Introduction

This course introduces the students to fundamental methods of Generative Arts and Design. The first half of the course focus on both constructive and search-based approaches and the second half focus on data-driven approaches, mainly using Neural Network techniques. Every week we will discuss a new method, including how to apply them to generate artifacts in domains such as visual arts, music, architecture, video games, etc. Methods will be implemented with Javascript and P5.js (Processing).

Prerequisites

CMPS12B: Introduction to Data Structure.

I expect that you are comfortable programming in one programming language and that you know basic data structures as well as the classic algorithms associated to them. Knowing Javascript is not expected in this course, but I assume you can quickly learn it as we discuss the methods.

Teaching Staff

- Instructor

Lucas N. Ferreira (lferreira@ucsc.edu)

Office Hours: E2-280, 1:00-3:00pm Mondays (or by appointment).

- Teaching Assistant

Max Kreminski (mkremins@ucsc.edu)

Office Hours: E2 393, 10am-12pm Fridays (or by appointment.)

Textbooks

• Generative Design: Visualize, Program, and Create with JavaScript in P5.js.
• Procedural Generation in Game Design.
• Procedural Content Generation in Games: A Textbook and an Overview of Current Research.
• Algorithmic Composition: Paradigms of Automated Music Generation.
• Eloquent JavaScript.

Lectures

Days & Times: TuTh 01:00PM-04:30PM
Location: Soc Sci 2 179

- Week 1

  • Lecture 1: Introduction (Tu 06/25)
    ○ Readings:
    ■ Generative Art - Chapter 1 - Introduction
    ■ Artnome - Why Love Generative Art?
  • Lecture 2: Javascript, Processing and p5.js (Th 06/27)
    ○ Readings:
    ■ P5.js: Get Started
    ■ P5.js: Overview

Assignment 1: Music Visualization with Particle Systems

- Week 2

  • Lecture 3: Randomness and Noise (Tu 07/02)
    ○ Readings:
    ■ Nature of Code - Chapter 1 - Introduction
    ■ Understanding Perlin Noise

Assignment 2: Terrain Generation with Perlin Noise

- Week 3

  • Lecture 4: Cellular Automata (Tu 07/09)
    ○ Readings:
- Lecture 5: Generative Grammars (Th 07/11)
  - Readings:
    - Nature of Code - Chapter 8 - Fractals
    - PCGBook - Chapter 5 - Grammars and L-Systems with Applications

Assignment 3: Interactive Artist NPC with Generative Grammars

- Week 4

  - Lecture 6: Search (Tu 07/16)
    - Readings:
      - PCGBook - Chapter 7 - Planning with applications to quests and story
  - Lecture 7: Evolutionary Algorithms (Th 07/18)
    - Readings:
      - Nature of Code - Chapter 9 - The Evolution of Code

Assignment 4: Evolving Cars

- Week 5

  - Lecture 8: Markov Models (Tu 07/23)
    - Readings
      - Markov Chains Explained Visually
  - Lecture 9: Neural Networks - Perceptron (Th 07/25)
    - Readings:
      - Nature of Code - Chapter 10 - Neural Networks

Assignment 5: Music with Markov Chains

Final Project: Proposal

- Week 6

  - Lecture 10: Neural Networks - Multilayer Perceptron (Tu 07/30)
    - Readings: ML Cheatsheet: Neural Networks
  - Lecture 11: TensorFlow.js (Th 08/01)
- Week 7
  - Lecture 12: Recurrent Neural Networks (Tu 08/06)
    - Readings: The Unreasonable Effectiveness of Recurrent Neural Networks
  - Lecture 13: Autoencoders (Th 08/08)
    - Readings: Intuitively Understanding Variational Autoencoders

- Week 8
  - Lecture 15: GANs (Tu 08/13)
    - Readings:
      - GAN Lab: Play with GANs on your Browser
  - Lecture 16: Project Presentation (Th 08/15)
    - Readings:

**Grading**

Your grade is broken down as follows:

- Class Participation (in-class exercises): 10%
- Programming Assignments: 50%
- Final Project: 40%

The mapping from Letter grade to score is the following:

- A+ = 100-97%
- A = 97-93%
- A- = 93-90%
- B+ = 90-87%
- B = 87-83%
- B- = 83-80%
- C+ = 80-77%
- C = 77-70%
- D = 70-60%
- F = 60-0%
Assignments

There will be 5 programming assignments in Javascript/p5.js due weekly on Thursday at 12:30pm.

- Submissions

Assignments will be submitted on Canvas as zipped project folders containing all of the necessary HTML/Javascript code.

- Late Policy

Late submissions of assignments will be penalized 25% off and will be accepted no more than 1 week late.

Final Project

The final project is intended for you to create an expressive and interactive experience with all the concepts learned during the course.