Algorithmic Creativity

HUM 2832C (3 credits)
Day & Time: Thursdays 12:50-3:50 pm
Professor: Dr. Heidi J. Boisvert
Location: Online - Zoom
Email: hboisvert@ufl.edu
Office Hours: Thursdays 10-12 pm or by appointment
Office Location: CISE, E111
Office Phone: 352-273-0513

Course Content —> Canvas Site: https://ufl.instructure.com/courses/561090
Course Collaboration —> Slack Workspace: https://algorithmiccreativity.slack.com/

Course Description:

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

This course introduces students to code as a creative medium. It provides students with basic concepts of machine generated art. Topics covered include formal grammars, Markov chains, probabilistic automata, and artificial neural networks. Students use these techniques to analyze and generate digital art, music and performances using open-source tools for experimenting with algorithms, such as p5.js, tensorflow.js, pureData, python and associated libraries, Unity and TouchDesigner. The course also familiarizes students with command line and gitHub for version control.

The course offers an introduction to computer programming tools within a critical aesthetic context. Students will create and analyze generative and algorithmic artwork, and consider how works derived from logical rulesets, algorithms, and the artful application of randomness can communicate human feelings and ideas. Students will consider the ethics of algorithmic systems in our culture and media, and create art works to address those issues and influence opinion.

Prerequisites: None

Course Goals:

To give students an introduction to:
– the history and contemporary field of computational creativity and creative technology.
– tools and techniques for creating experimental visual art, music, multi-media performances, games and other emerging forms of expression employing AI.
– collaborative strategies for working on teams with different disciplinary skills and backgrounds.

Learning Outcomes:

By the end of the course students will be able to:
– understand correct terminology for technical and design aspects of the field.
– apply emerging technology (machine learning, biophysical sensors, virtual reality) into their artistic practice.
– develop proficiency with foundational computational concepts: variables, data types, functions, conditional logic, loops, objects and arrays.
– co-create original work in the field of computational creativity.
– critically consider and discuss questions concerning the creative capabilities of computer systems and their impact on the arts.
– collaborate with students from other disciplines in the development of creative systems.

Required Course Materials:

– Canvas
– Slack
– GitHub
– Flash drive & other portable drives or Google Drive account to back up files
– Required Readings - Provided as PDFs
– Software Tutorials - Links will be provided
– Journal (Digital or Physical)
– Laptop (Mac or PC)

Required Software:

– p5.js (https://p5js.org/)*
– Processing (https://processing.org/)*
– Max/MSP (https://cycling74.com/)*
– PureData (https://puredata.info/)*
– TouchDesigner (https://www.derivative.ca/)
– Unity (https://www.unity.com/)*
– Unreal (https://www.unrealengine.com/)*

– ML5.js (https://ml5js.org/)*
– OpenAI (https://open.ai/)*
*Open-Source

Recommended Reading List:

Shiffman, Daniel. *The Nature of Code 2*, No Starch Press, 2024.
Veale, Tony & 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.
Wilf, Eitan. *The Inspiration Machine: Computational Creativity in Poetry & Jazz*. University of Chicago Press, 2023.

Industry Resources:

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/.

Grading Rubric:

The following rubric will be applied to in class coding exercises, final project and documentation.

VALUES	Excellent (90-100)	Good (80-89)	Fair (70-79)	Poor (60-69)	Unsatisfactory (0-59)
Concept	Core concept is intriguing, original, and well- explored	Core concept is intriguing but lacking in examination	Core concept is present and supported by the work	Core ideas are scattered without consideration	No clear concept, or work doesn't reflect it
Progress	Clear and consistent progress from ideation to execution	Progress was made, but was not consistent	Evidence of procrastination , "last minute" pushes or crunch	Lack of progress in 1-2 areas resulting in project deficiencies	Little to no progress shown on the project
Presentation	Concept is clearly presented and strongly supported through audio, visuals, interaction, and narrative (if applicable)	Concept is supported through presentation, but 2 or more areas of the design are lacking or distracting	Concept is weakly supported through presentation, project requirements met at a "bare minimum" level	1-2 presentation requirements are not met.	3+ presentation requirements are not met.
Skills	Clear demonstration of skills in all development areas (visual, text, audio, interaction, programming)	Clear demonstration of skill in 2+ development areas	Demonstrates skills, but omits topics covered in class.	Evidence of skills, but underutilizatio n of techniques learned in class	Does not use any techniques learned in class.

