UNSW Course Outline

COMP9517 Computer Vision - 2024

Published on the 25 Aug 2024

General Course Information

Course Code : COMP9517
Year : 2024
Term : Term 3
Teaching Period : T3
Is a multi-term course? : No
Faculty : Faculty of Engineering
Academic Unit : School of Computer Science and Engineering
Delivery Mode : Multimodal
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Undergraduate, Postgraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

Computer vision is the interdisciplinary scientific field that develops theories and methods allowing computers to extract high-level information from digital images or videos. From an engineering perspective it seeks to automate perceptual tasks normally performed by the human visual system. Generally, vision is difficult because it is an inverse problem, where only

insufficient information is available about the objects of interest in the image data. Physics-based mathematical and statistical models as well as machine-learning methods are used to assist in the task. Current real-world applications are wide-ranging, and include optical character recognition, machine inspection, retail object recognition, 3D model building, remote sensing, medical imaging, autonomous driving, motion capture, surveillance, face recognition, biometrics, and many others. This course provides an introduction to fundamental concepts and an opportunity to develop a real-world application of computer vision.

Course Aims

The course aims to give students a broad understanding of both classical and modern computer vision theories and methods, as well as practical skills in implementing and developing computer vision algorithms and applications.

In particular, the course will teach students about the formation process and characteristics of digital images, and the workings of techniques for image filtering and enhancement, feature extraction and representation, object detection and pattern recognition, image segmentation and classification, motion estimation and object tracking, and a wide range of applications. In addition to classical computer vision methods, students will also learn about modern machine learning and deep learning approaches for these tasks, and acquire practical skills in using them to solve real-world computer vision problems.

As computer vision is a broad, interdisciplinary field with many possible applications, the course intends to lay the theoretical (computer science) as well as practical (computer engineering) foundation to address future computer vision challenges. Also, since solutions to big challenges typically require not only individual but also team efforts, the course includes both labs and a group project to help develop the necessary skills through practical experience complementing the knowledge acquired in the lectures.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Explain basic scientific, statistical, and engineering approaches to computer vision
CLO2 : Implement and test computer vision algorithms using existing software platforms
CLO3 : Build larger computer vision applications by integrating software modules

Course Learning Outcomes	Assessment Item
CLO1 : Explain basic scientific, statistical, and engineering approaches to computer vision	• Lab tasks • Group Project • Final exam
CLO2 : Implement and test computer vision algorithms using existing software platforms	• Lab tasks • Group Project
CLO3 : Build larger computer vision applications by integrating software modules	• Group Project

Learning and Teaching Technologies

Moodle - Learning Management System | Blackboard Collaborate | Echo 360 | EdStem | WebCMS3

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Lab tasks Assessment Format: Individual	10%	Start Date: Weeks 2, 3, 4, 5 Due Date: Weeks 3, 4, 5, 7
Group Project Assessment Format: Group	40%	Start Date: Week 5 Due Date: Week 10
Final exam Assessment Format: Individual	50%	Due Date: 22 November - 5 December 2024

Assessment Details

Lab tasks

Assessment Overview

Four labs, one per week, in the first half of the course until flexibility week. Marking will be against specific assessment criteria in a marking guide. Feedback is provided implicitly, as the

required outcomes are indicated in the lab specifications. If needed, individual feedback can also be provided explicitly by the tutors in the weekly consultation sessions.

Course Learning Outcomes

- CLO1 : Explain basic scientific, statistical, and engineering approaches to computer vision
- CLO2 : Implement and test computer vision algorithms using existing software platforms

Detailed Assessment Description

More detailed assessment criteria will be provided during the term.

Assignment submission Turnitin type

Not Applicable

Generative AI Permission Level

No Assistance

This assessment is designed for you to complete without the use of any generative AI. You are not permitted to use any generative AI tools, software or service to search for or generate information or answers.
For more information on Generative AI and permitted use please see here.

Group Project

Assessment Overview

The group project starts in Week 5 with deliverables in Week 10 consisting of a report (at most 10 pages), code (together with the report up to 100 MB), and a group presentation (at most 10 minutes followed by a few minutes of Q&A). Each project group consists of 4-5 students. Marking will be against specific assessment criteria in a marking guide. Written feedback will be provided along with the final mark in the online marking system. Peer evaluation will be conducted to assess the contributions of the individual group members and the results will be used to moderate the marks assigned to each group member.

Course Learning Outcomes

- CLO1 : Explain basic scientific, statistical, and engineering approaches to computer vision
- CLO2 : Implement and test computer vision algorithms using existing software platforms
- CLO3 : Build larger computer vision applications by integrating software modules

Detailed Assessment Description

More detailed assessment criteria will be provided during the term.

Assignment submission Turnitin type

Not Applicable

Generative AI Permission Level

No Assistance

This assessment is designed for you to complete without the use of any generative AI. You are not permitted to use any generative AI tools, software or service to search for or generate information or answers.
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Final exam

Assessment Overview

The final exam is to test the knowledge and understanding of the material taught in the course, and consists of answering open and/or multiple-choice questions (up to 50 total), or writing a commentary on a published scientific article in the field (up to 2 pages excluding references), depending on the circumstances which determine whether the exam is in-person and invigilated or online. Marking will be against specific assessment criteria in a marking guide.

Course Learning Outcomes

- CLO1 : Explain basic scientific, statistical, and engineering approaches to computer vision

Detailed Assessment Description

More detailed assessment criteria will be provided during the term.

Assessment Length

Dependent on the exam type. See under Assessment Overview.

