CSE 167:
Introduction to Computer Graphics

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TAs and Tutors

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Course Overview

Rendering

- Synthesis of a 2D image from a 3D scene description
  - Rendering algorithm interprets data structures that represent the scene in terms of geometric primitives, textures, and lights
- 2D image is an array of pixels
  - Red, green, blue values for each pixel
- Objectives
  - Photorealistic
  - Interactive

Photorealistic rendering

Photorealistic rendering

- Physically-based simulation of light, camera
- Shadows, global illumination, multiple bounces of light
- Slow, can take minutes or hours to render an image
- Used in movies, animation
- Focus of CSE 168: Rendering Algorithms

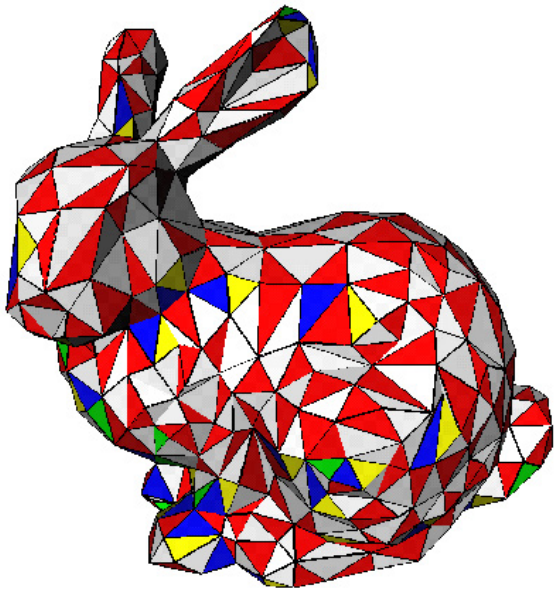
Interactive rendering

Interactive rendering

- Produce images within milliseconds
- Using specialized hardware, graphics processing units (GPUs)
- Standardized APIs (OpenGL, DirectX, Vulkan)
- Tries to be as photorealistic as possible
- Hard shadows, only single bounce of light
- Used in games, technical design, etc.
- Covered in this course

What will we render?

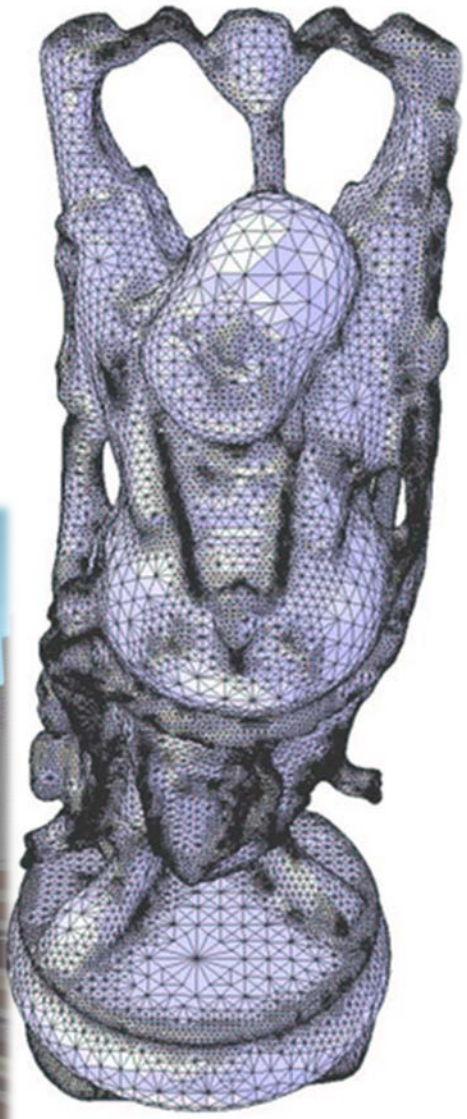
- Simple shapes: points, lines, triangles, quads
- 3D models
  - Basic 3D models consist of arrays of triangles



- Sources of 3D models:
  - Created with 3D modeling tool
  - Procedurally generated by algorithms
  - Created by scanning real objects

