San José State University
Department of Computer Science
CS185C, Section 01

Music Information Retrieval

Fall 2017

Course and Contact Information

Instructor:	Vidya Rangasayee
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Office Hours:	T/Th 12:30-1:20 PM. Additional hours by appointment only
Class Days/Time:	MW 13:30 - 14:45
Classroom:	MH 225
Prerequisites:	CS146 (or equivalent knowledge of data structures).
GE/SJSU Studies Category:	

Course Format : Technology Intensive, hybrid.

Faculty Web Page and MYSJSU Messaging: We will use Canvas for all class related materials. Discussions will be facilitated via Piazza. Any general questions must be posted on Piazza for benefit of others. Any specific/personal questions (grade related or personal situations) must be communicated via email.

Course Description

Goal: To understand the field of Music Information Retrieval (MIR). To understand the fundamentals of audio signals and use information from these signals to build intelligent audio systems using MIR algorithms. Use the MIR techniques and machine learning to solve problems in the broad area of music discovery and recommendations.

Topics covered will include fundamentals of audio signals, extracting low level audio features, building higher audio features such as tempo, pitch, genre, mood etc., using machine learning, both supervised and unsupervised, as applied to MIR.

Course Topics

Music representation, temporal and spectral features of audio signal, higher audio features (rhythm, tempo, melody, pitch), machine learning, classification - kNN, SVM, random forest, clustering - k-Means, Instrument classification, Synchronization, Source separation, Music datasets, sonification.

Course Objectives:

- To introduce students to fundamentals of music representation and audio signals
- To introduce students to structured approach to machine learning such as feature extraction, normalization, model selection, testing and evaluation.
- To help students understand the differences between supervised vs unsupervised machine learning
- To introduce students to standard machine learning algorithms such as nearest neighbors, Support Vector Machines, Mixture models, k-Means etc.
- To enable students to apply these techniques to solve problems in music recommendations, classification, source separation etc..
- To introduce students to public music datasets, as well as building their own and using them for research purposes.
- To introduce students to music transcription and sonification.

Course Learning Outcomes (CLO):

Upon successful completion of this course, students will be able to:

- Analyze a given audio signal and extract temporal and spectral features
- Use existing audio signal libraries such as librosa, essentia etc
- Understand the difference between various music formats such as wav, mp3 etc as well as other music representations such as midi, MusicXML etc.
- Extract low and high level features from audio signals and interpret pitch, melody rhythm etc.
- Implement supervised machine learning algorithms for classification - instrument classification, genre classification etc
- Implement unsupervised machine learning algorithms for clustering, source separation
- Understand techniques involved in music sonification and transcription.
- Create and/or use music datasets for all of the above.

Optional Texts/Readings

Textbook

Fundamentals of Music Processing

Author: Muller, Meinard

ISBN: 978-3-319-21945-5

Publisher: Springer

Other Readings

www.musicinformationretrieval.com

Other technology requirements / equipment / material

Python 2.7 or 3.x

Course Requirements and Assignments

SJSU classes are designed such that in order to be successful, it is expected that students will spend a minimum of forty-five hours for each unit of credit (normally three hours per unit per week), including preparing for class, participating in course activities, completing assignments, and so on. More details about student workload can be found in University Policy S12-3 at http://www.sjsu.edu/senate/docs/S12-3.pdf.

- Each student is expected to be present, punctual, and prepared at every scheduled class and lab session. It is assumed that the students already have basic knowledge of digital Boolean logic and fundamentals of programming.
- Attendance is **NOT** optional. Individual participation is also required. There will be no make-ups for missed midterm or assignments, unless any special arrangements is made with the instructor beforehand.
- There will be 6-7 **homeworks,** one **midterm** and **final project**. All home works should be submitted through Canvas. **No scanned copy** of handwritten solution is allowed.

Final Examination or Evaluation

In lieu of final exam, students will work on a final project.

Grading Information (Required)

1. Homework carries 4**0%** towards final score.
2. Midterm carries **20%** towards final score.
3. Final Project carries 4**0%** towards final score.

Submission is allowed till 11:59 pm on due date. You will lose 20% of the score for every day that your submission is LATE.

