Georgia Institute of Technology

CS 8803: Computer Graphics in the AI Era Syllabus

Fall 2026

Delivery: 100% Web-Based, Asynchronous

Dates course will run: Aug 24 – Dec 8, 2026

Instructor Information

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Office Hours: Weekly office hours via Zoom. Schedule posted on Canvas.

General Course Information

Course Website and Other Classroom Management Tools

Vercel Demo: cgai-gatech.vercel.app

GitHub: github.com/cg-gatech/cgai

Canvas: Main course website

Description

This course surveys modern computer graphics with emphasis on AI-enabled methods for modeling, rendering, simulation, and animation, focusing on implicit neural representations, neural rendering, Gaussian splatting, differentiable physics simulation, and generative models. The course positions these topics within classical graphics pipelines and provides both theoretical foundations and practical skills for building interactive and realistic content in contemporary AI-driven workflows.

Pre-Requisites

A working understanding of calculus (differentiation and integration) and linear algebra (vectors and matrices) is required. A basic familiarity with computer graphics concepts is helpful but not required. For students without a prior graphics background, the first three lectures are designed to provide a concise introduction to these fundamentals. No prior experience in AI or machine learning is required.

Course Goals and Learning Outcomes

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

- explain the mathematical and algorithmic foundations of implicit neural scene representations, volumetric rendering, and differentiable simulators
- implement core components of AI-era graphics pipelines, including SDF-based modeling and ray marching, NeRF-style volumetric rendering, 3D Gaussian splatting, and PBD-based simulation
- analyze and compare diffusion, score/flow matching, and world-model-based approaches for generative 3D graphics applications, and integrate these methods into practical graphics systems.

Course Structure

The course consists of 28 video lessons (two per week) and one midterm week, organized into six modules:

- **Module 1 - Foundation of Graphics (3 Lessons):** Course overview, geometry modeling, appearance modeling, and ray tracing. *Assignment 1: GLSL Ray Tracing.*
- **Module 2 - Signed Distance Fields (5 Lessons):** Signed distance field, primitives/operations, SDF rendering, grid representation, and neural representation. *Assignment 2a: SDF Rendering; Assignment 2b: Neural SDF.*
- **Module 3 - Neural Radiance Fields (5 Lessons):** Radiometry, participating media, NeRF, accelerating NeRF, and hybrid representations. *Assignment 3a: Volumetric Rendering; Assignment 3b: NeRF.*
- **Module 4 - 3D Gaussian Splatting (4 Lessons):** Points, splats, 3D Gaussian splatting, advanced 3D-GS. *Assignment 4: Gaussian Splatting.*
- **Module 5 - Position-Based Physics Simulation (5 Lessons):** Physics Simulation; particle methods, position-based dynamics, differentiable physics, neural physics. *Assignment 5: PBD Simulation.*
- **Module 6 - Generative Graphics Models (6 Lessons):** Math foundation for generative models, diffusion models, score/flow matching, geometry generation, video generation, world models. *Assignment 6: Diffusion Model.*

Course Requirements, Assignments & Grading

Assignment Distribution and Grading Scale

Assignment Weight Distribution and Due Dates

Assignment	**Weight** (Percentage, points, etc.)
Programming Assignments	**64%**
Mid Term Exam	**16%**
Final Project	**16%**
Creative Expression Sharing (Participation)	**4%**

Grading Scale

Your final grade will be assigned as a letter grade according to the following scale:

A 90-100%
B 80-89%
C 70-79%
D 60-69%
F 0-59%

Submitting Assignments and Feedback
All work (assignments, quizzes, exams) is submitted via Canvas-linked platforms. Rubric-based TA feedback will be provided for most assignments.

Assignment Due Dates
All assignments will be due at the times listed above. These times are subject to change so please check back often. Please convert from Eastern Time to your local time zone using a Time Zone Converter.

Late and Make-up Work Policy
Late work is penalized 5% per day up to four days; no submissions accepted after four days except for documented accommodations/

Technology Requirements and Skills

Computer Hardware and Software
Students should have access to a laptop with a GPU; integrated GPUs (e.g., Intel Iris or Apple Mseries) are sufficient. Several assignments require shader programming (GLSL/WebGL) and basic GPU compute support. Lightweight neural-network training uses Google Colab with short daily free GPU sessions. Basic familiarity with Python and Git is recommended.

Onboarding Quiz and Proctoring Information
All Georgia Tech online degree and certificate students are required to complete the Onboarding Quiz with Honorlock in the first week of the course. Honorlock is utilized for student identity verification and to ensure academic integrity. Honorlock provides student identity verification via facial and ID photos. You may also be asked to scan the room around you. The Onboarding Quiz is needed to help make sure that your identity is verified and that your system is set up to work with Honorlock online proctoring tool. You are required to complete this quiz early in the semester to avoid problems when taking proctored exams.