VALUES	Excellent (90-100)	Good (80-89)	Fair (70-79)	Poor (60-69)	Unsatisfactory (0-59)
Collaboration	Consistently provides honest, supportive feedback to peers, responsible in meeting team goals, and communicates effectively.	Generally supportive, responsible, and good communicatio n, with a few issues	Multiple issues/proble ms with collaboration, meeting goals, or communicatin g	Little to no evidence of communicatio n, goal setting, and collaboration in a team setting.	Disrespectful to fellow students work, with negative impacts to class/team dynamics.

Participation Rubric:

Criteria	Excellent (90-100)	Good (80-89)	Fair (70-79)	Poor (60-69)	Unsatisfactory (0-59)
Informed Preparation	Fully prepared for class with assignments and required class material.	Mostly prepared for class with assignments and required class materials.	Partially prepared for class with assignments and required class materials.	Minimally prepared for class with assignment and required class materials	Unprepared for class with assignments and required class materials.
Thoughtful Contributions	Student is able to contribute in meaningful ways to discussions, asks thoughtful and well-informed questions, able to back up a position with considered evidence and share their perspective on the issues raised.	Student is able to contribute to discussions, asks thoughtful questions, is able to back up a position and share their perspective on the issues raised.	Student is able to contribute in a limited way to discussions, asks uninformed questions, is unable to back up a position and share their perspective on the issues raised beyond like or dislike.	Student is unable to contribute in meaningful ways to discussions, asks no questions, asserts a position with no evidence, or has no perspective on the issues raised.	Student does not contribute to discussions, and asks no questions.

Criteria	Excellent (90-100)	Good (80-89)	Fair (70-79)	Poor (60-69)	Unsatisfactory (0-59)
Active Engagement	Active participation in class activities in small and large groups throughout the entire instructional episode.	Active participation in class activities in small and large groups, but may have occasional lapses in participation.	Moderate participation in class activities; student may rely on others to "cover" their participation.	Limited participation in class activities in small and large groups.	Does not participate in class activities in small and large groups. Exhibits a lack of interest in the activities.
Considerate	Student listens actively, treats others with respect even when disagreeing. Language used demonstrates a true interest in learning and understanding other perspectives.	Student listens, treats others with respect even when disagreeing.	Student listens inconsistently, treats others with respect when they agree with their perspective, but struggles to hear alternate viewpoints.	Student listens poorly, fails to treat others with respect, or otherwise demonstrates a lack of interest in others' ideas and perspectives.	Student does not listen, fails to treat others with respect, or otherwise demonstrates a lack of interest in others' ideas and perspectives.

Grading Scale:

A	94-100%		C	74-76%
A-	90-93%		C-	70-73%
B+	87-89%		D+	67-69%
B	84-86%		D	64-66%
B-	80-83%		D-	60-63%
C+	77-79%		E	<60%

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.
• **Check Slack** regularly for group and private messages.
• Post weekly reading responses to Canvas **by midnight the day before class** 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:

• To 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.
• To 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, military service, family emergency, 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.

- You 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. To “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

Course Schedule:

// Week 1 - Thursday, January 15th - INTRO - What is Computational Creativity? Overview of Course, Structure & Ideas

Lecture/Demo: History & Typology of Generative Art
Lab: GitHub & Version Control & p5.js Intro
In Class Exercise 0: Setup GitRepo

// Week 2 - Thursday, January 22nd - Generative Visual Art I

Lecture/Demo - Chance Operations & Chaos Theory
Read - Nature of Code - Chapter 0 - Randomness
Lab/In Class Exercise 1 - p5.js - Gaussian Distribution & Perlin Noise

// Week 3 - Thursday, January 29th - Generative Visual Art II

Lecture/Demo - Vectors & Forces
Read- Nature of Code - Chapters 1 & 2 - Vectors & Forces
Lab/In Class Exercise 2 - p5.js - Motion, Gravity et al

// Week 4 - Thursday, February 5th - Generative Visual Art III

Lecture/Demo - A-Life & Cellular Automata
Read - Nature of Code - Chapter 7 - Cellular Automata
Lab/In Class Exercise 3 - p5.js - Game of Life Simulations

