University of California, Berkeley

Orchestrating with machines

An introduction to assisted orchestration and to related techniques

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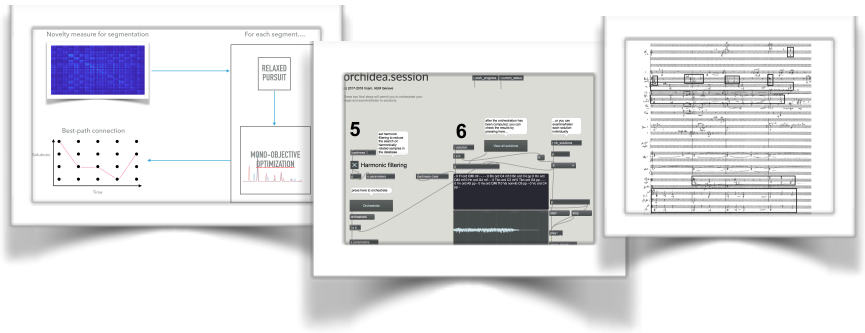
SPRING 2019 - MUSIC 202 SEMINAR



Course Meeting Times

Lectures and laboratory: 1 session / week, 3 hours / session

Prerequisites

The seminar is offered in the Department of Music and taught at CNMAT in the Spring of 2019. Participation requires advanced knowledge of music and/or computational sciences (such as Music 158b or Music 159 for example) and the permission of the instructor.

Description

Assisted orchestration (AO) can be thought as the process of searching for the best combinations of orchestral sounds to match a target sound under a specified metrics and specific constraints. Although a solution to this problem has been a long-standing request from many composers, it remains relatively unexplored because of its high complexity, requiring knowledge and understanding of both mathematical formalisation and musical writing.

This course will provide the foundations of assisted orchestration, focusing on the specific needs of each student.

After a general introduction aimed at providing both the scientific and philosophic backgrounds, the course will show in details the *Orchidea* tools for assisted orchestration.

Each student will have the possibility to apply the discussed techniques on her own specific problems during individual teaching sessions.

Grading

Student's grade will be determined by evaluating his/her performance on some assigned tasks for assisted orchestration. There are no exams and no final.

Calendar

#	TOPICS
1	Introduction to target-based assisted orchestration
2	Part1: A musical history of assisted orchestration: Xenakis, Metastaseis; Ligeti, Atmosphéres; Penderecki, Trenody; Harvey, Mortuos plango, vivos voco; Maresz, Metallics/ Metal extensions; Harvey, Speakings; [Chowning, Phonè] Part 2: Elements of musical signal processing (1): musical acoustics; representations of sound; introduction to vector spaces; norm; inner product
3	Elements of musical signal processing (2): projection and reconstructions, definition of analysis and synthesis; Fourier analysis; convolution
4	Introduction to low-level features for sound description and classification: spectral descriptors, autocorrelation, cepstrum and MFCC; Gaussian clustering and classification
5	Overview of optimisation techniques for musical applications: knapsack problem, multi-dimensional heuristics, genetic algorithms
6	The *Orchidea toolbox* for assisted orchestration (1): static orchestration and dynamic orchestration
7	The *Orchidea toolbox* for assisted orchestration (2): navigation of the solution, navigation of the dataset, custom datasets
8-16	Lab: the second part of the seminar will be focused on specific orchestration problems proposed by the students/instructor on individual basis

References and resources

There is no required text; lecture notes will be provided on selected topics. Useful references are:

- Yan Maresz, *On Computer-Assisted Orchestration,* Contemporary Music Review, vol. 32, n. 1, pg. 99-109, Routledge, 2013.
- Grégoire Carpentier and Damien Tardieu and Jonathan Harvey and Gérard Assayag and Emmanuel Saint-James, *Predicting Timbre Features of Instrument Sound Combinations: Application to Automatic Orchestration,* Journal of New Music Research, vol. 39, n. 1, pg. 47- 61, Routlegde, 2010
- C. E. Cella, On the geometric interpretations of signals, download from www.carminecella.com
- C. E. Cella, A simplified approach to the problem of assisted orchestration, download from www.carminecella.com
- J. Strawn (editor), Digital signal processing – an anthology, A-R Editions (March 1, 1985), chapters 1 and 2 (selection)
- J. Smith, The mathematics of the DFT, online version at https://www.dsprelated.com/freebooks/mdft/, chapter 5 (selection)
- Research page: www.carminecella.com/orchidea; introductory lecture on assisted orchetration (French): https://medias.ircam.fr/x7379f3