Course Outline Public

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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, pattern recognition, deep learning , segmentation, motion and image tracking, applications.

Course Timetable

The course timetable is available here (https://webcms3.cse.unsw.edu.au/COMP9517/19T2/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.

Lectures and Lecturers

There are three lecturers and an administrator for this course. Details are shown below. The final Applications lecture is usually delivered by an industry expert, details of which will be announced later on. Tutors will be available for consultation - check class web page for details.

Lecturer	Room	Phone	Email	Role
Dr Yang Song	K17 201C		yang.song1@unsw.edu.au (mailto:a.sowmya@unsw.edu.au)	Lecturer-in-charge
Dr Gelareh Mohammadi	K17 401D		g.mohammadi@unsw.edu.au (mailto:xcai@cse.unsw.edu.au)	Lecturer
Prof Erik Meijering			erik.meijering@unsw.edu.au (mailto:erik.meijering@unsw.edu.au)	Lecturer
Annette Spooner	K17 412-03		cs9517@cse.unsw.edu.au (mailto:a.spooner@student.unsw.edu.au)	Course Administrator

Lectures and Tutorials/Consultation Schedule

The course will be run during two 2-hour time slots per week. The first time slot will be a 2-hour lecture and the second time slot will be used mostly for a 1 hour lecture and 1 hour of lab. In the second week, where the Monday is a public holiday, a 2 hour lecture will be held on the Tuesday. The schedule will be found under Course Timetable (https://webcms3.cse.unsw.edu.au/COMP9517/19T2/timetable) .

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	Assignments, 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	Assignments, 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

Assumed Knowledge

Before commencing this course, students should:

- know how to program well in 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 OpenCV, Scikit-Learn, Keras.
- 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.

Compulsory Lab sessions will be used to examine a method or algorithm in some detail, and 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
- Large group project... allows students to work in teams and build a significant computer vision application

Assessment

Your performance in this course will be assessed by:

1. ONE small assignment - this will involve programming in Python
2. Lab work in specified weeks
3. ONE large project, with both individual and group components, involving:

    (a) Stage 1 - Design and Planning
    (b) Stage 2 - Implementation
    (c) Stage 3 - Final Demonstration & Report

4. A final examination.

The table below shows planned release and due dates for all assessment components and their assigned marks.
All dates refer to the day of the lecture in the indicated week, unless otherwise announced.

Assessment Type	Marks	Release Date	Due in
Assignment 1	10%	Week 1	Week 3
Lab Work	5%		Weeks 3 - 6
Project (multiple stages)		Week 5	Week 10
• Individual	25%		
• Group*	20%		
Exam	40%		Exam period

*Qualitative feedback will be provided for individual assessment components where applicable, and a single group mark will be released at the end.

Project Groups

A significant part of the assessment for this course will be through a group project. A project group will consist of 4-5 students. To vary the group size prior permission from the lecturer-in-charge is necessary.

Communication Modes and Etiquette

- **The Forum is your first port of call.** Post any query that is of wider interest to fellow students - on lectures, labs, assessments - we will attempt to answer within 24 hours.Forum link is on left panel.
- Contact LIC for late submission, absence, special consideration, assessment deadlines, lab and assessment content, see Contact details on left panel.

- Contact Course admin for issues with enrollment, file submission, group enrollment or any admin matter, see Contact details on left panel.

While every effort will be made to respond quickly to queries, a maximum of 24 hours should be allowed before posting or emailing reminders.

You are reminded to observe standards of equity and respect in dealing with students and staff in person, emails and forum posts as well as on all other communication media (see Student Conduct below).

Late Submission Penalty

Unless you have received special dispensation from the lecturer-in-charge, work that is submitted up to one day late will incur a penalty of 10% of your mark. Two days late will incur a penalty of 15%. Any later may not be accepted at all.

Special Consideration

If your work in this course is affected by unforeseen adverse circumstances, you should apply for Special Consideration. If your request is reasonable and your work has clearly been impacted, then

- for an assignment, you may be granted an extension
- for the Final Exam, you may be offered a Supplementary Exam

Note the use of the word "may". None of the above is guaranteed. It depends on you making a convincing case that the circumstances have clearly impacted your ability to work.

UNSW handles special consideration requests centrally (in the Student Lifecycle division), so all special consideration requests must be submitted via the UNSW Special Consideration (https://iaro.online.unsw.edu.au/special_consideration/home.login) website.

Special consideration requests must be accompanied by documentation, which will be verified by Student Lifecycle. Do not email the course convenor directly about special consideration.

Extensions on assignments will only be awarded if the majority of the team are affected. You will get a mark calculated in the same way as other students who sat the original assessment.

If you cannot attend the Final Exam because of illness or misadventure, then you must submit a Special Consideration request, with documentation, through MyUNSW within 24 hours of the exam. If your request is reasonable, then you will be awarded a Supplementary Exam (aka "Supp").

Note that UNSW expects you to be available to sit Supplementary Exams (held in the week Sep 9-13) if required. If you are awarded a Supp and do not attend, then your exam mark will be zero.

For further details on special consideration, see the UNSW Student website (https://student.unsw.edu.au/special-consideration) .

If you are registered with Disability Services, please forward your documentation to Yang Song (mailto:yang.song1@unsw.edu.au) within the first two weeks of semester.

Course Schedule

WeekLecture Topic *Lecturer*

1	Introduction, Image formation, Image processing	Dr Yang Song, Dr Gelareh Mohammadi
2	Image processing (Mon public holiday, no lab, 2 hour lecture Tues)	Dr Gelareh Mohammadi
3	Feature representation	Dr Yang Song
4	Pattern recognition (machine learning)	Dr Gelareh Mohammadi
5	Segmentation	Dr Yang Song
6	Deep learning	Dr Yang Song
7	Project consultation	Dr Yang Song
8	Motion and image tracking	Prof Erik Meijering
9	Recognition (applications)	Dr Yang Song
10	Project demos	Dr Yang Song, Dr Gelareh Mohammadi
11	Recap Mon (public holiday replacement)	Dr Yang Song

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 (http://homepages.inf.ed.ac.uk/rbf/BOOKS/BANDB/band... (http://homepages.inf.ed.ac.uk/rbf/BOOKS/BANDB/bandb.htm))
- 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. The assessments are being redesigned, to address level of difficulty as well as volume of work. The marking schemes will also be revised and better communicated to everyone.

2. A mix of experienced and relatively new tutors are being trained to improve communication.

3. Co-lecturers will be provided more information on course expectations and outcomes.

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

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.

F **or the purposes of COMP 9517** , plagiarism includes copying or obtaining all, or a substantial part, of the material for your assignment, whether written or graphical report material, or software code, **without written acknowledgement** in your assignment from:

1. a location on the Internet;
2. a book, article or other written document (whether published or unpublished) whether electronic or on paper or other medium;
3. another student, whether in your class or another class;
4. someone else (e.g. from someone who writes assignments for money).

Note that if you copy material from another student or non-student **with acknowledgement,** you will not be penalised for plagiarism, but the marks you get for this will be at the marker’s discretion.

The assessments provide opportunities for you to develop important skills. Use these opportunities!

Academic Integrity

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)

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Comments

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