COMP 4900/5900: Pattern and Texture Synthesis

Winter 2025

Instructor: David Mould **Email:** mould@scs.carleton.ca **Office Hours:** Tuesdays 5:00-6:00, HP 5346	**Office Location:** 5346 Herzberg **Class Location:** See Carleton Central **Class Time:** TTh 6:00-7:30
Prerequisites: (4900 only) one of COMP 3501, 3009, 4102	

Nature of the Course

This is a specialized course on creation of patterns and textures for computer graphics applications. Throughout the term, we will discuss various methods and algorithms, and implement some of them. The course will include a final project, which involves either a thorough implementation and minor extension of an existing algorithm, or an effort directed towards creating a novel algorithm.

The min approach to the material will be reading the primary literature: several weeks will be spent reading specific papers. with individual students from the class responsible for leading the discussion.

Topics to be Covered:

The course's main topics include the following, not necessarily in order.

- Procedural texture and noise
- Low-level image processing operators
- Pyramid-based image representations
- Texture mapping
- Simulation-based methods
- Non-parametric synthesis
- Patch-based synthesis
- Point and element distributions
- Vector texture
- Frequency-based synthesis
- Neural approaches

Important dates and deadlines can be found here: link, including class suspension for fall, winter breaks, and statutory holidays.

The class will not meet during the week of Feb 10-14.

Assessments

Grade Breakdown

- Assignments: 35%
- In-class presentations and discussions: 20%
- Course project: 35%
- Final exam: 10% (with minimum grade of 35% required to pass)

Note on final exam: A minimum grade of 35% (on base questions, that is, excluding bonus questions) is required in order to pass the course.
Many classes will involve discussing material read outside of class time. Do the assigned reading and plan to attend every class. Naturally, things happen from time to time and you may wind up missing the occasional class, but you would not expect to be successful if you miss a significant fraction of the scheduled meetings.

Course Project

Propose your own project. You will produce an implementation and a final writeup in the style of a scientific paper, including abstract, background, algorithm description, results and evaluation, and references. Typical projects involve either a substantial implementation of an existing method, as described in a recent research paper (within the last ten years) or a novel algorithm for some synthesis task. Project proposals will be due near the end of January and must be approved by the instructor. The final project submission will be due on the last day of the term.
COMP 5900 students will work individually and are expected to investigate their topic more thoroughly. COMP 4900 students can work individually or in a group of two, at your preference.

Late Policy

Assignments are due at midnight on the due date. Late submissions are accepted for up to three days, with a deduction of -10% per day: that is, for one, two, three, or four days late, the deduction schedule is -10%, -20%, -30%, -100%. Exceptions (extensions) can be arranged in advance, provided sufficient justification exists.
Discussion materials are due at the beginning of the class the discussion is scheduled. No extensions are possible: the class is depending on you to be ready for your discussion.

Learning Materials

Students are not required to purchase textbooks or other learning materials for this course.
While there is no required textbook, you may benefit from reviewing a general computer graphics textbook for background and for an additional presentation of texture mapping. Early background on procedural texture synthesis is given in this classic book:
Texturing and Modeling: A Procedural Approach (3rd ed), D.S. Ebert et al.

Papers for the course typically come from the ACM Digital Library. You have direct access to the ACM DL while on campus; off campus, you will need to go through the Carleton library website.

For prototyping, I recommend one of Processing (Java) or openFrameworks (C++). These are environments specialized for visualization and creative coding. You may also get some inspiration from Shadertoy, a standalone environment for real-time shaders.

Academic Accommodations and Regulations

Carleton is committed to providing academic accessibility for all individuals. You may need special arrangements to meet your academic obligations during the term. The accommodation request processes are outlined on the Academic Accommodations website (https://students.carleton.ca/course-outline/).

Statement on ChatGPT/Generative AI usage

Students are required to discuss their use of AI with the course instructor to ensure it supports the learning goals for the course.

Statement on Academic Integrity

Misconduct in scholarly activity will not be tolerated and will result in consequences as outlined in Carleton University's Academic Integrity Policy (see here). A list of standard sanctions in the Faculty of Science can be found here. Additional details about this process can be found on the Faculty of Science Academic Integrity website. Students are expected to familiarize themselves with and abide by Carleton University's Academic Integrity Policy.

Student Rights and Responsibilities

Students are expected to act responsibly and engage respectfully with other students and members of the Carleton and the broader community. See the 7 Rights and Responsibilities Policy for details regarding the expectations of non-academic behaviour of students. Those who participate with another student in the commission of an infraction of this Policy will also be held liable for their actions.