I first try scores of 90, 80, and 70 to cut off letter grades of A-, B-, and C-, respectively. If overall class performance is too low to use these cut offs, I set a cut off of C- to a lower score than the class total average but a higher score than 60 (this number may change), and divide the students' group above the cut off of C- into A+, A, A-, B+, B, B-, C+, C, C-. The rest of students will be given by a grade of D+, D, D-, F or WU depending on their class performance.

Note that "All students have the right, within a reasonable time, to know their academic scores, to review their grade-dependent work, and to be provided with explanations for the determination of their course grades." See University Policy F13-1 at http://www.sjsu.edu/senate/docs/F13-1.pdf for more details.

Classroom Protocol

1. **You must come to class on time!** Students entering the classroom late disrupt the lecture and / or the students already in class who may be engaged in lab or discussion. Late students will not be accepted in class.
2. If you miss a lecture you are still responsible for any material discussed or assignments given. A large portion of each class will be used for hands-on lab / discussion. All students are expected to participate in class activities. Students who are often absent will find themselves at a disadvantage during the tests.
3. No audio / video recording or photography in the classroom without prior permission of instructor. Instructor may provide review videos and/or flipped classroom.
4. No personal discussion or cell phone activity during class time. Please set the cell phone on **silent/vibrate** mode.

5. All e-mail communication to the instructor must have the subject line start with **[CS-185C, 01]**

6. Email to be sent to the instructor's SJSU email ID (vidya.rangasayee@sjsu.edu) only.
7. Start on your homework early and stay on top of them. Some assignments take way more time than you expect.
8. Start forming study/project groups now. It makes it easier to work with the group for the final project.
9. This semester I am trying to integrate with iclicker for attendance and engagement. You will need to register with iclicker and add this course in order to participate. Instructions coming soon

Have fun learning.

University Policies (Required)

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs' Syllabus Information web page at http://www.sjsu.edu/gup/syllabusinfo/"

CS 185C Music Information Retrieval, Fall 2017, Course Schedule

Tentative: Some of these topics would required more than one session.

List the agenda for the semester including when and where the final exam will be held. Indicate the schedule is subject to change with fair notice and how the notice will be made available.

All sections refer to the required textbook.

Week	Date	Topics, Readings, Assignments, Deadlines	Additional Notes
1	8/23//2017	Introduction to MIR	
2	8/28/2017	Introduction to MIR	HW01 Assigned
2	8/30/2017	Python Refresher	
3	9/4/2017	Python Refresher	
3	9/6/2017	Music Representations	HW01 Due
4	9/11/2017	Introduction to Audio Signal Processing - Fourier Transform	HW02 Assigned
4	9/13/2017	DFT, STFT	
5	9/18/2017	Temporal and Spectral Feature extraction	
5	9/20/2017	Temporal and Spectral Feature extraction	HW02 Due
6	9/25/2017	Pitch extraction, Beat detection	HW03 Assigned
6	9/27/2017	Rhythm, Tempo identification	
7	10/2/2017	Rhythm, Tempo identification	
7	10/4/2017	Introduction to Machine Learning - Supervised Learning	HW03 Due
8	10/9/2017	K Nearest Neighbors - Instrument Classification	HW04 Assigned
8	10/11/2017	K Nearest Neighbors - Instrument Classification	
9	10/16/2017	Cross Validation and Evaluation	Project Proposal Due
9	10/18/2017	SVM - Genre Classification	

10	10/23/2017	MIDTERM	Online
10	10/25/2017	Project work - NO CLASS	HW04 Due
11	10/30/2017	Unsupervised Learning	HW05 Assigned
11	11/1/2017	K- Means - Instrument Classification	
12	11/6/2017	Additional Machine Learning	
12	11/8/2017	Music Sychronization - Dynamic Time Warping	
13	11/13/2017	Music Sychronization - Dynamic Time Warping	Project Midpoint review
13	11/15/2017	Music Structural analysis	HW05 Due
14	11/20/2017	Introduction to MIR Music datasets and tags	HW06 Assigned
14	11/22/2017	THANKSGIVING NO CLASS	
15	11/27/2017	Source Separation	
15	11/29/2017	Music Transcription	HW06 Due
16	12/4/2017	Sonification	
16	12/6//2017	Project Demo	
17	12/11/2017	Project Demo	Project due
Final Exam			