

# Speech Signal processing 2011

David Weenink

February – March 2011

## 1 Administrativa

Master	General Linguistics
Module	Speech Signal Processing
Code	TW85231
Points	5 ECTS
Precondition	Master, reasonable mathematical background or affinity
Period	Semester 2, block 1 (February–March 2010)
Information	Onderwijssecretariaat Taal- en Letterkunde also IFA teaching also The page in the studiegids
Teacher	David Weenink
Time & Place	Wednesday 9:00–12:00, PCHoofthuis K.05
Language	English
Book	SSPBook:D.J.M. Weenink, Speech signal processing by Praat, To be published in 2011 (book will change during the course, don't print it)

## 2 Contents

Getting students familiar with advanced techniques used in speech signal analysis, speech synthesis and speech recognition. This year we will work towards the generation of artificial signals and test relation between formant frequency analysis and bandfilter methods on the TIMIT database.

### 2.1 Goals

The following goals:

- Spectral analyses like band filter analysis and Fourier spectra.

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

## **2.2 Examination**

Weekly assignments and final assignment. All weekly assignments have to be fulfilled to be able to participate in the final assignment. Communication via BlackBoard>Assignments.

## **3 The weekly classes**

### **3.1 Week 1, Wednesday February 2**

Administrativa. Recapitulation of signals, sine, cosine, phase and sampling.

Scripting

Literature: Mathematics: Weenink (2011, Ch. 1,2,3,4 and App. A & B).

### **3.2 Week 2, February 9**

Spectra

Theory: SSPBook chapter 7 on spectra;

Assignment 1.

### **3.3 Week 3, February 16**

Theory: Klatt and Klatt (1990); Klatt (1980) and Weenink (2011, ch. 11: KlattGrid)

Information on synthesis of stop-liquid clusters see (Williams, 1996).

CV and C synthesis/analysis see Harrington and Cassidy (1999, Ch. 4)

See [http://www.fon.hum.uva.nl/david/ma\\_ssp/doc/](http://www.fon.hum.uva.nl/david/ma_ssp/doc/) for these articles.

Assignment 2.

### **3.4 Week 4, February 23**

More synthesis.

Assignment 3.

### 3.5 Week 5, March 2

Theory: Discriminant and Principal component analysis Weenink (2006, Ch 3, especially 3.5).

Assignment 4.

### 3.6 Week 6, March 9

Theory: The TIMIT acoustic phonetic database Weenink (2006, Ch 8).

Bandfilter analysis, Pich analysis, Discriminant analysis, PCA

### 3.7 Week 7, March 16

Canonical correlation zie Weenink (2011, Ch. 7).

## References

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

Klatt, D. H. (1980): “Software for a cascade/parallel formant synthesizer”, *J. Acoust. Soc. Am.* **67**: 971–995.

Klatt, D. H. and L. C. Klatt (1990): “Analysis, synthesis, and perception of voice quality variations among female and male talkers”, *J. Acoust. Soc. Am.* **87**: 820–857.

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

URL: [http://www.fon.hum.uva.nl/david/thesis\\_djmw.pdf](http://www.fon.hum.uva.nl/david/thesis_djmw.pdf)

Weenink, D. J. (2011): *Speech Signal Processing by Praat*, To be published.

URL: <http://www.fon.hum.uva.nl/david/sspbook/sspbook.pdf>

Williams, D. R. (1996): “Synthesis of initial (/s/-) stop-liquid clusters using Hlsyn”, in *Proc. ICSLP 1996*, 2219–2222.