CS559: Computer Graphics

Lecture 1 Introduction
Li Zhang
University of Wisconsin, Madison
Today

• Introduction to Computer Graphics
• Course Overview
What is Computer Graphics

• Using computers to generate and display images

• Core areas
  – Modeling
    • lighting, shape, reflectance ...
  – Rendering
    • math models -> images

The Digital Michelangelo Project
Stanford University
What is Computer Graphics

- Using computers to generate and display images
- Core areas
  - Modeling
    - lighting, shape, reflectance ...
  - Rendering
    - math models -> images
  - Animation
    - how things change

Park and Hodgins, SIGGRAPH 2006
What is Computer Graphics

- Using computers to generate and display images
- Related areas
  - Image processing

Image Analogies, Hertzmann et al, SIGGRAPH 2001
What is Computer Graphics

• Using computers to generate and display images
• Related areas
  – Image processing
  – 3D photography
What is Computer Graphics

• Using computers to generate and display images

• Related areas
  – Image processing
  – 3D photography
  – Visualization

PV-Wave, Visual Numerics
What is Computer Graphics

• Using computers to generate and display images

• Related areas
  – Image processing
  – 3D photography
  – Visualization
  – Virtual reality

U.S. Navy personnel using a VR parachute trainer
http://en.wikipedia.org/wiki/Virtual_reality
What is Computer Graphics

• Using computers to generate and display images

• Related areas
  – Image processing
  – 3D photography
  – Visualization
  – Virtual reality
  – User interaction
Why do we care?

• Cool pictures – fantasy world

Graphique3d.republika.pl  Pirates of the Caribbean
Why do we care?

• Applications
  – Industry Design
Why do we care?

- Applications
  - Industry Design
  - Architecture
Why do we care?

• Applications
  – Industry Design
  – Architecture
  – Movies

Star War, Episode I, Lucas Film

Finding Nemo, Waltt Disney
Why do we care?

• Applications
  – Industry Design
  – Architecture
  – Movies
  – Games

America’s army, released by US Government

US Game Sales:
• $4.82 billion in December
• $~18 billion for all of 2007
market research firm NPD, Jan 17
Why do we care?

• Applications
  – Industry Design
  – Architecture
  – Movies
  – Games
  – Training

Image from Defense News, 31 Jan 07
Why do we care?

• Applications
  – Industry Design
  – Architecture
  – Movies
  – Games
  – Training
  – Virtual World

Second Life
Why do we care?

• Applications
  – Industry Design
  – Architecture
  – Movies
  – Games
  – Training
  – Virtual World
  – Medical Imaging

Jingyi Yu, Graphics, U Delaware
Why do we care?

• Applications
  – Industry Design
  – Architecture
  – Movies
  – Games
  – Training
  – Virtual World
  – Medical Imaging
  – Visualization

Jingyi Yu, Graphics, U Delaware
A broader view

• Computer Graphics is
  – The technology for communicating and interacting with information *in a visual way*

• Visual information is
  – Intuitive
  – Parallel
  – Correlated
What’s covered in this class

• Not!
  – Paint and Imaging packages (Photoshop)
  – CAD packages (AutoCAD)
  – Rendering packages (Maya)
  – Modeling packages (3D Max)
  – Graphics Modeling and Languages (RenderMan)

• We will cover...
  – Graphics programming languages (OpenGL)
  – Graphics algorithms
  – Graphics data structures
  – Graphical User Interface (GLUT)
  – Applied geometry and modeling
  – Shape and motion capture
What’s covered in this class

• Image related topics
  – Light, eye, and cameras,
  – Digital images, sampling and re-sampling
  – Color concepts, image adjustment, compositing
  – Filtering, Warping, Panorama
What’s covered in this class

• Project 1: A picture processing system
  – Implement basic image processing operations like filtering, re-sampling, warping,
  – Image compositing, impressionist painting
What’s covered in this class

• Geometric Modeling
  – coordinate systems, transformation
  – 2D/3D primitives, projection,
  – OpenGL, graphics pipeline, 3D UI issues
  – Shape concepts, parametric forms, splines
  – Meshes, subdivision surfaces
What is this class about?

• Project 2: Roller coaster train
What’s covered in this class

• Basic Rendering techniques
  – Visibility, scan-conversion,
  – Lighting, Texture mapping,
  – Ray tracing, global illumination,
What’s covered in this class

- Project 3: A graphics town

Brandon Smith
What’s covered in this class

• Project 3: A graphics town
What’s covered in this class

• Project 3: A graphics town

Daniel Geil
What’s covered in this class

• Project 3: A graphics town

Marc Lenz
What’s covered in this class

• Project 3: A graphics town

Xiang Ji and Yuxiang Yang
Staff

• Instructor: Li Zhang
  – lizhang@cs.wisc.edu
  – Office hours: Monday Wednesday 2:15-3:00pm
  – Office location: 6387 Comp S&ST

• TA: Chi Man Liu
  – cx@cs.wisc.edu
  – Office hours: Tu 11-noon, Th 3-4
  – Office location: 1301 Comp S&ST
Course info

• Mailing list: compsci559-1-s08@lists.wisc.edu
• Course web: www.cs.wisc.edu/~cs559-1
• Computers: storm lab -- 1366 Comp S&ST
• Language: C++
• Compiler: MS Visual Studio 2005
Books

• Peter Shirley. *Fundamentals of Computer Graphics, 2nd ed*
  – note: the new 2nd edition is considerably different than the first - it is green (not orange).
  – check the [errata page](#) for the first printing.
Books

  – An older edition (available online) would be OK. It’s an important reference.
Prerequisites

• CS367 (Data Structures)
• Math 320, 340 or CS416 (some familiarity with linear algebra)
• C/C++
  – You can learn it as you do project, but you need to work very hard.
Exams

• Midterm
  – Monday, March 24th from 7:15-9:00pm

• Final
  – Saturday, May 17th from 7:45-9:45pm
Grading

- Projects: 25% * 3
- Midterm: 10%
- Final: 15%
- Late policy
  - 80% 1\textsuperscript{st} day, 60% 2\textsuperscript{nd} day, … 0% 5\textsuperscript{th} day,
    - Prorated hourly
  - Can be late ONCE without penalty in the semester,
    - But can’t be later than demo date
  - Penalty Recovery
Class Survey

- https://learnuw.wisc.edu/
- Questions like your major/home department, familiarity with C++ etc.

- YOU NEED TO FINISH THIS BEFORE WE GRADE YOUR FUTURE PROJECTS
Questions?