Computational Creativity: The Practice of Generative Systems

HUM2832C | Online

Professor Marlon Barrios Solano Thursdays 10:40am - 1:40pm EST

“This course introduces students to computation as a creative medium and offers an introduction to generative and programming tools within a critical aesthetic context. It provides students with basic concepts of machine generated art, allowing them to create and analyze generative and algorithmic artwork.”

Course Description

Computational creativity is the application of computer technologies to emulate, study, stimulate, and enhance human creativity. Algorithmic creativity extends this to the use of AI methods—such as machine learning, natural language processing, computer vision, and generative adversarial networks—to produce creative outputs ranging from text, images, music, and video to complex systems, architectures, and inventions.

This course introduces students to code as a creative medium within a critical aesthetic and ethical context. Students will learn foundational concepts of machine-generated art, exploring formal procedural methods, grammars, probabilistic automata, and artificial neural networks.

A key focus will be the **principle of Generativity**: a cognitive condition of creating predictions that organize action and perception based on context and system dynamics. Generativity emphasizes that systems—whether **computational, human, or hybrid**—can produce adaptive, open-ended, and emergent outcomes. Students will explore how generative processes themselves, both algorithmic and cognitive, become frameworks for artistic creation. The course also introduces **Generative AI** and its impact on computational media, cognition, and cultural production.

Students will create experimental digital artworks, sound pieces, and performances using open-source tools such as **p5.js** and associated libraries, as well as technical workflows involving the command line, **GitHub** for version control, and **Visual Studio Code** as a programming environment. Through making and critique, students will examine how works derived from logical rulesets, algorithms, and the artful use of randomness can express human feelings and ideas, while also considering the ethical and social implications of algorithmic systems in art and media.

Prerequisites: None

Course Goals

This course aims to provide students with an introduction to:

- The history and contemporary field of computational creativity and creative technology.
- The **principle of Generativity** as it applies to cognition, creativity, and algorithmic design: how predictions organize action and perception in **computational, human, and hybrid systems**.
- Tools and techniques for creating experimental visual art, sound, multimedia performances, games, and emerging forms of expression employing AI and generative methods.
- Collaborative strategies for working on teams across different disciplinary skills and backgrounds.
- The cultural, aesthetic, and ethical implications of **Generative AI** in contemporary computational and cognitive media.

Learning Outcomes

By the end of the course, students will be able to:

- Develop proficiency with foundational computational concepts: variables, data types, functions, conditional logic, loops, objects, and arrays.
- Understand correct terminology for procedural design, generativity, and computational art-making.
- Apply principles of **interactivity and generativity** to create web-based multimedia works.
- Co-create original work in the field of computational creativity using both algorithmic and hybrid approaches.
- Critically discuss the creative capabilities of computer systems, from simple algorithms to complex AI, and their impact on the arts and society.
- Collaborate with students from other disciplines in developing creative computational systems.
- Analyze and respond artistically to the cultural, ethical, and epistemic questions raised by algorithmic and generative systems.

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COURSE SCHEDULE AND TOPICS

Week 1 - Introduction to Computational Creativity and Generative Art
Week 2: Generative Visual Art - Exploring Chance Operations, Chaos and Complexity Theory in Visual Art
Week 3 - Generative Visual Art II: Vectors & Forces
Week 4 - Generative Visual Art III: A-Life & Cellular Automata
Week 5 - Generative Sound: Oscillators and Beyond
Week 6 - Generative Visual Art: Particle Systems and Autonomous Agents
Week 8 - Physics and Matter
Week 9 - Fractals and Generative Grammars
Week 10 - Evolutionary Computing and Genetic Algorithms
Week 11 - Rule-Based Systems, Markov Chains, and Grammars
Week 12 - Computational Cognition: Perceptron, Machine Learning, and Neural Networks
Week 13 - Neuro-Evolution and Reinforcement Learning
Week 14 - Exploring Generative AI with Large Language Models (LLMs) , Generative Adversarial Networks (GANs) and P5.js
Week 15 - Cross-Disciplinary Integration
Week 16 - Final Exam - Final Project Showcase & Crits

Required Course Materials:

- Canvas
- GitHub (create a free account)
- Flash drive & other portable drives or Google account to back up files
- Required Readings - Provided as links
- Software Tutorials - Links will be provided
- Journal (Digital)
- Laptop (Mac or PC)
- Internet Connection

Relevant Software (all software and environments are open source)

- P5.js (https://p5js.org/Links to an external site.
- P5.js Online Editor (https://editor.p5js.org/
- Links to an external site.)
- ML5.js (https://ml5js.org/)
- Visula Studio Code VScode (https://code.visualstudio.com/
- Links to an external site.

  Tone.js (https://tonejs.github.io/
- Links to an external site.
- ML5 (https://ml5js.org/)
- Replicate (https://replicate.com/ Links to an external site.

Recommended Reading List:

Shiffman, Daniel. *The Nature of Code 2*, No Starch Press, 2024.

Links to an external site.

