Audio Content Analysis

Juan Pablo Bello
CS-GY 9223 Selected Topics in Computer Science / EL9173 Selected Topics in Signal Processing: Audio Content Analysis
NYU Tandon CSE / ECE

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- This course: https://wp.nyu.edu/jpbello/teaching/aca/

Audio Content Analysis

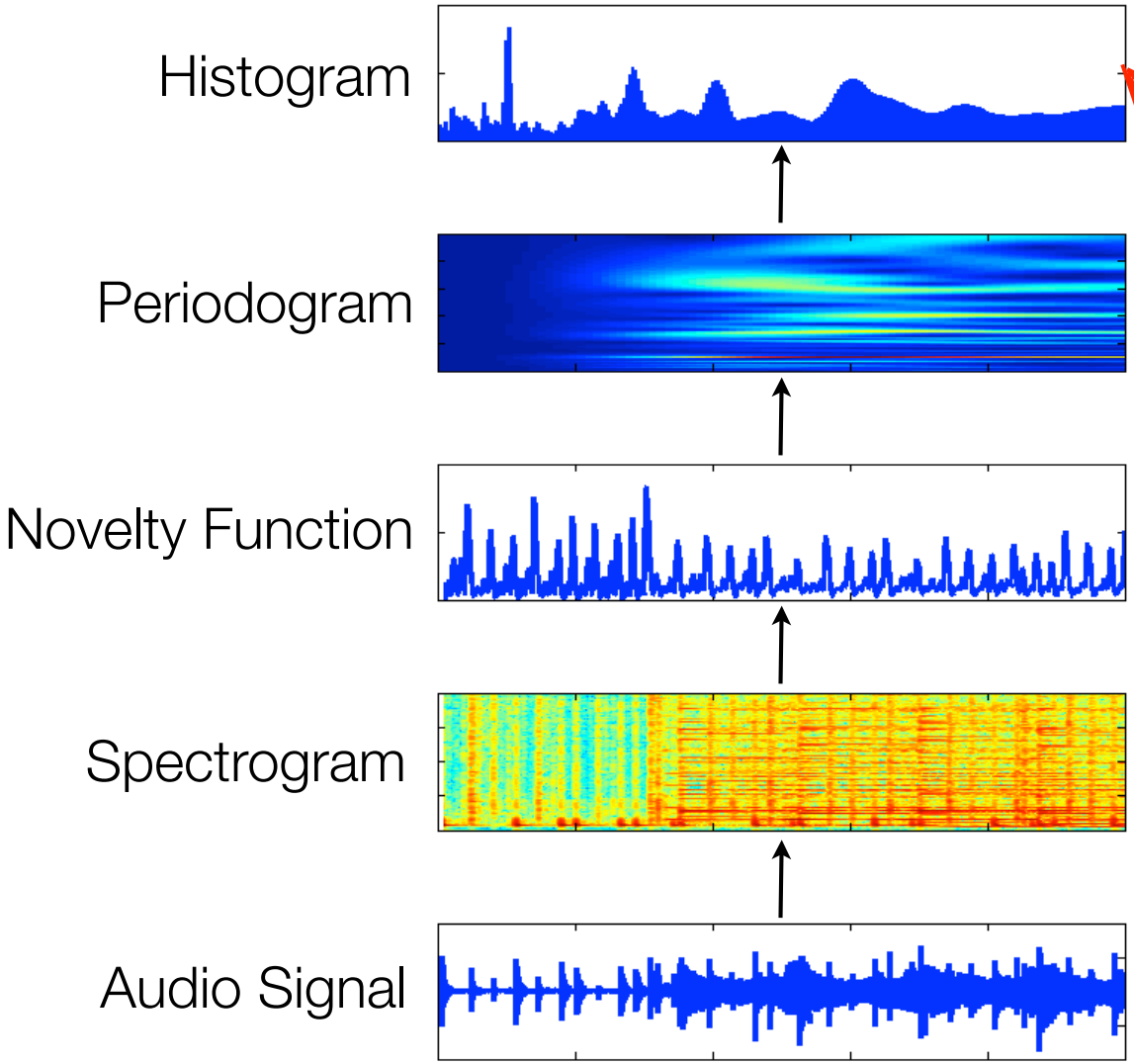
- Research, development and application of systems and techniques intended for the automatic analysis and understanding of sounds, in other words, the development of “listening machines”.

- Grounded in the combined use of theories, concepts and methods from signal processing, computer science, acoustics (psycho-, bio-, -ecology), cognition, speech science, and music.

- Sounds: speech, music, environmental sound

- Audio Signal Processing? Computational Auditory Scene Analysis? Computer Audition? Machine Listening?

