Course Outline

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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, pattern recognition, deep learning , segmentation, motion and image tracking, recognition, stereo correspondence and 3-D vision, applications.

Course Timetable

The course timetable is available here (/COMP9517/17s2/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	Quizes, Project
the ability to engage in independent and reflective learning	Assignment, Project
the skills to locate, evaluate and use relevant information (Information Literacy)	Quizes, 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, including Matlab
- 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. Lab sessions will be used to examine a method or algorithm in some detail.

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
- Quizes... allow students to test subject knowledge acquired
- Large group project... allows students to work singly and in teams and build a significant computer vision application

Assessment

Assessment Type	***Marks***	***Release Date***	***Due in***
Assignment	1 *5* %	Week 2	Week 4
Fortnightly quizes (5)	25%		Weeks 3, 5, 7, 10, 12
Project (multiple stages)**	50%		
• *Stage 1, individual*		Week 5	Week 7
• *Specs of stage 2, group*		Week 7	Week 10
• *Demo, group*			Week 13
• *Individual Contribution report*			Fri of Week 13
• *Group Project report*			Fri of Week 13
Participation and feedback	10%		

** Note that the project is worth 50% of the total marks and consists of multiple stages, some of which are done individually and others in groups. Qualitative feedback will be provided on each stage, and a single project mark released after final demo and reports

submission.

Student Conduct

The **Student Code of Conduct** (Information (https://student.unsw.edu.au/conduct) , Policy (https://www.gs.unsw.edu.au/policy/documents/studentcodepolicy.pdf)) sets out what the University expects from students as members of the UNSW community. As well as the learning, teaching and research environment, the University aims to provide an environment that enables students to achieve their full potential and to provide an experience consistent with the University's values and guiding principles. A condition of enrolment is that students *inform themselves* of the University's rules and policies affecting them, and conduct themselves accordingly.

In particular, students have the responsibility to observe standards of equity and respect in dealing with every member of the University community. This applies to all activities on UNSW premises and all external activities related to study and research. This includes behaviour in person as well as behaviour on social media, for example Facebook groups set up for the purpose of discussing UNSW courses or course work. Behaviour that is considered in breach of the Student Code Policy as discriminatory, sexually inappropriate, bullying, harassing, invading another's privacy or causing any person to fear for their personal safety is serious misconduct and can lead to severe penalties, including suspension or exclusion from UNSW.

If you have any concerns, you may raise them with your lecturer, or approach the School Ethics Officer (mailto:ethics-officer@cse.unsw.edu.au) , Grievance Officer (mailto:grievance-officer@cse.unsw.edu.au) , or one of the student representatives.

Plagiarism is defined as (https://student.unsw.edu.au/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:

- Plagiarism and Academic Integrity (https://student.unsw.edu.au/plagiarism)
- UNSW Plagiarism Procedure (https://www.gs.unsw.edu.au/policy/documents/plagiarismprocedure.pdf)

Make sure that you read and understand these. Ignorance is not accepted as an excuse for plagiarism. In particular, you are also responsible that your assignment files are not accessible by anyone but you by setting the correct permissions in your CSE directory and code repository, if using. Note also that plagiarism includes paying or asking another person to do a piece of work for you and then submitting it as your own work.

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW staff and students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.

If you haven't done so yet, please take the time to read the full text of

- UNSW's policy regarding academic honesty and plagiarism (https://student.unsw.edu.au/plagiarism)

The pages below describe the policies and procedures in more detail:

- Student Code Policy (https://www.gs.unsw.edu.au/policy/documents/studentcodepolicy.pdf)
- Student Misconduct Procedure (https://www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf)
- Plagiarism Policy Statement (https://www.gs.unsw.edu.au/policy/documents/plagiarismpolicy.pdf)
- Plagiarism Procedure (https://www.gs.unsw.edu.au/policy/documents/plagiarismprocedure.pdf)

You should also read the following page which describes your rights and responsibilities in the CSE context:

- Essential Advice for CSE Students (https://www.engineering.unsw.edu.au/computer-science-engineering/about-us/organisational-structure/student-services/policies/essential-advice-for-cse-students)

Course Schedule

Week	***Lecture Topic***	***Lecturer***
1	Introduction to Digital Images	Arcot Sowmya
2	Image Processing	Arcot Sowmya
3	Frequency based Techniques	Arcot Sowmya
4	Feature-based Alignment and Image Stitching	Xiongcai Cai
5	Pattern Recognition	Xiongcai Cai
6	Deep Learning for Feature Extraction and Classification	Arcot Sowmya
7	Segmentation	Peter Cai
8	Motion and Image Tracking	Peter Cai
9	Project Presentations	Arcot Sowmya
10	Recognition	Arcot Sowmya
11	3D Vision	Arcot Sowmya
12	Applications	Arcot Sowmya
13	Project Demos	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/)
- 9. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep learning, MIT Press, 2016.
- Aurelien Geron, Hands-on Machine Learning with Scikit-Learn & TensorFlow, O'Reilly Media, 2017.

Course Evaluation and Development

This course is evaluated each session using the myExperience system.

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

1. To provide more explanation of concepts and algorithms, the lab sessions will have more structured work assigned.

2. To provide more examples and real-life applications, links to demos and research papers will be added.

3. More lectures will be taught by the LiC, to ensure better continuity.

4. To provide more feedback, forum participation and peer feedback will be encouraged and rewarded.

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Comments

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