

**General module information**

Title: Sound and Music Signal Analysis

Type: course module

Language of instruction: English

ECTS points: 5 ECTS

Period: 1 February 2016 — 30 June 2016

Placement

2nd semester, M.Sc. in Sound and Music Computing

Module coordinator

Aalborg: Mads Græsbøll Christensen (coordinator)

Academic content and relationships to other modules/semesters

The formal study plan description of the module can be found here (page 16):

http://www.sict.aau.dk/digitalAssets/101/101055_94332_kandidat-lyd--og-musik.pdf

The course introduces the fundamentals sound and music analysis: 1) methods required to perform analysis of sound and music signals; 2) representations commonly used in sound and music analysis; 3) various analysis tasks involving sound and music representations. The first part focuses on the basic methods, e.g., spectral analysis, parameter estimation, audio decomposition methods, filterbanks, etc. The second part includes commonly used representations for characterizing sound and music signals, e.g., parametric models, spectrograms, mel-frequency cepstral coefficients, chromagrams, and source-filter models. The third part focuses on examples of sound and music analysis tasks, e.g., tuning of musical instruments, transcription of music, key and chord detection, and modification of sound and music signals.

Objectives and learning goals**Knowledge**

- Must be able to understand and describe spectral analysis, parameter estimation, methods for audio decompositions, and filterbanks.
- Must be able to understand the assumptions upon which various methods and representations are based.
- Must be able to distinguish between pitch, loudness and timbre, and explain how these relate to the various representations.
- Must be able to understand and identify how audio analysis tasks relate to human sound perception, and characteristics of music and sound.

Skills

- Must be able to analyze and explain the tools and representation used for a given sound and music analysis task.
- Must be able to select, implement and apply selected methods for analysis of sound and music signals.
- Must be able to evaluate the performance and properties of the selected methods and



representations for sound and music analysis.

- Must be able to explain and argue for the assumptions made when using particular tools and representations for sound and music analysis.

Competences

- Must be able to understand and evaluate research in the area of sound and music signal analysis.
- Must be able to discuss and evaluate the appropriateness of various representations for a given sound and musical analysis task.
- Must be able to choose between and judge methods and representations for sound and music analysis.

Extent and expected work load

The total workload is 5 ECTS. The course is organized as approximately 12 lectures with exercises and individual project work. It is broken down preparation for sessions 1 ECTS, lectures 1 ECTS, exercises for sessions 1 ECTS, and 2 ECTS work on an individual project and preparation for the exam.

Pre-requisites for participation

The prerequisites for the course module are the mandatory courses on previous semesters of the M.Sc. program in Sound and Music Computing.

The prerequisites for participation are listed in the study plan:

http://www.sict.aau.dk/digitalAssets/101/101049_10209_medialogi--aalborg--esbjerg-og-k--benhavn--2010.pdf

It is important that the students have completed the following courses:

- Multivariate Statistics and Pattern Recognition
- Sound Processing

Examination

As part of the course, each student is required to complete an individual 2 ECTS project in which contents covered in the course is applied to a problem of relevance to Sound and Music Computing. The oral exam will be based on this project and the theory covered in the lectures. In the project, the student must solve a sound and music signal analysis problem, like recognition of musical instruments, tuning, transcription, key and chord detection, model-based synthesis. This could involve, for example, spectral analysis, model-based approaches, chromagrams, and MFCCs. The student must demonstrate that he/she understands the involved theory, concepts and methods.

In summary, the project and the presentation must at least satisfy the following criteria:

- An application of sound and music signal analysis must be picked and described (e.g., a classification or information retrieval task).
- Sound and music signal analysis must be performed using the methods covered in the course.
- The theory behind the analysis must be described in detail.

Failure to meet these criteria will lead to an automatic failed grade. The exam will be an individual 20 minutes (everything included) oral exam. It will be based on the project (practice) and the contents of the lectures (theory). The student will present the project to the examiner who will ask questions about the project and the general curriculum. The student must prepare a demonstration of the sound processing and a set of slides for presenting the project and the background theory. The source code used in the project must be available at the exam. **To attend the exam, the presentation must be uploaded in**



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moodle before the specified deadline. Failure to comply with the requirements specified here will result in a failed grade. The grade will depend on the quality of the project, the presentation, and the ability of the student to answer questions in relation to the project and the course contents in relation to both theory and practice.

To ensure a consistent grading, we propose that lecturers act as examiners for other campuses for a maximum of one day with any remaining exams being handled by local staff members.