CS 148: Introduction to Computer Graphics and Imaging

Creative Expression (CE) WAYS course

Instructor: Ron Fedkiw
Website: cs148.stanford.edu
Meeting Times: Tuesday and Thursday, 10:30am to 11:50am
What can I do with graphics?

https://www.youtube.com/watch?v=Tmm4BQX8TCQ
Visual Effects: Liquids

Battleship

Terminator 2

The Day After Tomorrow
Visual Effects: Gases

Harry Potter and the Order of the Phoenix

Terminator 3

Star Wars Episode III
Visual Effects: Solids

- Destruction: fracture, explosions, etc.

Super 8

2012
Visual Effects: Digital Doubles

The Curious Case of Benjamin Button
Visual Effects: CG Creatures

Yoda, Star Wars Episode II

Sméagol/Gollum, The Lord of the Rings
Motion Capture

Facial capture in Avatar

Motion capture of Olympic swimmer Dana Vollmer by Manhattan Mocap
Animated Films

Toy Story 3

Monsters, Inc.
Video Games

**Spore**

**Crysis**

**Braid**
What can I do with graphics?

https://www.youtube.com/watch?v=aThCr0PsyUA&fe
2D Image Processing
Computer-Aided Design

Sketchup

ProEngineer
Scientific Visualization

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

- Digital photography
- Inkjet and laser printers
- Digital video and HDTV
- Electronic books
- Graphics on the web:
  - Photos (flickr)
  - Videos (youtube)
User Interfaces

Ivan Sutherland, Sketchpad, Light-pen, vector display

Apple iPad

Console Controller
Virtual Reality

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

Ivan Sutherland: Head-mounted displays, with mechanical tracker

Oculus Rift
Graphics Hardware

NVIDIA Fermi

NVIDIA OptiX
Cameras and Smartphones

• Sales of smartphones outweigh sales of cameras by a factor of 3
• Most smartphones have cameras
• 5 billion mobile phones are in use worldwide
  • 4.4 billion camera phones and 1.2 billion smartphones
• World population is 7 billion
Overview of the Graphics Track

Creative Expression (CE) WAYS course

1. **CS 148** (core class)
   
   A. Using the computer to draw pictures
   
   B. Theoretical background (math/physics) for the technical aspects of drawing pictures
   
   C. Coding: You will write code but will not submit any code. Instead, *you will show your pictures via live demos*
Overview of the Graphics Track

2. **CS 248** (creating a videogame)
   
   A. Now that you know how to draw a picture (CS 148), we cover many other aspects of graphics using the specific example of a video game.
   
   B. Topics include: Platforms, game design, artificial intelligence, UIs/GUIs, computational geometry, computer animation, simulation, etc.
   
   C. You may write a 2D game if your game is a mobile or web game – This doesn’t stress rendering which is the topic of CS 148 but covers everything else.
Overview of the Graphics Track

3. Other Courses

A. Rendering CS 348B
B. Special Topics: CS 448
C. Cameras: CS 178, CS 478
D. Math: CS 205A, CME 102, CME 104, CME 108, MATH 113
E. Geometry: CS 164, CS 268, CS 348A, CS 468
F. Computer Vision: CS 231A, CS 231B
G. Image Processing EE 368/CS 232
H. Robotics: CS 223A, CS 225A, CS 327A
I. Mobile Devices: CS 193I, CS193P
Graphics Faculty

Leo Guibas
Pat Hanrahan
Marc Levoy
Ron Fedkiw

NEW FACULTY:

Maneesh Agrawala
Doug James
CS 148 – 2 Milestones

Scanline Render: *Portal, Valve Corporation*

Raytraced Render: *San Miguel Scene, PBRT*

Math and Optics
Assignments and Grading

- **Grading**: 40% scanline image, 40% raytraced image, 20% homeworks

- The weekly graded homeworks are designed as building blocks towards the scanline and raytraced images
  - There will be 4 homeworks for each image (8 total)

- You may use a partner for both the HWs and the images
  - You may change partners as often as you wish throughout the quarter

- Homework is assigned Tuesday and due the following Monday from 3-7pm

- Grading is done via live demos with the CAs
  - The CAs will/may ask you various questions
  - Make sure you can answer questions about all parts of the code, regardless of which parts you or your partner may have done individually

- Grading is based on a check/plus/minus grading scale
  - If your homework grades are not going well, do not be surprised if your final image grade is lower than you expect
  - Feedback is very important in computer graphics!
# Course Outline

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<td>In-Class Demo</td>
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<td>Ray Traced Image: covers lectures 11-18</td>
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<td>Final Exam: TBA</td>
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- Arrange with the TA’s now, if you need special consideration for scheduling of the In-Class Demos
How To Approach This Course

• This is essentially a project based course
• Your goal is to explore digital image creation via various computer graphics techniques
  • The course is supposed to be fun!
  • It’s not supposed to be a programming course or math course, except that programming and math are necessary enabling technologies
• The instructor and CAs are your guides
• Lectures are meant to lead you in the right direction --- just to get your started
  • They are not meant to tell you everything
  • You should utilize the reference reading materials
  • You should utilize the CAs, your classmates, online resources, and your imagination...
Some of Last Year’s Images...
Some 2013 Images (2 years ago)
A 348B image...