Automatic Speech Recognition (ASR)

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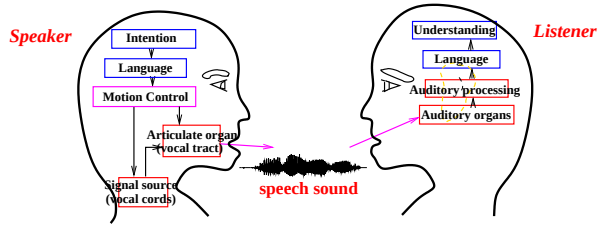
Centre for Speech Technology Research (CSTR)

Semester:	**2 (*12/Jan/2009 – 27/Mar/2009*)**
Credit Level:	**11**
Credit Points:	**10**
Pre-requisite course:	**SP (PPLS)**
Date & Time:	**Monday, Thursday, 15:00-15:50**
Room:	**AT 4.12**
Course web page:	
	http://www.inf.ed.ac.uk/teaching/courses/asr/

What is ASR ?

Research on speech processing:

- **Science** Reveal mechanisms or rules how humans
  - generate speech
  - recognise speech
  - communicate each other with the help of speech
- **Engineering** develop systems that
  - synthesise speech like real humans
  - recognise / understand humans speech like humans do
  - provide natural human-computer interface



Why learning ASR is important ?

- **SR is one of the typical human intelligent activities.**

  ASR: finds practical ways of how machines can imitate the activities

- **Tackling real world problems ↔ toy problems**

  ↓

  complex / mixed research domains
  - audio signal processing
  - pattern recognition / machine learning
  - natural language processing
  - speech understanding
  - dialogue control / planning
  - system integration

  → key idea: statistical approach, optimisation

Why learning ASR is important ? *(cont. 2)*

- **Impacts**
  - **signal processing: LPC, PARCOR**
  - **pattern recognition: DP**
  - **machine learning: HMM, GMM**
  - **language processing: statistical LM (n-gram)**

Course description

SP (PPLS) : intuitive introduction to ASR + TTS
← pre-requisite courses

ASR (Informatics) : practical ASR
more theories, algorithms and maths !
+
experiments (developing an ASR system)

- Recommended courses: "Learning from Data" (LFD), "Probabilistic Modelling and Reasoning" (PMR), "Empirical Methods in Natural Language Processing" (EMNLP),
- Assessment weighting:

  Written examination: 70%
  Assessed assignments: 30% **(one assignment)**

Schedule

Week	Monday		Thursday	
1	12.Jan	Signal analysis	15.Jan	Signal analysis
2	19.Jan	Statistical PR	22.Jan	*LAB*
3	26.Jan	Statistical PR	29.Jan	*LAB*
4	02.Feb	HMM	05.Feb	HMM
5	09.Feb	Context-dependent model 1	12.Feb	Context-dependent model 2
6	16.Feb	Lexicon and language model	19.Feb	*LAB*
7	23.Feb	Search and decoding	26.Feb	*LAB*
8	02.Mar	Speaker adaptation 1	05.Mar	*LAB*
9	09.Mar	Speaker adaptation 2	12.Mar	Case study
10	16.Mar	Current topics	19.Mar	Review
11	23.Mar	(no lecture)	26.Mar	(no lecture)

Week 1 – 3 & Labs	Week 4–11
H.Shimodaira	S.Renals

Reference Texts

- for basic understanding:
  - John N. Holmes, Wendy J. Holmes, "Speech Synthesis and Recognition", Taylor and Francis (2001), 2nd edition
- for deep understanding:
  - Xuedong Huang, Alex Acero and Hsiao-Wuen Hon, "Spoken language processing: a guide to theory, algorithm, and system development", Prentice Hall (2001).
  - Lawrence R. Rabiner and Biing-Hwang Juang, "Fundamental of Speech Recognition", Prentice Hall (1993).
  - B. Gold, N. Morgan, "Speech and Audio Signal Processing: Processing and Perception of Speech and Music", John Wiley and Sons (1999).

Before start ...

- There are a lot of maths!
  No need to understand them in details, but try to get ideas.
- Lectures (as in syllabus) + Lab sessions (exercises)
  - Lab session:
    - Analysis of speech signals
    - Generative models (GMM and EM-algorithm)
    - Continuous speech recognition
    - Language models
    - Continuous speech recognition system
- Contact information

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