COMP30019 Graphics and Interaction

Introduction

Lecturer: Adrian Pearce
Tutor: Alex Zable and Chris Ewin

Department of Computing and Information Systems
University of Melbourne

The University of Melbourne
Lecture outline

Introduction

What is graphics and interaction?

Syllabus

Theory and practice

Examples

Project work
A little bit about me

- Associate Professor in the Department of Computing and Information Systems
- Education:
  - PhD (Computer Science) Curtin, B.Sc. (Hons) UniMelb
- Research Interests:
  - AI Planning for Autonomy
  - Cognitive Robotics
  - Scheduling & Supply Chain Optimisation
  - Supervise 3 PhDs; Advised 10 PhDs to completion
- Current research projects . . .
AI planning & scheduling for supply chain optimisation

Autonomous Robotics

Photo Courtesy of Rio Tinto Iron Ore

Project with Peter Stuckey, Michelle Blom, Nir Lipovetzky from CIS
AI planning & scheduling for trusted autonomy

Project Tyche DST Group

Tyche Special Research Initiative (SRI) on Trusted Autonomy:

- Survivability, Explainability and Distributed Adaptability in Autonomous Systems
- Automated Reasoning Under Irreducible Uncertainty; and
- Autonomous Team Tactics Discovery with Automated Planning.

Project with Liz Sonenberg, Tim Miller, Nir Lipovetzky, Michelle Blom, Miquel Ramirez from CIS
More information...


COMP30019 Graphics and Interaction (reflects LMS schedule)):

What is computer graphics and interaction?

Patented by Morton Heilig around 1957, constructed prototype in 1962
What is Unity?

Unity 3d:
http://unity3d.com

What is (who is) Adam?:
https://www.youtube.com/watch?v=Qa0S9JS3XVk
Aims:

▶ understand common operations in computer graphics and the basic properties of light and colour; and
▶ understand the principles of interaction and how to develop 3D applications.
The aim of COMP30019 Graphics and Interaction

The objective of this subject is to understand and gain proficiency in computational approaches to graphics and interaction.

At the end of this subject, you should be able to

- encode customised shaders for geometric and lighting models for displaying realistic objects and animated scenes in real-time,
- apply efficient algorithms for computer graphics, augmented reality and (potentially) robotics applications, and
- design and implement interactive 3D Apps
Syllabus

Topics covered will include

- 2-D and 3-D **analytic geometry** for graphics,
- representation of **3-D** objects,
- computational techniques for realistic graphic **rendering** via programmable **shading languages** and
- techniques for **interactive** system development.
Computer graphics: concerns numerical algorithms for transforming geometric models into pixelated images (the main theme of this subject).

Applications include computer games, computer aided design, simulation, virtual and augmented reality and visualisation and forms the basis of all graphical user interfaces.
Computer vision: concerns the transformation of images into models (the reverse of computer graphics).

- Applications include face and body (skeleton) recognition and robotic perception such as used for mobile robots or pilotless aeroplanes or medical imaging.

Image processing: concerns the transforming images into other images (typically used as an adjunct to graphics or vision).

- Applications include smoothing, sharpening, segmenting or automatically texturing images, also commonly used in photographic editing.
Examples: Medical surgery
Google glasses...
...for driving
Autonomous Robots
...Google driverless car (Artificial intelligence)
... tourism
...shopping
Natural user interfaces (Touch)
Microsoft surface
Gaming

Photo courtesy Bluetongue & THQ
Gaming - Kinect Sensor

Photo courtesy of XBox Sports, Microsoft
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Syllabus

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Examples

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Introduction
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What is graphics and interaction?

Syllabus

Theory and practice

Examples

Project work

Photographic editing

Image processing

Displaying & printing images

Sharpening, smoothing, texturing & colouring

Storing & compressing images or video

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Introduction
Computer graphics

Photographic editing
Image processing
Displaying & printing images
Computer-aided design (CAD)
Computer games & movie making
Graphical user interfaces (GUI’s)
Computer simulation
Sharpening, smoothing, texturing & colouring
Storing & compressing images or video

models → images
images → models
images → images
Computer graphics

- Computer games & movie making
- Graphical user interfaces (GUI's)
- Natural user interfaces (NUI's)
- Augmented reality
- Robot perception
- Text recognition & image retrieval

Image processing

- Displaying & printing images
- Storing & compressing images or video
- Sharpening, smoothing, texturing & colouring

Computer vision

- Photographing editing
- Computer vision
- Image processing
- Computer-aided design (CAD)

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Introduction
Medical surgery (Augmented reality)
Project work

You will be involved in programming, either individually or in small groups, an

- **App** in *Unity* on Windows 8.1 in *C#*, using the *CG* shader language
- We will provide you with a Microsoft *Pro surface*

Note that we will not be teaching explicitly *C#*, except for providing example code in the tutorials/workshops.
Exercise: an image question?

Images can vary in the number of dimensions represented according to their sources and can be either multi-dimensional, two- or one-dimensional. E.g. In the ear and brain surgery examples images clearly included 2D (individual image frames) and 3D (image sequences or movies).

**Question:** can you think of other examples of images concerning *different dimensions* of

- 3D images involved in these applications?
- 2D images?
- An example of a 1D image (yes, there is one involved)?
- An example of a 0D image?