

Introduction to COSC470

COSC470: Special Topic
Computer Vision | 3D Reconstruction
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COSC470 in One Slide

- Gathering images of the world is easy
- These are 2D slices of a 3D (4D?) world
- How can we make 3D models from collections of 2D images?
- This is a (big) slice through Computer Vision
- Solution has many parts
- These parts are used for many other tasks

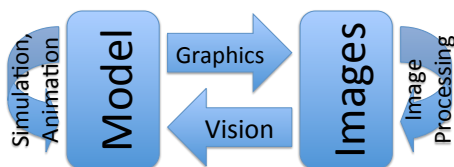
Example: Building the Clocktower



Example: Building the Clocktower



Vision, Graphics, Image Processing



3D Reconstruction Overview

- Detect features in images
- Match these features between image
- Estimate camera motion
- Recover sparse 3D structure
- Optimise
- Recover dense 3D structure
- Reproject images onto the structure

The Plan (big picture)

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|-------------------------|----------------------------------|
| 1. Introduction | 8. Stereo Geometry |
| 2. Image Processing | 9. 3D Reconstruction |
| 3. Feature detection | 10. (?) |
| 4. Feature matching | 11. Multi-view
reconstruction |
| 5. Cameras + Transforms | 12. Surface modelling |
| 6. Transform estimation | 13. Review |
| 7. Image Warping | |

The Plan (for each week)

- A two hour class each week
 - There will be some reading to do to consolidate the last lecture and/or introduce the current one
 - We will have some discussion based around this, the practical work, and general issues
 - Also some lecture material (discussion welcome)
 - Usually some practical element as well
- Of course, this may vary from week to week

The Plan (for today)

- Introduction
- Discussion about the course
- Lecture (overview of the course)
- Practical demonstration (intro to OpenCV)

Assessment

- Two assignments (30% each)
 - First is feature matching, focus on experimental design and evaluation
 - Second is a choice of 2D image mosaicing or 3D reconstruction from two images (stereo)
- Exam (40%)
 - Mix of short answer (recall) and longer answer (analysis) questions

Maths and Programming

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| <ul style="list-style-type: none"> • We'll use a bit of maths <ul style="list-style-type: none"> – Geometry (lines, points, projections) – Linear algebra (solving systems of equations) – Statistics (error models, probability etc.) – Numerical methods (optimisation etc.) • A tool, not the purpose | <ul style="list-style-type: none"> • You'll be expected to write programs <ul style="list-style-type: none"> – C++, but background in C and/or Java is enough – Will use OpenCV library to be productive quickly – Other libraries used to support mathematics • Writing code is part of the study process |
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Starting Points for Discussion

- What is your background?
- What do you want to get out of this course?
- What do/don't you like about my plan?