For example ...



nature, bird, woodpecker

Orca whale, mating call

voice, male, stressed

speech, female, newscast

music, breakbeat, fast

Brit-pop, drum

Applications (a few examples)

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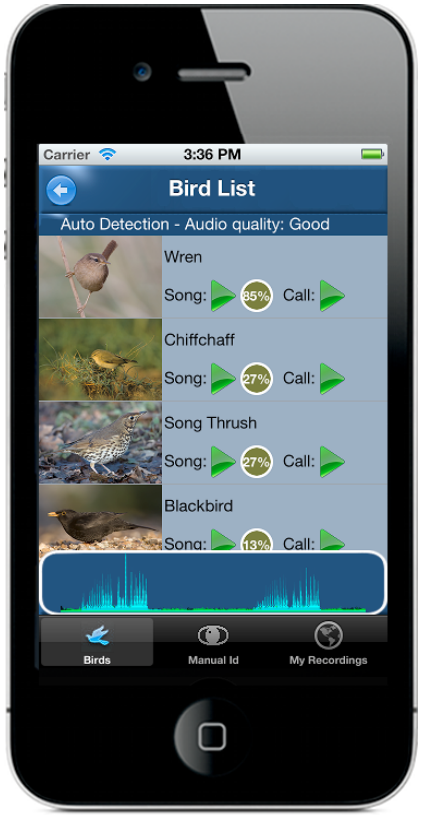
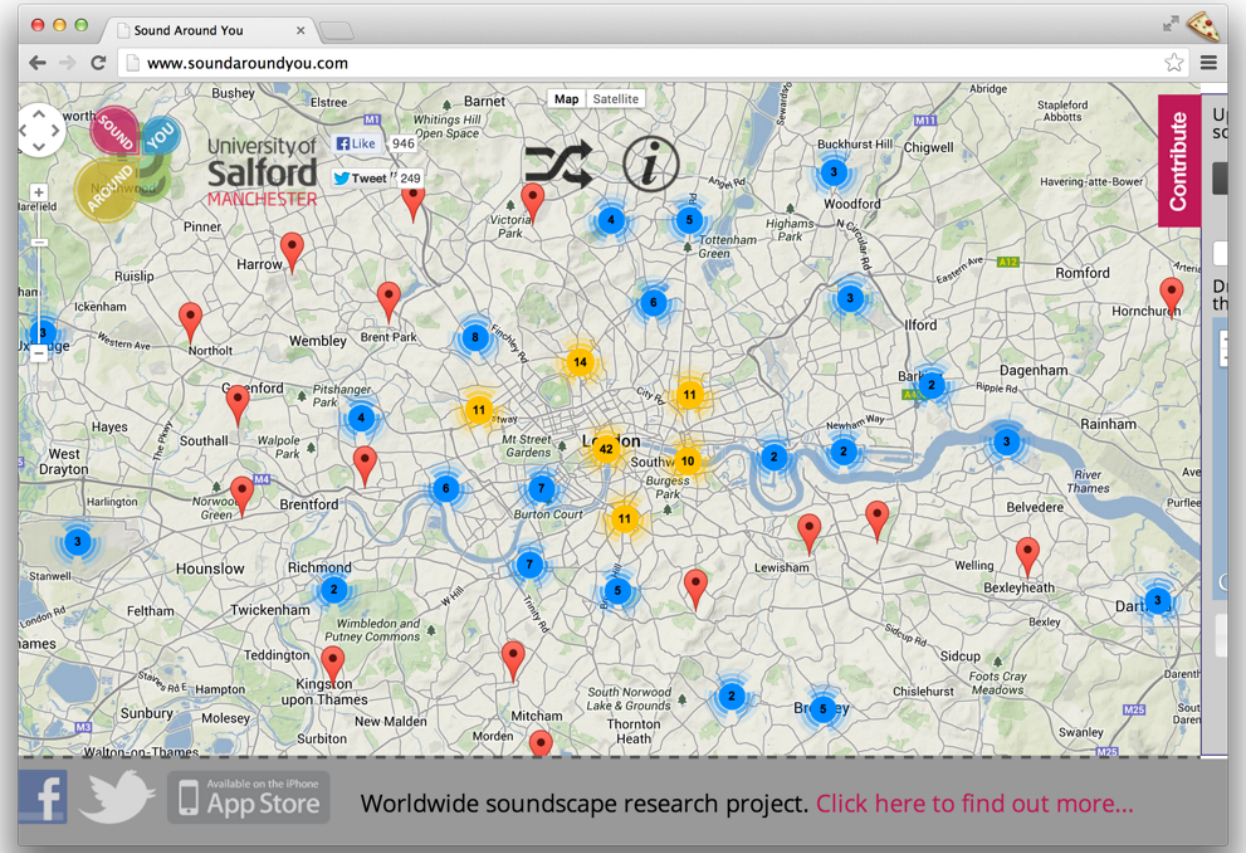
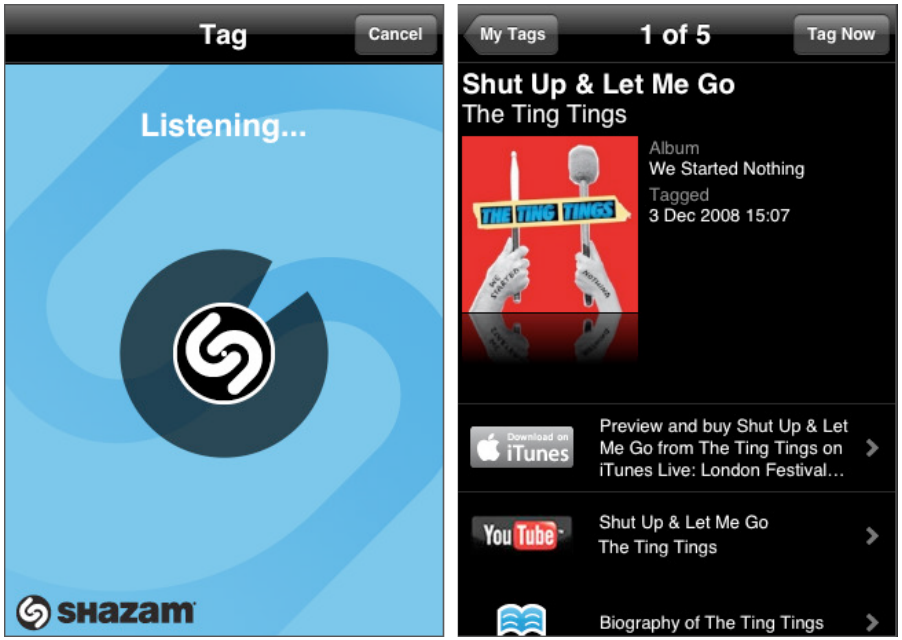




