Course Outline

COMP9517
Computer Vision
Teaching Period 2 2011

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Course Staff

Contact Details

Staff Name	Role	Email	Phone
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Arcot Sowmya	Course Convenor	sowmya at cse.unsw.edu.au	56933
Xiongcai Cai	Lecturer	xcai at cse.unsw.edu.au	55644

Consultations

Staff Name	Day/Time	Location

Course Details

Course Code: COMP9517
Course Title: Computer Vision
Units of Credit: 6
Course WebSite: http://www.cse.unsw.edu.au/~cs9517/
Handbook Entry: http://www.handbook.unsw.edu.au/postgraduate/courses/2011/COMP9517.html

Course Summary

The course will cover topics from: Introduction, image processing, feature detection and matching, feature-based alignment, image stitching, segmentation, recognition, motion estimation, tracking and temporal models, feature tracking, stereo correspondence, 3-D reconstruction , applications

Course Aims

Computer vision develops mathematical techniques for recovering three-dimensional shape and appearance of objects in images (Szeliski, 2010). Vision is difficult because it is an inverse problem, where only insufficient information is available when trying to recover some unknowns. Physics-based and statistical models are used to assist in the task. Current real-world applications are wide-ranging, and include optical character recognition, machine inspection, objection recognition in retail, 3-D model building in photogrammetry, medical imaging, automotive safety, match move in Hollywood (merging computer generated imagery with live action footage), motion capture, surveillance, fingerprint recognition and biometrics and others.

Student Learning Outcomes

After completing this course, students will:

- know the foundations of scientific, statistical and engineering approaches to computer vision
- learn to implement and test some computer vision algorithms
- learn to appreciate the building and integration of large vision applications

This course contributes to the development of the following graduate attributes:

Graduate Attribute	Where Acquired
the skills involved in scholarly enquiry	Problem sets, Project
an in-depth engagement with relevant disciplinary knowledge in its interdisciplinary context	Project
the capacity for analytical and critical thinking and for creative problem solving	Project
the ability to engage in independent and reflective learning	Assignment, Project
the skills to locate, evaluate and use relevant information (Information Literacy)	Project
the capacity for enterprise, initiative and creativity	Project
the skills required for collaborative and multidisciplinary work	Project
the skills of effective communication	Project Presentation- Demo, Report

Assumed Knowledge

Before commencing this course, students should:

- know to program well in C or C++, or be willing to learn it on their own
- be familiar with data structures and algorithms
- be able to learn to use and integrate software packages
- be familiar with vector calculus and linear algebra

Teaching Rationale

Classroom lectures are a major part of the teaching. Because of the volume of material available on the subject, lectures are better able to present high level overviews as well as in-depth presentation of selected topics. A compulsory lab session is where interactive teaching occurs, providing an opportunity for feedback and constructive comments, as well as evaluation. This year, an optional tutorial/lecture hour is being trialled, where some additional background material as well as other related topics will be explored.

Teaching Strategies

- Lectures ... introduce concepts, show examples
- Tutorial... provides an opportunity to cover background material and provide extension in other areas
- Lab...provides opportunity for interaction, feedback and evaluation
- Assignment .. allows students to solve a significant problem early and quickly
- Take home problem Sets... allow students to test subject knowledge acquired
- Large group project... allows students to work in teams and build a significant computer vision application

Assessment

Week 6 Week 11

Assessment Type	Marks	Release Date	Due in
Assignment	10%	Week 2	Week 4
Project Stage 1	10%	Week 4	
Project Stage 2 Proposal	10%	Week 6	Week 7
Problem set 1	15%	Week 7	Week 8
Problem set 2	15%	Week 10	Week 11
Project Demo	20%	Week 11	Week 13
Project Report inc Testing and Evaluation	20%		Friday of Week 13

Academic Honesty and Plagiarism

Plagiarism is defined as "using the words or ideas of others and presenting them as your own". UNSW and CSE treat plagiarism as academic misconduct, which means that it carries penalties as severe as being excluded from further study at UNSW. There are several on-line sources to help you understand what plagiarism is and how it is dealt with at UNSW:

- Learning Centre: Plagiarism and Academic Integrity
- MyUNSW: Plagiarism and Academic Misconduct
- CSE: Addendum to UNSW Plagiarism Guidelines
- CSE: Yellow Form (whose terms you have agreed to)

Make sure that you read and understand these. Ignorance is not accepted as an excuse for plagiarism.

Course Schedule

Week	Lecture Topic
1	Introduction
2	Image Processing
3	Feature Detection and Matching
4	Feature-based Alignment and Image Stitching
5	Pattern Recognition
6	Segmentation
7	Recognition
8	Motion
9	Tracking and Temporal Models
10	Feature Tracking
11	Stereo Correspondence and 3-D Reconstruction
12	Applications, Review

Resources for Students

Texts and recommended readings:

- Textbook

  Richard Szeliski, Computer Vision: Algorithms and Applications, Springer 2011 (electronic version available for download)

- Reference Books

  1. Linda G. Shapiro and George C. Stockman, Computer Vision, Prentice Hall, 2001

  2. Forsyth, D. and Ponce, J. , Computer Vision: A modern approach, Prentice Hall, 2011 (second edition)

  3. Ballard, D. H. and Brown, C. M., Computer Vision, Prentice Hall, New Jersey, 1982

  4. Gonzalez, R. C. and Woods, R. E., Digital Image Processing, Addison Wesley, Sydney, 2008 (third edition)

  5. Sonka, M., Hlavac, V. and Boyle, R., Image Processing, Analysis and Machine Vision, Chapman and Hall, Melbourne, 2007 (third edition)

  6. Duda, R. O., Stork, D. and Hart, P., Pattern Classification, John Wiley and Sons, 2000

  7. Medioni, G. and Kang, S. B., Emerging Topics in Computer Vision, Prentice Hall, NJ, 2005 8. Simon J. D. Prince, Computer vision: models, learning and inference, to be published by Cambridge University Press 2012; (electronic version available for download)

Course Evaluation and Development

This course is evaluated each session using the CATEI system.

The course used a new textbook in 2010 (published online in 2010). This re-oriented the course to a more graphics-based generative approach to computer vision. This was a deliberate choice, but involved a lot of new work. Student feedback was positive and suggestions for improvement constructive

Following the suggestions, the following changes are being made in this offering: students will be encouraged to solve problems as exercises purely for practice (that will not be assessed; the lab sessions will continue to be used to provide feedback on assessments and students encouraged to attend; and assignment and project implementations will be standardized to allow better comparison of student effort and achievement.