CPSC 314
Computer Graphics

Dinesh K. Pai

Lecture 1: Introduction

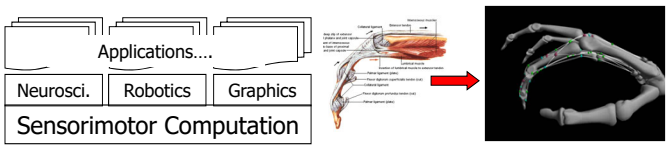
Course website:

http://sensorimotor.cs.ubc.ca/cpsc-314/

People

- Instructor: Dinesh K. Pai, pai@cs.ubc.ca
  Office hours: on Zoom. (time TBD) till then, by appointment.
- Very experienced TA team, Senior TA: Guanxiong (Eric) Chen
- For general course-related questions, use the Piazza discussion board
  - You can also meet with TAs during scheduled lab times.
  - The instructor is also available by appointment for questions not suitable for the discussion board

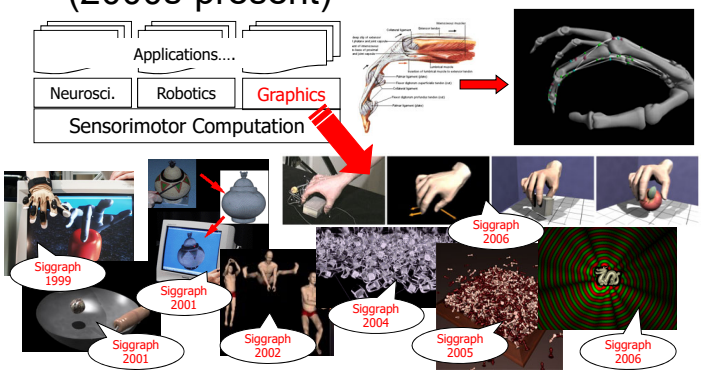
About me…



Sensorimotor Computation in Graphics

More details at http://sensorimotor.cs.ubc.ca/pai/

- (2000s-present)



2020 Canadian Computer Graphics Achievement Award
https://graphicsinterface.org/awards/chccs-scdhm-achievement/dinesh-k-pai/

Accolades for my former (Ph.D.) students

See cs department home page
https://www.siggraph.org/acm-siggraph-2021-awards/

2021 Computer Graphics Achievement Award:
Doug L. James

My current research:

Digital Humans

Course Communication

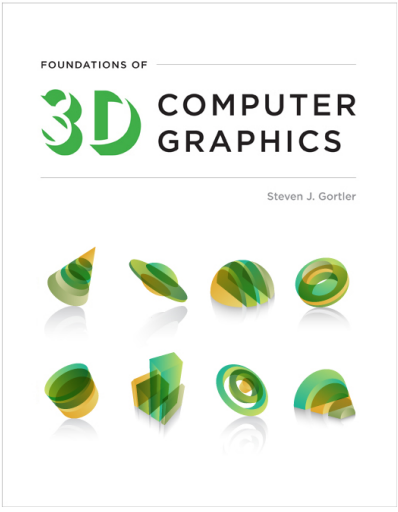
- Lectures: MWF 10-10:50 DMP 310. On Zoom till at least Jan 24
- Labs start next week. Attendance is not mandatory but highly recommended.
- Course website: syllabus and static resources http://sensorimotor.cs.ubc.ca/cpsc-314/
- Canvas: Official announcements, assignments and lecture materials posted there
- Discussions: We will use Piazza. You can access the Piazza link and sign up from Canvas (see left margin of course page)

COVID considerations

- Switch to http://sensorimotor.cs.ubc.ca/cpsc-314/

Textbook and Programming

- Required Textbook: Steven J. Gortler (2012) Foundations of 3D Computer Graphics, MIT Press
- Available online from UBC library, free to UBC students.
- However, note that the book uses OpenGL, we use closely related WebGL. Use text for understanding theory.
- Programs will use: Three.js, JavaScript, WebGL, and GL Shading Language (main focus)



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Prerequisites

- One of MATH 200, MATH 217, MATH 226, MATH 253 AND
- One of MATH 152, MATH 221, MATH 223 AND
- Either (a) CPSC 221 or (b) all of CPSC 260, EECE 320
- The following are essential for success
  - good grasp of linear algebra
  - exposure to calculus; “mathematical maturity”
  - “CS maturity”; programming experience. Expect you to pick up basic knowledge of JavaScript and WebGL

This is not an easy course!

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Course Schedule

- See https://canvas.ubc.ca/courses/83413/assignments/syllabus

Schedule of topics

Day	Date	Note	
1	Jan 10		Introduction
2	Jan 12		Pipeline.
3	Jan 14	A1 out	Hello Earth. Introduction to Threejs.
4	Jan 17		Geometry 1: Points, Vectors and Coordinates
5	Jan 19		Geometry 2: Transformations
6	Jan 21	Dropdate	Geometry 3: Frames
7	Jan 24		Frames in Practice (5)
8	Jan 26	A1in	Review 1
9	Jan 28	A2out	Quiz 1
10	Jan 31		Scene Graphs (and Object3D)
11	Feb 2		Mathematics of Rotations

Grading

marks %	work
40	programming assignments (4)
25	final exam
15	midterm exam
20	quizzes (2)

First assignment will be available next week

Quiz schedule is already set. See course web page for dates, and plan your schedule to avoid those dates!

