

MUSI 6201

Computational Music and Audio Analysis

Syllabus Fall 2015

Contact

- **Lecturer**

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- **Teaching Assistance**

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1 Credits and Hours

3 credit hours

Lecture: Mon and Wed, 3:05–4:25pm in Couch 102

2 Course Description and Objectives

Introduction to the software-based analysis of digital music signals. This course covers the basic approaches for musical content analysis and teaches students to approach this class of problems and think algorithmically. Topics include pitch tracking, beat tracking, audio feature extraction, and genre classification. The classes focus is on the audio signal processing part of music information retrieval.

3 Learning Outcomes

After successful completion of the class, the students will demonstrate

- an understanding of typical analysis approaches for audio and music signals,
- the ability to use this understanding to design MIR systems for music analysis, and
- the ability to implement such designs in a programming language such as Matlab.

4 Prerequisites

The course will be open to any interested students. Prior coursework or experience in (digital) signal processing and machine learning is expected. Programming experience and familiarity with Matlab will be helpful.

5 Procedures

Class will meet two times weekly, see Sect. 1. Attendance is expected but not factored into your grade if not mentioned otherwise below. Additional or alternate lab times may be arranged with the instructor.

6 Course Materials

6.1 Text Book

The class will be based on the following text book:

Alexander Lerch (2012), *An Introduction to Audio Content Analysis: Applications in Signal Processing and Music Informatics*, Jon Wiley & Sons, Hoboken

It is available electronically here (access to this site may be restricted from off-campus):
ieeexplore.ieee.org/servlet/opac?bknumber=6266785

6.2 Recommended Reading

- Li, T., Ogihara, M. and Tzanetakis, G. (Eds.) (2012), *Music Data Mining*. CRC Press
- Klapuri, A. and Davy, M. (Eds.) (2006), *Signal Processing Methods for Music Transcription*. Springer
- Mueller, M. (2007), *Information Retrieval for Music and Motion*. Springer

6.3 Software

The assignments and project work will be done in Matlab. Note the following license information:

www.matlab.gatech.edu

Other tools and programming languages can be used if approved by the instructor.

7 Method of Evaluation

The overall grade consists of:

- **25% assignments:**
Assignments will be posted according to the tentative schedule outlined in Sect. 8. All assignments will contribute to the assignment grade with equal weight.
- **25% quizzes:**
Quizzes might take place unannounced at any time during the semester. The overall number of quizzes will be between 5 and 15. Each student will have one “joker”, meaning that the worst result will be discarded and will not contribute to the overall grade.
- **5% participation**
- **10% mid-term exam**
- **5% mid-term presentation:**
Each group (2 students) will present project overview including a status report, related publications, current and future work, and a time schedule.
- **30% project:**
Each group (2 students) will work on a class project. The core of this project has to be an MIR algorithm, but there is no additional restrictions: it might be a research project, an application for a specific task, etc. The overall project grade will consist of

- 50% algorithmic design and implementation
- 30% final paper
- 20% final poster presentation & project demo

7.1 Grading and Grading Policies

All assignments, papers, presentations, projects, quizzes, and exams will be graded in points. The final grade for the course will be determined by dividing the total points earned by the number of points possible for each of the categories listed above. These numbers will be converted into a grade according to the following scale:

- $A = 100 - 90\%$
- $B = 89 - 80\%$
- $C = 79 - 70\%$
- $D = 69 - 60\%$
- $F = 59\%$ and below.

Grades may be assigned per group or individually as announced (e.g., projects are in most cases per group, quizzes are usually per individual). Students are encouraged to support each other, but each submission has to be clearly executed by the individual/group being graded. More specifically, two or more individuals/groups handing in the same code/answers will be reported for academic misconduct (see Sect. 9).

All assignments, papers and other artifacts are due **ON THE DUE DATE**. The due date will be announced per assignment on t-square. A penalty of **TEN POINTS PER DAY** will be applied to all late assignments and late project papers. Documented illnesses and family emergencies are excepted, of course. Quizzes and exams cannot be made up unless you have a valid, documented excuse.

8 Course Outline

The class will be structured into the following parts: the lecture, the in-class exercises, the assignments, and the project work. The tentative schedule, subject to change, is:

Week	Topics	Exercise	Assignment
1	introduction	Matlab	
2	fundamentals (convolution, correlation, Fourier)	spectrogram	ACF pitch tracking
3	instantaneous features, feature selection	features, PCA	
4	peak and loudness features	PPM, RMS	
5	pitch tracking	HPS, AMDF	
6	key detection, chord detection	pitch chroma	
7	onset detection	onset detection	onset detection
8	tempo and downbeat detection	tempo detection	
9	mid-term exam		
10	mid-term project presentation		
11	genre and mood classification	regression	genre classification
11	audio alignment	DTW & Viterbi	
12	audio fingerprinting		
13	audio structural analysis		structure detection
15	music performance analysis		
16	project presentation		
17	poster presentation		

9 Academic Integrity

Students must do their own work on assignments, projects, and tests unless collaboration is previously specified and approved by the instructor. Students caught cheating will receive zero credit for that assignment/quiz/test and may be subject to further sanctions through the Office of Student Integrity. Students are expected to abide by the Georgia Tech Honor Code and avoid any instances of academic misconduct, including but not limited to:

- Possessing, using, or exchanging improperly acquired written or oral information in the preparation of a paper or for an exam.
- Substitution of material that is wholly or substantially identical to that created or published by another individual or individuals.
- False claims of performance or work that has been submitted by the student.

Please refer to the published Georgia Institute of Technology Academic Honor Code for further information:

www.honor.gatech.edu/content/2/the-honor-code

10 Statement regarding Students with Disabilities

In accordance with the Americans with Disabilities Act, students with bona fide disabilities will be afforded reasonable accommodation. The ADAPTS Office will certify a disability and advise faculty members of reasonable accommodations. The web site for a student requesting accommodation is:

www.adapts.gatech.edu/faculty_guide/sturespon.htm

11 Statement regarding Changes in Course Requirements

Since all classes do not progress at the same rate, it may be necessary to modify the above requirements or their timing as circumstances dictate. For example, the number and frequency of exams may be changed, or the number and sequence of assignments will be altered. In either of these cases, adequate notification will be given in writing and be discussed in class.