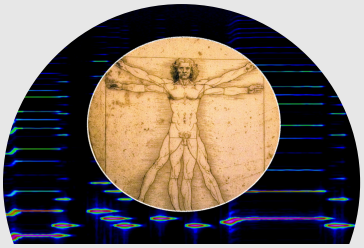

Computational creativity for music and the arts

MUSIC 30

Instructor Info

Carmine-Emanuele Cella

Center for New Music and Audio Technologies (CNMAT)

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Course Info

Prereq: None

CNMAT (McEnerney Hall)

Lab Info

CNMAT (McEnerney Hall) - Laptop and headphones required

Overview

Computational creativity for music and the arts (MUS30) is..

Learning Objectives

- Understand...
- Learn to critically review a paper and summarize it, as well as review and provide helpful criticism to your peers' work

Material

Required Text

Cella, C. E. *Creative computing for music and sound*. MIT Press, in preparation. ("CEL")

Recommended Texts

D. Benson, *Music: a mathematical offering*, freely available on author's web page. ("BEN")

A. Burkov, *The Hundred-page machine learning book*, freely available on author's web page, 2019. ("BUR")

A. Géron, *Hands-on machine learning with Scikit-Learn & TensorFlow*, O'Reilly, 2017. ("GER")

Other

Music 30 will use Python/Anaconda (`https://www.anaconda.com`, link to external site) and Cycling'74 Max (`http://cycling74.com/`, link to external site) programming environments extensively during the labs. The open-ource audio editor Audacity (`https://www.audacityteam.org`, link to external site) will be also used during classes. Students must have access to a laptop computer with these software packages installed and must have headphones. Students may choose to purchase Max, or alternatively there are student authorization options.

Any required journal/conference articles and all the source code will be provided on *bCourses*.

Grading Scheme

20%	Assignments
30%	Midterm Exam
50%	Final Exam

Grades will follow the standard scale: A = 89.5-100; B = 79.5-89.4; C = 69.5-79.4; D = 60-69.4; F <60. Curving is at the discretion of the professor.

FAQs

Do I need to know machine learning?

No. The essential tools of machine learning will be introduced in the course. However, some familiarity with linear algebra is recommended.

Do I need to know Python programming?

While it is not strictly necessary, it is recommended to know at least the basic structures of the language. Several labs will use Python programs and you will be asked to execute them.

Do I need to know Max programming?

No. All Max-based labs will use ready-to-use patches with a graphical interface.

How much musical knowledge is required?

Nothing more than an intuitive understanding of concepts such as melody or timbre. The motivation of the course, however, is to produce tools to create and transform sound so you should be at least interested in this.

Make-up Policy

Make-up exams or assignments will only be allowed for students who have a substantiated excuse approved by the instructor *before the due date*. Leaving a phone message or sending an e-mail without confirmation is not acceptable. Labs are mandatory.

Diversity and Inclusivity Statement

I consider this classroom to be a place where you will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability - and other visible and non-visible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Disabled Students' Program (https://dsp.berkeley.edu), as soon as possible, to make an appointment to discuss your special needs. Please e-mail me in order to set up a time to discuss your learning needs.

Academic Integrity

Berkeley's honor code states "As a member of the UC Berkeley community, I act with honesty, integrity, and respect for others." The honor code is a cornerstone of our learning community and of this course. It is your responsibility to know and follow academic integrity policies. I will gladly answer any questions you have.

Harassment and discrimination

The University of California strives to prevent and respond to harassment and discrimination. Engaging in such behavior may result in removal from class or the University. If you are the subject of harassment or discrimination there are resources available to support you. Please contact the Confidential Care Advocate (sa.berkeley.edu/dean/confidential-care-advocate) for non-judgmental, caring assistance with options, rights and guidance through any process you may choose. Survivors of sexual violence may also want to view the following website: survivorsupport.berkeley.edu. For more information about how the University responds to harassment and discrimination, please visit the Office for the Prevention of Harassment and Discrimination website: ophd.berkeley.edu.

Class Schedule

MODULE 1: Foundations

#	Topic	Readings
Week 1	Computational creativity is not . . . creative: the four *P*s of creativity	F. Carnovalini and A. Rodà,Computational Creativity and Music Generation Systems: An Introduction to the State of the Art. Front. Artif. Intell. 3:14, 2020
	Creative artefacts vs assisted creation: dualities in modelling creativity	R. L. DE Màntaras, Artificial Intelligence and the Arts: Toward Computational Creativity, in The Next Step: Exponential Life, 2017
Week 2	Three introductory views on sound: physical, perceptual and cultural	[BEN, ch. 1.1-1.7]
	Introduction to musical timbre and digital signals	[BEN, ch. 7.1-7.6, appendix M]
Week 3	The five pillars of creative computing (I): probabilities	
	Lab (Python): Markov models for text and music generation	
Week 4	The five pillars of creative computing (II): projective spaces	C. E. Cella, A geometric interpretations of signals, 2015, available on www.carminecella.com
	Lab (Python): transforming sounds and images with convolutional maps	C. E. Cella, On room impulse response measurements with sine sweeps, 2017, available on www.carminecella.com
Week 5	The five pillars of creative computing (III): unsupervised and supervised statistical learning	[BUR, ch. 1]
		C. E. Cella, Logistic regression and artificial neural networks, 2015, available on www.carminecella.com
	Lab (Python): classification of musical timbres	[BUR, ch. 2.7]
		V. Lonstalen, C. E. Cella, Deep convolutional networks on the pitch spiral for musical instrument recognition, ISMIR 2016, New York, USA
Week 6	The five pillars of creative computing (IV): logical rules and generative grammars	
	Lab (Python): L-systems for natural patterns and melodic generation	
Week 7	The five pillars of creative computing (V): optimisation	
	Lab (Max): computer-assisted orchestration with Orchidea	
Week 8	Review	Module 1
	EXAM	MIDTERM

MODULE 2: Transformations

Week 9	Modelling time and timbre in music	H. C. Crayencour, C. E. Cella, Learning, probability and logic: towards a unified approach for content-based Music Information Retrieval, Frontiers in Digital Humanities, April 2019
	Lab (Max and Python): granular synthesis and *AudioGuide*	
Week 10	Modeling musical style (I): projections	
	Lab (Max/MSP): spectral freeze and cross-synthesis, a prelude to musical style transfer	
Week 11	Modeling musical style (II): probabilities and unsupervised learning together	C. E. Cella, Sound-types: a new framework for symbolic sound analysis and synthesis, ICMC 2011, Huddersfield, United Kingdom
	Lab (Python): sound-types, a further step towards musical style transfer	C. E. Cella and J.J. Burred, Advanced sound hybridizations by means of the theory of sound-types, ICMC 2013, Perth, Australia
Week 12	Modeling musical style (III): supervised learning with deep neural networks	L. Gabrielli, C. E. Cella, F. Vespertini, D. Droghini, E. Principi and S. Squartini, Deep Learning for Timbre Modification and Transfer: an Evaluation Study, AES 144th, 2018, Milan, Italy
	Lab (Python): an algorithm for universal musical style transfer	Noam Mor, Lior Wolf, Adam Polyak, Yaniv Taigman, A universal music translation network, ICLR 2019

MODULE 3: Connections

Week 13	Extending the techniques to other arts: image style transfer	
	Evaluation of creative outcomes	
Week 14	On the aesthetics of computational creativity	
	Social impact of assisted creation	
Week 15	Review	Modules 2 and 3
	EXAM	FINAL