CS8803-O27 Syllabus

Computer Graphics in AI Era, Section O27, 3 Credits

Fall 2026 | CRN 95194

Instructor Information

Instructor	Email
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General Course Information

Description

This course offers a comprehensive introduction to modern computer graphics, with a focus on methods that have emerged over the past decade and the ways AI has transformed modeling, rendering, simulation, and animation. Central topics include implicit neural representations, differentiable rendering, Neural Radiance Fields (NeRF), 3D Gaussian Splatting, neural and differentiable physics simulation, generative models, and world models. The course connects these modern topics to classical graphics concepts such as shape representation, volumetric media, splatting, and physically based animation, giving students both theoretical insight and practical experience in AI enabled graphics systems.

Course Learning Outcomes

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

Explain how modern AI driven methods extend core computer graphics ideas in geometry, appearance, rendering, simulation, and animation.

Analyze and implement representative graphics techniques including Signed Distance Fields, Neural Radiance Fields, Gaussian Splatting, position based simulation, and diffusion based generative models.

Build programming assignments and project components using GPU based graphics tools and lightweight neural network workflows.

Relate emerging graphics methods to traditional graphics foundations and evaluate their strengths, limitations, and practical tradeoffs.

Communicate technical and creative work through quizzes, project deliverables, and structured sharing of course outcomes.

Course Topics and Structure

The course includes 28 lectures in total (approximately two per week) plus a mid semester checkpoint period. Major units are:

Foundation of Computer Graphics: course overview, geometry modeling, appearance modeling, and ray tracing.

Implicit Neural Representation: Signed Distance Fields, operations on SDFs, rendering, and neural SDF representations.

Neural Radiance Fields: radiance-field foundations, participating media, volumetric rendering, NeRF, and acceleration strategies.

Gaussian Splatting: point-based graphics, splatting, Gaussian splatting, and advanced splatting methods.

Physics Simulation: mathematical foundations, particle-based simulation, position-based dynamics, differentiable physics, and neural physics simulation.

Generative Models and World Models: generative-model foundations, diffusion models, score-based and flow-matching ideas, geometry generation, and world models.

Required Course Materials

There is no required textbook. Course materials will be provided through Canvas, the course GitHub page, and instructor materials. Students should have access to a laptop with graphics capabilities sufficient for GLSL or WebGL-based assignments. Several assignments also use lightweight neural-network training in Google Colab, so students should have access to a Google account and be comfortable working with Python and Git at a basic level.

Grading Policy

Grades are based on the following components:

Assignments: 64% total (eight programming assignments worth 8% each)

Quiz: 16%

Final Project: 16%

Creative Expression Sharing: 4%

Description of Graded Components

Programming assignments develop practical skills in ray tracing, signed distance fields, volumetric rendering, NeRF, Gaussian splatting, simulation, and diffusion-based graphics workflows. The quiz assesses understanding of core concepts and mathematical foundations. The final project gives students an opportunity to explore a modern topic in AI-enabled graphics in greater depth. Creative Expression Sharing highlights communication and reflection on technical or visual outcomes produced during the semester.

Attendance and Participation

Regular attendance and participation are strongly encouraged because the course builds progressively across technical topics and visual demonstrations. Students are responsible for keeping up with course announcements, lecture materials, and deadlines whether or not they are present in class.

USG Required Course Policies

Attendance and/or Participation

Students are expected to engage consistently with lectures, assignments, and course communications. Participation in class activities and timely completion of coursework are important for success in a fast-moving technical course.

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards and to follow Georgia Tech's Academic Honor Code and Student Code of Conduct.

In this course, students may discuss concepts with classmates, but submitted assignments, code, quizzes, project reports, and shared materials must reflect the student's own understanding unless explicit collaboration is authorized. Any use of external code, datasets, online resources, or generative AI tools must be appropriately acknowledged. Students are responsible for being able to explain and defend all submitted work.

Core IMPACTS

Not applicable.

Additional Georgia Tech Required Policies

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services as soon as possible to make an appointment to discuss your needs and obtain an accommodations letter. Please also email me as soon as possible so that we can discuss how to support your learning in this course.

Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The Student-Faculty Expectations Agreement articulates some basic expectations that you can have of me and that I have of you. Respect for knowledge, hard work, and cordial interactions will help build the environment we seek in this class.

Course Expectations, Policies, and Resources

Pre- and/or Co-Requisites

Students are expected to be familiar with computer graphics at approximately the level of CS 3451, including basic ideas in geometry, transformations, rendering, and animation. A working knowledge of calculus and linear algebra is also expected. No prior background in AI or machine learning is required.

Collaboration, Group Work, and Use of Generative AI

Discussion of course ideas with peers is encouraged, but unless the instructor explicitly approves team-based work, each student must submit their own code, writing, and project artifacts. Generative AI tools may be used as supplemental aids for brainstorming, debugging, or exploration, but they may not replace student understanding or be used to submit uncredited work. Any meaningful AI assistance should be disclosed, and students remain fully responsible for the correctness, originality, and integrity of everything they turn in.

Extensions, Late Assignments, and Missed Work

Assignments are expected to be submitted on time. Requests for extensions should be made as early as possible. Extensions or alternate arrangements may be granted for documented illness, Institute-approved activities, religious observances, or other serious circumstances. Students who miss a quiz or other required graded activity should contact the instructor promptly to discuss whether a make-up or alternate arrangement is appropriate.

Course Websites and Resources

Course resources include the GitHub page (https://github.com/cg-gatech/cgai), the course demo site (https://cgai-gatech.vercel.app/), Canvas for course materials and submissions, and Ed Discussion or other course communication platforms as announced by the instructor.