Course Policies, Expectations & Guidelines

Communication Policy
Canvas hosts official announcements, slides, readings, and grades. Ed Discussion provides Q&A and discussions. Zoom is used for office hours. For technology, the Digital Learning Support team at b.gatech.edu/digitallearningsupport for assistance. You can reach the Canvas Hotline by phone at 1 (877) 259-8498 or email at support@instructure.com.

Online Student Conduct and (N)etiquette
Although it is not expected to be a problem in a graduate-level class, students are asked to behave in the discussions and other class interactions professionally and civilly. If you are in doubt, do not post it! Instructors reserve the right to remove any postings deemed inappropriate, unprofessional, or otherwise distracting from the course.

University Use of Electronic Email
A university-assigned student e-mail account is the official university means of communication with all students at Georgia Institute of Technology. Students are responsible for all information sent to them via their university-assigned e-mail account. If a student chooses to forward information to their university e-mail account, he or she is responsible for all information,

including attachments, sent to any other e-mail account. To stay current with university information, students are expected to check their official university e-mail account and other electronic communications on a frequent and consistent basis. Recognizing that some communications may be time-critical, the university recommends that electronic communications be checked minimally twice a week.

Plagiarism & 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. All students enrolled at Georgia Tech, and all its campuses, are to perform their academic work according to standards set by faculty members, departments, schools, and colleges of the university; and cheating and plagiarism constitute fraudulent misrepresentation for which no credit can be given and for which appropriate sanctions are warranted and will be applied. For information on Georgia Tech's Academic Honor Code, please visit www.catalog.gatech.edu/policies/honor-code/.

Any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will be reported to the Office of Student Integrity, which will investigate the incident and identify the appropriate penalty for violations.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at (404) 894-2563 or disabilityservices.gatech.edu/, as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible to set up a time to discuss your learning needs.

Copyright

Among the materials that may be protected by copyright law are the lectures, notes, and other material presented in class or as part of the course. Always assume the materials presented by an instructor are protected by copyright unless the instructor has stated otherwise.

Student-Faculty Expectations Agreement

At Georgia Tech we believe that it is important to strive for an atmosphere of mutual respect, acknowledgment, and responsibility between faculty members and the student body. See catalog.gatech.edu/rules/21/ for an articulation of some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

Subject to Change Statement

The syllabus and course schedule may be subject to change. Changes will be communicated via Canvas and Ed Discussions. It is the responsibility of students to check email messages and course announcements to stay current in their online courses.

Course Schedule

Week/Dates	Modules/Lessons	Assignments
1 Aug 24	M1L1 Modeling and GPU; M1L2 Lighting Shading and Texturing	
2 Aug 31	M1L3 Ray Tracing; M2L1 SDF Mathematical Foundation	Assignment 1 Released
3 Sep 7	M2L2 Primitive and Operations; M2L3 Ray Marching	Assignment 1 Due; Assignment 2a Released
4 Sep 14	M2L4 Grid-Based SDF Representation; M2L5 Neural SDF Representation	Assignment 2a Due; Assignment 2b Released
5 Sep 21	M3L1 Radiance Field; M3L2 Participating Media	Assignment 2b Due; Assignment 3a Released
6 Sep 28	M3L3 Neural Radiance Field; M3L4 Accelerating NeRF	Assignment 3a Due; Assignment 3b Released
7 Oct 5	M3L5 Hybrid Representations; M4L1 Gaussian Representation	Assignment 3b Due
8 Oct 12	M4L2 Footprint and Splatting; M4L3 Gaussian Splatting	Assignment 4 Released
9 Oct 19	M4L4 Dynamic Gaussian Splatting; M5L1 Physics Simulation 101	Assignment 4 Due
10 Oct 26	Review Session and Midterm	Midterm Exam; Final Project Released
11 Nov 2	M5L2 Particle Simulation; M5L3 Position-based Dynamics	Assignment 5 Released
12 Nov 9	M5L4 Differentiable Physics and Adjoint Method; M5L5 Neural Physics Simulation	
13 Nov 16	M6L1 Generative Models Overview M6L2 Diffusion Models	Assignment 5 Due; Assignment 6 Released
14 Nov 23	Thanksgiving. No class.	
15 Nov 23	M6L3 Score Distillation and 3D Generation; M6L4 Video World Models	
16 Nov 30	M6L5 3D World Models	Assignment 6 Due