One chapter of each of these books will be read:

- *Metacreation: Art and Artficial Life Michell Whitelaw. MIT Press. 2006*
- Veale, T ony & F . Amilcar Cardoso, Editors. *Computational Creativity: The Philosophy and Engineering of Autonomously Creative Systems*. Springer, 2019.
- Besold, Tarek Richard, Marco Schorlemmer, Alan Smaill et al. *Computational creativity research: toward creative machines*. Atlantis Press, 2015.
- Machado, Penousal, Juan Romero & Gary Greenfield, Editors. *Artificial Intelligence and the Arts: Computational Creativity, Artistic Behavior, and Tools for Creatives*, 2021.
- Francois- David Pachet, Pablo Gervas, Andrea Passerini, Mirko Degli Esposti.

Computational Synthesis and Creative Systems. Springer, 2022.

- Brown, Oliver. *Beyond the Species: Making Machines That Make Music*, MIT Press,

2021.

Industry Essentials:

https://isea-archives.siggraph.org/

https://eyeofestival.com/

https://grayarea.org/

https://www.eyebeam.org/

https://www.siggraph.org/

https://nips.cc/

https://www.acm.org/

https://www.leonardo.info/

https://ars.electronica.art/about/en/archive/

https://www.dance-tech.net/

https://computationalcreativity.net/home/about/computational-creativity/

Grading Policy*:

– 40% in class coding exercises

– 40% final project– 10% documentation

– 10% participation

* University grading policy can be found here:

https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/

Links to an external site.

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Expectations:

• **Arrive on time** and attend all classes— see below for attendance policy.

• Spend at least **2-4 additional hours a week** (outside of class) on class projects, readings, experimenting with tech & writing in journal.

• **Check Canvas** for assignments and materials (typically announced and posted at the end of class on Thursday).

• Post weekly reading responses to Canvas **by midnight on Mondays** unless otherwise specified in the assignment.

• **Actively participate** in class discussions & group critiques.

• **Back up your work** regularly.

• **Follow good device etiquette**: No cell phone use during class. Laptops only used for lecture note-taking and related class activities.

• **Thoughtfully contribute** to a positive classroom environment, while actively supporting and challenging your classmates' ideas.

• **Push yourself creatively and technically**. Be ambitious. Work hard.

Stay open and curious!

Communication:

• T o contact your instructor with a brief, private question or message, **send a DM (Direct Message) through Slack**.

• If you have a question that may be relevant to the group (about homework, etc.), **post in the #general channel** on Slack for all to see and comment on.

• Use Slack for easy communications with your classmates as well—you can DM individuals or selected groups.

• T o discuss a longer matter with your instructor, DM to set up an appointment or come by during office hours.

Attendance Policy:

• Students are expected to attend every class, arrive on time, and actively engage/participate.

• **If you will be absent, or if you are running late, DM your instructor ASAP .**

• In the case of an absence, contact a classmate for notes and what you missed, check Canvas for assignments, and contact the instructor if you have additional questions.• Lateness and absences will impact your grade. Worse, not showing up will impact everyone else in the class. As most of our projects are collaborative, we are

dependent on everyone's presence and full participation.

• All in-class activities are graded for participation. Unexcused absences will result in a 0 for participation for the day. *Students with excused absences can make up missed in-class activities.*

• Unexcused lateness counts as 1/3 absence when up to 25 minutes late, 1/2 absence when 26-50 minutes late, and a full absence beyond that point.

• Absences may be excused in the following cases: documentation of illness provided by a doctor, religious observance with advance notice, official school-related activity (with documentation and advanced notice), and on a case-by-case basis for other critical events. Religious observations do not require documentation.

• Y ou are allowed 2 "unexcused absences." Each additional unexcused absence will result in a penalty of a full letter grade (10%) from the final grade per "unexcused" absence.

• Project critiques are mandatory. Missing a critique will result in a deduction of one letter grade for the corresponding project. *Critiques can be made up or credit for a similar exercise can be provided for students with excused absences.*

• For University Attendance Policy, please refer to this link for acceptable reasons for excused absences: https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/.

Academic Integrity Policy:

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing

this assignment." The Conduct Code specifies a number of behaviors that are in violation of this code and the possible sanctions. Click here to read the Conduct Code. If you have any questions or concerns, please consult with the instructor or TAs in this class.*Instructor Note: Code borrowed from another source at more than four lines in length must be attributed as a //comment within the code itself. If you are unsure of whether or not your work may constitute plagiarism, please check with your instructor before submitting.*

In-Class Recording:

• Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding.

All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. T o "publish" means to

share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

Course Accommodations for Students with Disabilities:

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center here: https://disability.ufl.edu/get-started/. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Student Evaluation Requirements:

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

Course Structure (Lecture, Lab & Demos):

Lecture/Demo - Context setting and introducing tools & techniques

Lab/In Class Exercise - Scaffold development pipeline and experimentation

Read/Respond - Critically engage with readings/videos by writing up a short reaction to key points in preparation for discussion

Experience/De-construct - Research new algorithmically generated art work to identify narrative devices, experience design strategies and technology employed to build a collective toolbox

Studio - Hands-on, collaborative project development