I547/B557: Music Information Processing: Audio

Fall 2016

Instructor C. Raphael (craphael@indiana.edu)

Classes MW 9:30 – 10:45 Lindley Hall 008

Office Informatics 315 856-1849

Office Hours TR 4-5 and by appt.

AI Sanna Wager

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AI office hr Thursday 2:00

Course Web page http://www.music.informatics.indiana.edu/courses/I547

Course Material

This course deals with various music analysis and processing problems using sampled audio as the primary data representation. We discuss pitched sound and noise from both a physical and perceptual point of view, digital signal processing including filtering and its relationship to Fourier techniques, and time-frequency representation analogous to human hearing. We treat a variety of sound and music applications including audio effects, score following, automatic music transcription, and musical accompaniment systems. The class is open to all graduate students, but students should be prepared for some mathematics, computer science and statistics.

Homework There will be homework assignments consisting primarily of computing exercises in R with applications to various aspects of digital audio processing and music analysis. R is a free program that can be downloaded for various platforms from http://cran.r-project.org/

Grading

Grading will be based on largely on homework assignments (35%) which students should expect to be both challenging and illuminating. There will be a midterm (25%) and a final exam (30%) and a final project (10%).

Course Material

1. Sampled Audio Basics
2. Pitch and Periodicity
   (a) Sine Waves and their Perception
   (b) Musical Intervals, Perfect Ratios, Tuning
   (c) Beats and Aliasing
3. Constructing Audio from Sine Waves
   (a) Fourier Series and Musical Timbre
   (b) Learning Additive Synthesis Models
   (c) The Fourier Transform
   (d) Randomness and Noise
   (e) Convolution, Filtering, and Autoregression,
   (f) Reberberation
4. Time Frequency Representations
   (a) Audio Effects
   (b) Time-Stretching
   (c) Compression and Processing Audio in the STFT Domain
5. Score Following
   (a) Off-line Following
   (b) On-line Following
   (c) Musical Accompaniment Systems
6. Recognition of Music Audio
   (a) Pitch and Chord Recognition
   (b) Monophonic Instrumental and Singing Recognition
   (c) Polyphonic Recognition
   (d) Precise Pitch Tracking