N547/I547/I602: Music Information Processing: Audio

Fall 2012

Instructor  
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Classes  
TR 13:00 - 14:15 Informatics West 105

Office  
Informatics West 313

Office Hours  
TR 14:15 - 16:00 or by appointment

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

(The easiest way to access the web page is to google "I547")

Course Material
This is an introduction to Music Informatics, providing basic techniques of processing sampled music audio. 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 analysis, and time-frequency representation analogous to human hearing. We also talk about basics about dynamic programming, Hidden Markov Model and their applications in analyzing music audio. We will also introduce several music applications in this course includes audio effects, additive synthesis, score following, automatic music transcription. This course is open to all graduate students who are interested in apply computer technology to music audio. There is no prerequisites for this course, but students should be prepared for some mathematics, computer programming 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 (50%) which students should expect to be both challenging and illuminating. There will be either a final exam or a final project (TBD) (25%) as well as a class participation component (25%).
Course Material

1. Sampled Audio Basics
2. Pitch and Periodicity
   (a) Sine Waves and their Perception
   (b) Musical Intervals, Perfect Rations, 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
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