Introductions

Pat Hanrahan

- Part of the original team at PIXAR
- Academy awards: RenderMan / BSSRDF skin
- Research: rendering, graphics systems and architectures, and visualization

Course assistants:
Crystal Lemire, Katherine Breeden, Alexis Haraux, Jorge Lara-Garduno, Daniel Ritchie, Matt Watson

Why Study Computer Graphics?
Entertainment

Movies
Toy Story 3
Pixar Disney

Games
Spore
W. Wright, Elec. Arts

Computer-Aided Design

Mechanical CAD
Architectural CAD
Electronic CAD
Visualization

Science, engineering and medicine

The Virtual Human
Karl-Heinz Hoehne

Outside-In
The Geometry Center

Visual Simulation and Training

Apollo spacecraft
Flight simulators
Driving simulators
Surgical simulation

davinci surgical robot
Intuitive Surgical

Driving simulator
Toyota Higashifuji Technical Center
Digital Media Technologies

Convert traditional analog media to digital media
  ■ Desktop publishing and printing
  ■ Digital photography
  ■ Digital video and HDTV

Emergence of new media
  ■ Multimedia computers and media servers
  ■ Networked graphics and the web
  ■ Electronic books, magazines and newspapers
  ■ Sharing photos (flickr) and videos (youtube)
  ■ Virtual worlds (Google Earth, Second Life)

With new possibilities for creating and mixing content from different sources
Graphical User Interfaces

Desktop metaphor

- **Input:** Keyboard, mouse
- **Output:** Cathode-ray tube

Ivan Sutherland, Sketchpad
Light-pen, vector display

Douglas Engelbart
Mouse

Emerging User Interfaces

Different scales: Small and large
Emerging sensors: Multi-touch, accelerometers, ...

Apple iPad
Microsoft Surface
Ultimate Interface? Virtual Reality

Immersive interfaces
- **Input**: 3D 6-DOF tracking, gloves
- **Output**: Head-mounted and projection displays

Ivan Sutherland
Head-mounted displays, mechanical tracker

Wolfgang Krueger, Pat Hanrahan
Responsive Workbench
Projection display, magnetic tracker

Course Goals

Provide an overview of graphics and imaging
- Image capture, manipulation and display
- 3D graphics: geometry, rendering, animation

Basic representations (geometry, images, ...)
Basic algorithms (rendering, subdivision, ...)
Technology (GPUs, camera, displays, input)
Theory and Practice

Science and Mathematics
- Physics of light and color
- Geometry and perspective
- Mathematics of curves and surfaces

Engineering
- Hardware: Graphics processors, sensors
- Software: Graphics libraries, window systems

Art and Psychology
- Perception: Color, shading, motion, ...
- Art and design: Composition, form, lighting, ...

Administration
Prerequisites

Mathematics
- Math 41 and 42: Calculus 1 & 2
- Vectors, matrices, basic linear algebra
- Polynomials
- Basic signal processing, Fourier transform
- Helpful: Math 51, Math 103/104/113, CS 205

Programming
- CS 107
- Fluent in C++
- Fluent with development environment

Evaluation

Weekly programming assignments (70% of grade)
- 8 assignments
- Expect 5-10 hours per assignment
- Handed out on Thu; due following Thu
- No late days
- Drop assignment with lowest score (count 7/8)

Midterm and final (30% of grade)
- Written exams
- Open-book/notes/computer, closed-network
- Cover concepts and problem-solving
Graphics Track

Two required graphics courses

CS148
- Broad overview of graphics and imaging
- Designed to be a standalone course

CS248
- CS148 is a prerequisite (both should be taken)
- Emphasizes real-time 3D graphics (games)
- Modeling, rendering, animation

More information

csmajor.stanford.edu/ProgramSheets/CS_Graphics_1112PS.pdf

Course Wiki

cs148.stanford.edu

https://graphics.stanford.edu/wikis/cs148-11-fall
Graphics Processing Units (GPUs)

NVIDIA Fermi
Input & Interactive Techniques

Digital Cameras
Displays

Typography and Page Layout

/Utopia-Regular

/less
/z3
/oe
/at
/acute
/four
/eth
/aring
/ogonek
/zero
Light and Color

Mattes, Layers, and Compositing
Filtering and Sampling

No Jaggies

Compression
Modeling and Rendering

Animation and Simulation