Applications (a few examples)



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Resources

- IEEE: https://2018.ieeeicassp.org/, http://www.waspaa.com/ , https://asru2017.org/, http://www.signalprocessingsociety.org/technical-committees/list/audio-tc/ , http://www.signalprocessingsociety.org/publications/periodicals/
- ISCA: http://www.isca-speech.org/ , http://interspeech2018.org/ , http://www.journals.elsevier.com/speech-communication
- AES: http://www.aes.org/events/conventions/ , http://www.aes.org/events/conferences/ , http://www.aes.org/journal/
- ASA: http://acousticalsociety.org/meetings , http://asadl.org/jasa/
- EURASIP: http://www.eurasip.org/index.php , http://www.eusipco2018.org/
- ISMIR: http://www.ismir.net/, http://www.ismir.net/all-papers.html
- Others: http://www.smc-conference.org/ , http://www.dafx.de/

Calendar: Lectures

- Week 1-2 Fundamentals, and time-frequency representations
- Week 3-4 Novelty: onset detection
- Week 5-6 Periodicity: pitch detection and beat tracking
- Week 7-8 Timbre: low-level features and spectral envelope
- Week 9-10 Pitch distribution: chroma, chord and key recognition
- Week 11-12 Sound classification

Assessment

- Assignments: 40% (4 x 10% each): announced in class/website, due a week after posting, penalties will apply to delays of up to 20 hours.
- Mid-term exam: 30% (choose 3 out of 4 questions), on 03.28
- Projects: 30% (groups of 2)
  - Proposal (04.06): 5%
  - Final project + presentation (05.09): 25%
- Class Participation: extra points (attendance, questions, discussions, interest)

Calendar: Important dates Spring 2018

- 03.14 - Spring break
- 03.28 - Mid-term exam
- 04.06 - Project proposals
- 05.09 - Final project submission and presentation

Tutoring/Resources

- TA: Vincent Lostanlen, office hours Fridays 10am-12pm, 13th floor, 370 Jay Street
- USE THE OFFICE HOURS (Tuesdays 2-5pm)
- All relevant information is (or will be published) on the class website - Please read it carefully and keep checking for updates.
- https://wp.nyu.edu/jpbello/teaching/aca/

Recommended Reading

- Virtanen, T., Plumbley, M., and Ellis, D. (Eds) “Computational Analysis of Sound Scenes and Events”. Springer (2018)
- Wang, D. and Brown, G. "Computational Auditory Scene Analysis". John Wiley & Sons (2006)
- Müller, M. “Fundamentals of Music Processing: Audio, Analysis, Algorithms and Applications”. Springer (2015)
- Lerch, A. “An Introduction to Audio Content Analysis”. John Wiley & Sons (2012)
- Gold, B., Morgan, N., and Ellis, D. “Speech and Audio Signal Processing”. 2nd edition, Wiley (2011)
- Klapuri, A. and Davy, M. (Eds.) “Signal Processing Methods for Music Transcription”. Springer (2006)
- Smith, J.O. “Mathematics of the Discrete Fourier Transform (DFT)”. 2nd Edition, W3K Publishing (2007)
- Further reading will be recommended as the course progresses.

To do

- Familiarize yourself with Python / Matlab ASAP!
- See list of resources on the website
- START LOOKING FOR PROJECT TOPIC: Visit resource links, talk to current members of the MARL-MIR group (meets Tuesdays 10am, 6th floor conference room, 35 W 4th Street), Attend relevant seminars (most Thursdays @ 1pm).