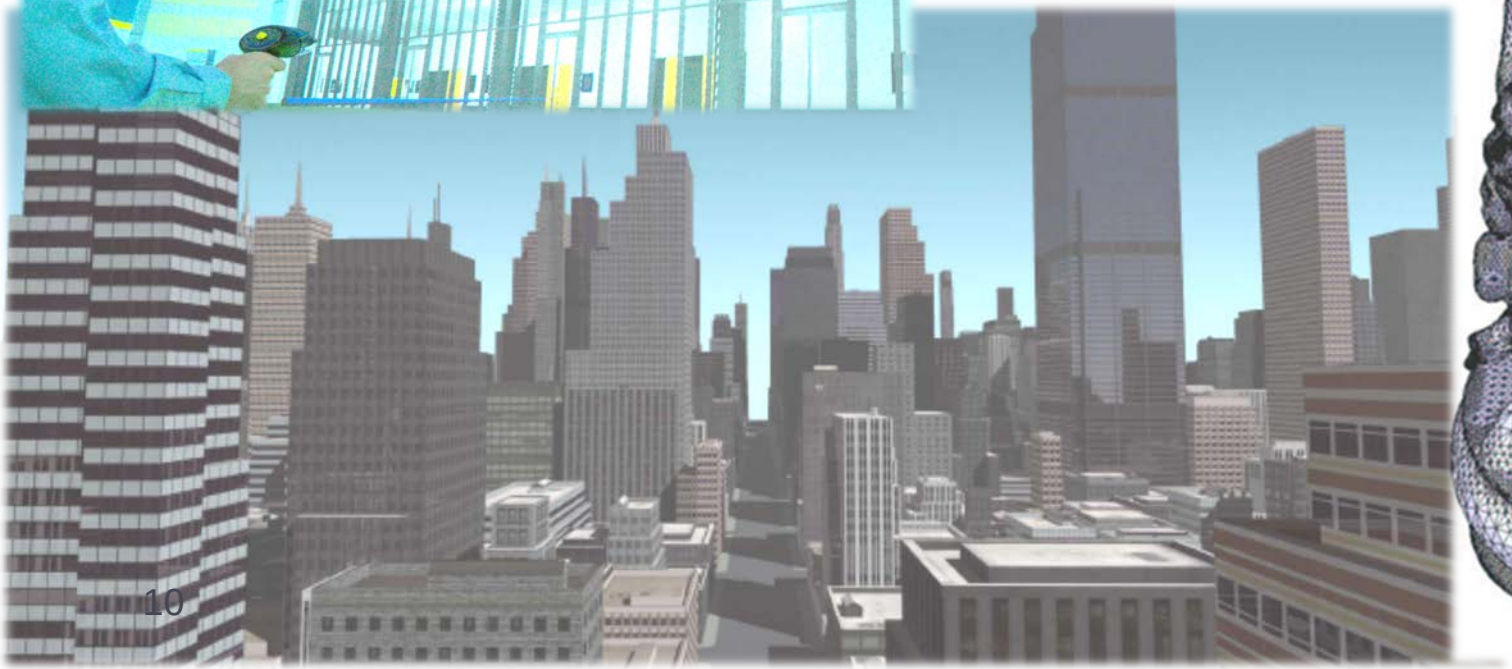
Modeling

Scanned statue



3D modeled building

Procedural city



3D Modeling Tools

- Blender (open source, free)
  - https://www.youtube.com/watch?v=Kik4iZp5mjE
- Sketchup (free)
- Maya
- 3ds Max
- Rhino 3D

Prerequisites

Familiarity with:

- C++
- Object oriented programming
- CSE 100: Advanced Data Structures
  - Data structures in C++: linked lists, graph structures, class or struct arrays
  - Data structure analysis
  - Deciding on appropriate data structures to solve problems
- Standard Template Library
- Git version control system for **private** source code repository

Topics Covered

- Basic skills:
  - Vector and matrix mathematics
  - Coordinate system transformations
  - 3D to 2D projection
  - Rasterization

Topics Covered

- OpenGL:
  - Lighting
  - Texturing
  - Shading
  - GL Shading Language (GLSL)

Topics Covered

- High Level Concepts:
  - Scene Graph
  - Culling
  - Parametric Curves and Surfaces
  - Procedural Modeling

Topics Covered

- Visual Effects:
  - Environment Mapping
  - Shadows
  - Deferred Rendering

Course Organization

Information on Course Web Site

URL: http://ivl.calit2.net/wiki/index.php/CSE167F2020

- Course Staff
- Office Hours
- Weekly Schedule
- Textbooks
- Homework Assignments
- Grading Information
- Course Schedule

Canvas

- For homework and exam grades
  - Check your grades regularly
  - Let us know if a grade is missing or incorrect
    - Allow a few days for grades to be entered
- Upload source code
  - Only ASCII (text) files
- Upload video

Piazza

- Discussion forums for
  - homework projects
  - final exam
  - other topics
- IA office hour schedule

Programming Projects

- 4 programming assignments
  - All are individual projects – no team work allowed for programming
- Find assignments and due dates on course home page
- Starter code is on home page
- Use your own PC/laptop with OpenGL
- Individual assistance by IAs during office hours
- Turn in by upload to Canvas
  - Due dates are on Sundays at 23:59pm PT
  - Make video and upload to Canvas
  - Upload source code to Canvas (no binaries except executable)
- All programming projects have extra credit option for extra 10% score

Waitlisted Students

- Includes Extension School and Concurrent Enrollment
- Recommended to work on first homework project even if not yet enrolled
- Canvas access only once enrolled
- Piazza access available now

Homework Project 1

- Will go on-line by tomorrow evening
- In the meantime: get starter code working

Announcements

- First homework discussion
  - Wednesday 1-1:50pm on Zoom

Final Projects from CSE 167 Fall 2019

- Shoreline
  - Warren Hu
  - https://www.youtube.com/watch?v=06wwuIXlbf8
- Shooting Range
  - Xiaoyang Yu, Graham Mcknight
  - https://www.youtube.com/watch?v=5Qmjrx85dpQ
- City Sim
  - Luke Deerinck, Jeremiah Johnson
  - https://www.youtube.com/watch?v=wYLW-WyMnRE