// Week 5 - Thursday, February 12th - Generative Music I

Lecture/Demo - Oscillations & Sounds Waves
Read - Nature of Code - Chapter 3 - Oscillations
Lab/In Class Exercise 4 - MAX or PureData - Build a Synthesizer

// Week 6 - Thursday, February 19th - Generative Music II

Lecture/Demo - Fractals & Noise
Read - Nature of Code - Chapter 8 - Fractals
Lab/In Class Exercise 5 - MAX or PureData - Granular Synthesis

// Week 7 - Thursday, February 26th - Generative Music III

Lecture/Demo - Genetic Algorithms & Evolutionary Ecosystems
Read - Nature of Code - Chapter 9 - Evolutionary Computing
Lab/In Class Exercise 6 - MAX or PureData - Genetic Algorithm Experiment

// Week 8 - Thursday, March 5th - Generative Games I

Lecture - Rule-Based Systems, Markov Chains & Grammars
View - Coding Challenge #42 - Markov Chain - 2 parts
Lab/In Class Exercise 7 - Unity - Markov Chains Optimizer

// Week 9 - Thursday, March 12th - Generative Games II

Lecture/Demo: Cognitive & Reactive Multi-Agent Systems
Lab: Nature of Code - Chapter 5 - Autonomous Agents
Lab/In Class Exercise 8 - Unity - AI Waypoints

SPRING BREAK - NO CLASS MARCH 19th

// Week 10 - Thursday, March 26th - Generative Games III

Lecture/Demo - Artificial Neural Networks & Deep Learning
Lab: Nature of Code - Chapter 10 - Neural Networks - Unity
Lab/In Class Exercise 9 - Unity - InteractML Models

// Week 11 - Thursday, April 2nd - Generative Dance + Theatre I

Lecture - Particle Systems & Optical Flow
Lab - Nature of Code - Chapter 4 - Particle Systems
Lab/In Class Exercise 10 - TouchDesigner - Particle Paths & Feedback

// Week 12 - Thursday, April 9th - Generative Dance + Theatre II

Lecture/Demo - Physics & Matter
Lab - Nature of Code - Chapter 6 - Physics Libraries
Lab/In Class Exercise 11 - TouchDesigner - ChainGPU Physics Simulator

// Week 13 - Thursday, April 16th - Generative Dance + Theatre III

Tuesday - Lecture/Lab Demo - Neuroevolution & Reinforcement Learning
Thursday - Lab - Nature of Code - Chapter 11 - Neuroevolution
Lab/In Class Exercise 12 - TouchDesigner - TD Neuron Framework

READING DAY - NO CLASS - APRIL 23rd

// Week 14 - Cross-Disciplinary Integration - Final Project Showcase & Crits

Additional Campus Resources:

Health and Wellness

U Matter, We Care: If you or someone you know is in distress, please contact umatter@ufl.edu, 352-392-1575, or visit U Matter, We Care website to refer or report a concern and a team member will reach out to the student in distress.

Counseling and Wellness Center: Visit the Counseling and Wellness Center website or call 352-392-1575 for information on crisis services as well as non-crisis services.

Student Health Care Center: Call 352-392-1161 for 24/7 information to help you find the care you need, or visit the Student Health Care Center website.

University Police Department: Visit UF Police Department website or call 352-392-1111 (or 9-1-1 for emergencies).

UF Health Shands Emergency Room / Trauma Center: For immediate medical care call 352-733-0111 or go to the emergency room at 1515 SW Archer Road, Gainesville, FL 32608; Visit the UF Health Emergency Room and Trauma Center website.

GatorWell Health Promotion Services: For prevention services focused on optimal wellbeing, including Wellness Coaching for Academic Success, visit the GatorWell website or call 352-273-4450.

Academic Resources

E-learning technical support: Contact the UF Computing Help Desk at 352-392-4357 or

via e-mail at helpdesk@ufl.edu.
Career Connections Center: Reitz Union Suite 1300, 352-392-1601. Career assistance and counseling services.

Library Support: Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center: Broward Hall, 352-392-2010 or to make an appointment 352-392-6420. General study skills and tutoring.

Writing Studio: 2215 Turlington Hall, 352-846-1138. Help brainstorming, formatting, and writing papers.

Student Complaints On-Campus: Visit the Student Honor Code and Student Conduct Code webpage for more information.

On-Line Students Complaints: View the Distance Learning Student Complaint Process.