Course Outline

Contents

- Course Details
- Course Summary
- Course Timetable
- Course Aims
- Student Learning Outcomes
- Assumed Knowledge
- Teaching Rationale
- Teaching Strategies
- Assessment
- Academic Honesty and Plagiarism
- Course Schedule
- Resources for Students
- Course Evaluation and Development

Course Details

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

Course Summary

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

Course Timetable

The course timetable is available here (/COMP9517/16s2/timetable) .

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. This course will provide an introduction to fundamental concepts and an opportunity to develop an application.

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 capabilities:

Graduate Capability	**Acquired in**
the skills involved in scholarly enquiry	Assignment, 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	Test, Project
the ability to engage in independent and reflective learning	Assignment, Project
the skills to locate, evaluate and use relevant information (Information Literacy)	Test, 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; Assignment Report

Assumed Knowledge

Before commencing this course, students should:

- know to program well in any of C/C++, Java, Python, or be willing to learn it independently
- be familiar with data structures and algorithms, and basic statistics
- be able to learn to use and integrate software packages
- be familiar with vector calculus and linear algebra, or be willing to learn them independently

Teaching Rationale

The principal mode of teaching is class lectures. 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.

The compulsory lab session will provide an opportunity for evaluation and feedback.

Teaching Strategies

- Lectures ... introduce concepts, show examples
- Lab sessions... will be used for evaluation and feedback
- Assignment .. allows students to solve a significant problem early and quickly
- Mid-term test ... allow students to test subject knowledge acquired
- Large group project... allows students to work in teams and build a significant computer vision application

Assessment

Assessment Type	***Marks***	***Release Date***	***Due in***
Assignment	10%	Week 2	Week 4

Mid-term test	30%	Week 9	
Project (multiple stages):	50% (in total):		
• *Stage 1*	*10%*	Week 4	Week 7
• *Specs of stage 2*	*10%*	Week 7	Week 10
• *Demo*	*10%*		Week 13
• *Performance evaluation (during demo and in report)*	*10%*		
• *Report*	*10%*		Fri of Week 13
Attendance at labs	10%		

Academic Honesty and Plagiarism

Plagiarism is defined as (https://student.unsw.edu.au/what-plagiarism) *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 (http://www.lc.unsw.edu.au/plagiarism/index.html)
- MyUNSW: Plagiarism (https://student.unsw.edu.au/plagiarism) and Academic Misconduct (https://www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf)
- CSE: Addendum to UNSW Plagiarism Guidelines (http://www.cse.unsw.edu.au/~chak/plagiarism/plagiarism.html)
- CSE: Yellow Form (http://www.cse.unsw.edu.au/people/studentoffice/policies/yellowform.html) (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***	***Lecturer***
1	Introduction to Digital Imaging	Arcot Sowmya
2	Image Processing	Arcot Sowmya
3	Feature Detection and Matching	Arcot Sowmya
4	Feature-based Alignment and Image Stitching	Arcot Sowmya
5	Pattern Recognition	Peter Cai
6	Segmentation	Peter Cai
7	Feature Tracking	Peter Cai
8	Object Recognition	Peter Cai
9	Class test	Arcot Sowmya
10	Project Stage 2 Specification	Arcot Sowmya
11	3D Vision	Yang Wang/Arcot Sowmya
12	Tracking and Temporal Models	Yang Wang/Arcot Sowmya
13	Project Demo	Arcot Sowmya

Resources for Students

Texts and recommended readings:

- Textbook Richard Szeliski, Computer Vision: Algorithms and Applications, Springer 2011 (electronic version available: http://szeliski.org/Book (http://szeliski.org/Book)) (http://szeliski.org/Book/)
- 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, 2nd edition, 2011
- 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, 3rd edition, 2008
- 5. Sonka, M., Hlavac, V. and Boyle, R., Image Processing, Analysis and Machine Vision, Chapman and Hall, Melbourne, 3rd edition, 2007
- 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, Cambridge University Press, 2012 , (electronic version available: http://www.computervisionmodels.com (http://www.computervisionmodels.com)) (http://www.computervisionmodels.com/)

Course Evaluation and Development

This course is evaluated each session using the CATEI system.

Based on feedback, the following changes are being made in this offering:

1. An experienced co-lecturer is now available and will co-teach the course.

2. More training for tutors will be provided, to improve the lab experience, feedback on assignments and with programming.

3. The marking criteria will be released before the assessments.

4. To better guide the group project, lab mentors will be assigned to specific groups.

5. Consultation on use of software packages will be encouraged during lab time.

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