Speech Signal Processing 2007

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1 Administrativa

Master	General Linguistics
Module	Speech Signal Processing
Code	TW8523
Points	5 ECTS
Precondition	Bachelor, reasonable mathematical background or affinity
Period	Semester 1, blocks 1 and 2 (sept–dec 2007)
Information	Onderwijssecretariaat Taal- en Letterkunde also IFA teaching also The page in the *studiegids*
Teacher	David Weenink
Time & Place	Wednesdays 17:00–19:00, PCH 104-A
Language	English

2 Contents

Getting students familiar with the techniques used in speech signal analysis, speech synthesis and speech recognition. This year we will work towards the generation of artificial signals and test different kind of formant frequency analysis methods.

2.1 Goals

The following goals:

- The making of noise-free recordings of good quality.
- Speech coding and compression.
- Spectral analyses like band filter analysis and Fourier spectra.

- Filtering and convolution.
- Autocorrelation and pitch determination.
- Performing analyses automatically by scripting.

2.2 Examination

Weekly assignments and final assignment. All weekly assignments have to be fulfilled to be able to participate in the final assignment.

3 The weekly classes

3.1 Week 1: Wednesday, September 5, 2007

Contents: Administrativa. Recapitulation of signals. Fourier analysis. Recording.
The handout and the assignment for this week.

3.2 Week 2: Wednesday, September 12, 2007

Contents: Acoustic Theory of Speech Production.
The handout for this week.
The assignment about making a recording in the studio.
The assignment about the glottal source signal.

3.3 Week 3: Wednesday, September 19, 2007

Contents: Frequency-domain analysis of Digital Speech Signals (Harrington & Cassidy, 1999, Chapter 6).

3.4 Week 4: Wednesday, September 26, 2007

Contents: Complex numbers, Frequency and time domain analysis (Harrington & Cassidy, 1999, Chapters 5&6). The handout for this week.
The assignment for this week.

3.5 Week 5: Wednesday, October, 3, 2007

Contents: Digital Filters, Pre-emphasis, Formant Filters.
(Harrington & Cassidy, 1999, Chapter 7)
The assignment for this week. The handout for this week.

3.6 Week 6: Wednesday, October, 10, 2007

Contents: Linear prediction I. (Harrington & Cassidy, 1999, Chapter 8, except 8.5, 8.6)
The handout for this week. The assignment for this week.

3.7 Week 7: Wednesday, October, 17, 2007

Contents: Fundamental Frequency and Pitch Analysis. PRAAT's pitchanalysis as described in boersma (1993).
The handout for this week.

3.8 No class: Wednesday, October, 24, 2007

3.9 Week 8: Wednesday, October, 31, 2007

Contents: Linear prediction II. Robust linear prediction Lee (1988).
The handout for this week.
The assignment for this week.

3.10 Week 9: Wednesday, November, 7, 2007

Contents: Bandfilter analysis. Vergin & O'Shaughnessy (1999).
The handout for this week.

3.11 Week 10: Wednesday, November, 14, 2007

Contents: Classification of speech data (Harrington & Cassidy, 1999, Chapter 9)
The handout for this week.
The assignment for this week.

3.12 Week 11: Wednesday, November, 21, 2007

Audio and speech compression.
Peter Noll, "MPEG Digital Audio Coding", *IEEE Signal Processing Magazine*, September 1997, 59–81.
Jean-Marc Valin, Speex: A free codec for free speech, http://www.speex.org/
The handout for this week.
The assignment for this week. (Simultaneous masking.)

3.13 Week 12: Wednesday, November, 28, 2007

3.14 Week 13: Wednesday, December, 5, 2007

No class.

3.15 Week 14: Wednesday, December, 12, 2007

Contents: Relation formant frequencies and principal components. Chapters 3, 7, minus the mathematical parts, and chapter 8 from Weenink (2006).
Downloadable from http://www.fon.hum.uva.nl/david/ma_ssp/2007/thesis_djmw_2006.pdf
The TIMIT-data are available here.
The assignment for this week.

4 Changes

20070904: Initial version.
20070913: Week 2.
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20071014: Opgave 5
20071017: Week 7
20071031: Week 8
20071106: Week 9
20071107: Week 10
20071119: Link naar Vergin & O'Shaughnessy. 20071123: Assignment 8

References

Harrington, J. & S. Cassidy (1999): *Techniques in Speech Acoustics*, Kluwer Academic Publishers.

Lee, C.-H. (1988): "On robust linear prediction of speech", *IEEE Trans. on Acoustics, Speech, and Signal Processing* **36**: 642–649.

Weenink, D. (2006): *Speaker-adaptive vowel identification*, Ph.D. thesis, University of Amsterdam.