science

- **HKUST:** The Hong Kong University of Science and Technology
  Department of Computer Science and Engineering
  Date: 4-Dec-2012
  Hosts: Prof. Dekai Wu (dekai@cs.ust.hk) and Prof. Pascale Fung
  audience: students and scientists from engineering and computer science

- topics of discussion during the lectures and during the subsequent lab visits:

  - differences between processing for spoken and written language
  - use of pitch frequency in acoustic vector for ASR
  - use of neural networks and their specific arcitecture for ASR including feedforward MLP vs. recursive bidirectional LSTM