About “in class” quizzes

- Duration 50 minutes. Students are expected to take them during the class hour, either in DMP 310 or another larger classroom.
- Using Canvas, on your laptop. If you choose not to use your own laptop, we will arrange for you to take it using a lab computer.
- Closed book. 

Only your Canvas quiz page should be open during the exam.
- Invigilators will be available to clarify questions about the exam

Any questions?

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What is Computer Graphics?

Many slides courtesy of Min Hyuk Kim, KAIST

What is Computer Graphics?

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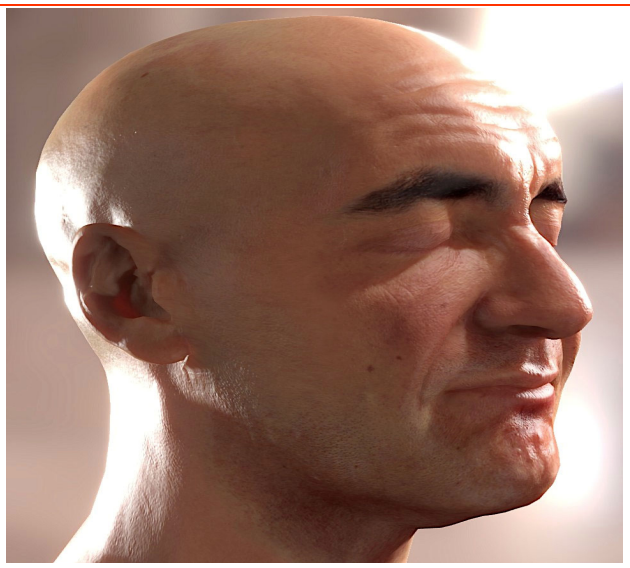
What is Computer Graphics?

What is Computer Graphics?



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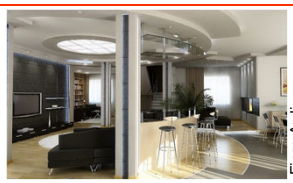
What is Computer Graphics?

(a) 

(b) 

(c) 

Answers: Graphics Graphics Graphics

- All of them are purely computer graphics images, created by the latest *graphics* techniques

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What is Computer Graphics?

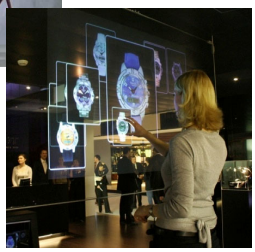
- *The Study of Algorithms and Systems for Generating Images with Computers*
- Includes the study of:

Representation

Manipulation

Interaction

Applications



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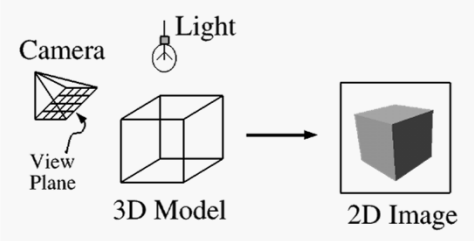
What is Computer Graphics?

- **Imaging** = representing 2D images
- **Modeling** = representing 3D objects
- **Rendering** = constructing 2D images from 3D models
- **Animation** = simulating changes over time



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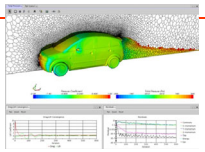
Applications of Computer Graphics

Movies

Games

Computer-Aided Design

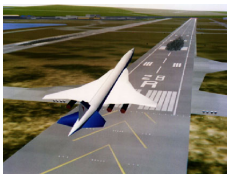


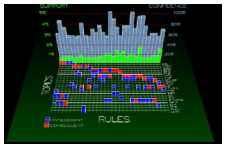
Computer-Aided Analysis

Cultural Heritage

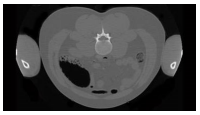
User Interface

Simulation Training





Information Visualization



Medical Imaging

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Applications of Computer Graphics

Pixar - Ratatouille (2007)

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Applications of Computer Graphics

- Unreal Engine 5 (demo May 2020)
  - https://www.youtube.com/watch?v=qC5KtatMcUw

Web 3D and VR

- WebGL 2.0 and HTML5 examples
  - https://threejs.org/
    - https://threejs.org/examples
    - http://carvisualizer.plus360degrees.com/threejs/
    - http://globe.chromeexperiments.com/
  - https://playcanv.as/e/p/44MRmJRU/

Used in 314

In this course you will learn how to

- Represent 3D shapes
- Transform 3D shapes
- Render 2D images from 3D shapes
- Model shading and lighting
- Create details of appearance using textures
- Program all of the above using the Three.js library, WebGL API and GL Shading Language

For next class

- Review Chapter 1 of textbook
- Review Math 200 and Math 221. We'll be covering some essential mathematics for 3D graphics soon.