Computer Graphics Fundamentals

CS 480/680 Syllabus

Instructor	**Dr. Jonathan Metzgar | jbmetzgar@alaska.edu | twitter: microwerx_**
Class	ELIF 301
Office	Duckering 543 | 907 474 6104 | MW 9am-noon, 5:15-6pm or by appointment
Web	Blackboard and https://www.cs.uaf.edu/~jbmetzgar/
CRN	CS480 77505 F02 and CS680 77507 F02
Book	Computer Graphics: Principles and Practice 3e, ISBN 978-0-321-39952-6
Grades	A [90-100], B [80-89], C [70-79], D [60-69], F [0-59]
Other	Credits 3+0 Drop by 9/7 Withdraw by 11/7 Special days: Labor Day 9/3, Thanksgiving 11/21-25, Final 12/13 1-3pm Prerequisites: MATH 314 Linear Algebra and CS311 Data Structures & Algorithms

Introduction

In this course, we will learn the fundamentals of computer graphics including vector and matrix mathematics, 2D and 3D primitives, rendering algorithms, and application design. The objective is to learn a broad perspective of computer graphics algorithms and principles.

Course Outcomes

Students will be able to

- Implement computer graphics algorithms using web technologies like TypeScript and WebGL 1.0
- Recall the basic realtime rendering pipeline and the rendering equation

$$L_o(\boldsymbol{x} \to \omega_o) = L_e(\boldsymbol{x} \to \omega_o) + \int_\Omega f_r(\omega_i, \omega_o) L_i(\omega_i \to \boldsymbol{x})(\omega_i \cdot \boldsymbol{n}) d\omega_i$$

- Utilize input from a variety of different sources including keyboards, mice, and game pads
- Understand 2D and 3D transformations including translation, scaling, rotation, and projections
- Use data structures including vertex array buffers, 2D images, cube maps, and 3D voxels
- Create 2D graphics using typography, sprites, and tiled background graphics
- Understand how 3D models are created with points, lines, triangles, and curved surfaces
- Evaluate vector, matrix, and quaternion mathematical operations in 4D space
- Write vertex shaders using GLSL to perform typical 2D and 3D transformations
- Create and implement a hierarchical scene graph using a directed acyclic graph
- Implement collision detection algorithms using spheres and axis aligned bounding boxes
- Write fragment shaders to create physically based lighting and nonphotorealistic effects
- Add basic artificial intelligence and sound and music to a web application
- Create interactive computer graphics applications according to a theme
- Successfully complete a project and present a research paper with a professional Latex template

Grades

The course load consists of two exams, nine homework assignments, and a research project. The midterm exam and final exam are both worth 20% of your final grade. Your research project will be worth 20% of your final grade. The 9 homework assignments will be worth 40% of your final grade. The lowest homework grade will be replaced by the average grade of the remaining homework grades, but ALL homework must be completed. Graduate students will be expected to do more work. The exams are based on the content of the assigned readings.

IMPORTANT! Homework and Projects are due by midnight. Late homework gets penalized one whole letter grade each day that it is late starting at 12:01AM. Late homework after 3 days receives no credit.

Policies

Students are expected to be at every class meeting on time, and are responsible for all class content, whether present or not. If absence from class is necessary, in-class work (other than quizzes) and homework may be made up only if the instructor is notified as soon as possible; in particular, absences due to scheduled events must be arranged ahead of time. Academic dishonesty will not be tolerated, and will be dealt with according to UAF procedures. Students in this class must pay the CS lab fee. Payment allows access to the computing lab.

UAF academic policies http://www.uaf.edu/catalog/current/academics

CS Department policies http://www.cs.uaf.edu/departmental-policies

Disabilities Services:

The UAF Office of Disability Services implements the Americans with Disabilities Act (ADA), and ensures that UAF students have equal access to the campus and course materials. I will work with the UAF Office of Disability Services (208 WHITAKER BLDG, 474-5655) to provide reasonable accommodation to students with disabilities.