Assignment submission Turnitin type

Not Applicable

Generative AI Permission Level

No Assistance

This assessment is designed for you to complete without the use of any generative AI. You are not permitted to use any generative AI tools, software or service to search for or generate information or answers.
For more information on Generative AI and permitted use please see here.

General Assessment Information

Tools such as GitHub Copilot, ChatGPT, Google Bard, and other tools based on large (language) models or other generative artificial intelligence (AI) techniques, look likely to become heavily used by programmers. However, you need a good understanding of the language you are coding in and the systems involved before you can effectively use these tools. Using these tools to generate code instead of writing the code yourself will hinder your learning. Therefore, in this course, you are not permitted to submit code generated by such tools. Submitting code generated by such tools will be treated as plagiarism and penalised accordingly.

Grading Basis

Standard

Requirements to pass course

Achieve an overall score of at least 50% from all combined assessment components to pass the course.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 9 September - 15 September	Lecture	Introduction & Image Formation
	Laboratory	Lab Preparations
Week 2 : 16 September - 22 September	Lecture	Image Processing
	Laboratory	Lab 1
	Tutorial	Consultation Session
Week 3 : 23 September - 29 September	Lecture	Feature Representation
	Laboratory	Lab 2
	Tutorial	Consultation Session
Week 4 : 30 September - 6 October	Lecture	Pattern Recognition
	Laboratory	Lab 3
	Tutorial	Consultation Session
Week 5 : 7 October - 13 October	Lecture	Image Segmentation
	Laboratory	Lab 4
	Tutorial	Consultation Session
Week 6 : 14 October - 20 October	Other	Flexibility Week (No Lectures)
	Group Work	Group Project
	Tutorial	Consultation Session
Week 7 : 21 October - 27 October	Lecture	Deep Learning I
	Group Work	Group Project
	Tutorial	Consultation Session
Week 8 : 28 October - 3 November	Lecture	Deep Learning II
	Group Work	Group Project
	Tutorial	Consultation Session
Week 9 : 4 November - 10 November	Lecture	Motion Tracking
	Group Work	Group Project
	Tutorial	Consultation Session
Week 10 : 11 November - 17 November	Lecture	Guest Lectures on Computer Vision Applications
	Group Work	Group Project
	Tutorial	Consultation Session

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

General Schedule Information

The course schedule includes two 2-hour lectures per week during all weeks of the term, except for flexibility week (week 6). Additionally, starting from the second week, there is a 1-hour weekly consultation session where tutors are available to explain the Labs (in the first weeks of the course) and Assessment 2 - Group Project (in the later weeks), as well as to answer any related questions.

Course Resources

Recommended Resources

All course materials will be provided online. There is no need to buy a book. In the lectures we will be referring to various resources for further reading, many of which are freely available online:

- Richard Szeliski. Computer Vision: Algorithms and Applications. Second Edition, Springer, 2021.
- Dana H. Ballard and Christopher M. Brown. Computer Vision. Prentice Hall, 1982.
- Ian Goodfellow, Yoshua Bengio, Aaron Courville. Deep Learning. MIT Press, 2016.
- David A. Forsyth and Jean Ponce. Computer Vision: A Modern Approach. Prentice Hall, 2011.
- Simon J. D. Prince. Computer Vision: Models, Learning and Inference. Cambridge University Press, 2012.

Other resources of interest (available from the library or perhaps online as well) include:

- Linda G. Shapiro and George C. Stockman. Computer Vision. Prentice Hall, 2001.
- Rafael C. Gonzalez and Richard E. Woods. Digital Image Processing. Addison Wesley, 2008.
- Milan Sonka, Vaclav Hlavac, Roger Boyle. Image Processing, Analysis and Machine Vision. Chapman and Hall, 2007.
- Richard O. Duda, Peter E. Hart, David G. Stork. Pattern Classification. John Wiley and Sons, 2000.
- Gérard Medioni and Sing Bing Kang. Emerging Topics in Computer Vision. Prentice Hall, 2005.

And furthermore we will cite many scientific articles that you may consult for more detailed information.

Course Evaluation and Development

This course is evaluated every term using the MyExperience system. The feedback provided by the students is carefully analysed by the convenor and lecturers, and points of improvement are taken on board where possible. Based on the student feedback in past terms, the following changes will be introduced this term:

- Most of the lectures will be in person but other course components will remain online.
- Lectures will be livestreamed and provide an opportunity to interact with the lecturer.
- Labs will contain more introductory material and explanation in consultation sessions.
- Consultations will remain online but will be scheduled separately from the lectures.
- Feedback on the labs will be provided faster so it can be taken into account for later labs.
- Several administrative changes will streamline project group formation and assessment.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Erik Meijering					Yes	Yes
Lecturer	Yang Song					No	No
	Sonit Singh					No	No
Administrator	Andrew Gunawan					No	No
	Piumi Don Simonge					No	No

Other Useful Information

Academic Information

I. Special consideration and supplementary assessment

If you have experienced an illness or misadventure beyond your control that will interfere with your assessment performance, you are eligible to apply for Special Consideration prior to, or within 3 working days of, submitting an assessment or sitting an exam.

Please note that UNSW has a Fit to Sit rule, which means that if you sit an exam, you are declaring yourself fit enough to do so and cannot later apply for Special Consideration.

For details of applying for Special Consideration and conditions for the award of supplementary assessment, please see the information on UNSW's Special Consideration page.

II. Administrative matters and links

All students are expected to read and be familiar with UNSW guidelines and polices. In particular, students should be familiar with the following:

- Attendance
- UNSW Email Address
- Special Consideration
- Exams
- Approved Calculators
- Academic Honesty and Plagiarism
- Equitable Learning Services

III. Equity and diversity

Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course convener prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equitable Learning Services. Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.

IV. Professional Outcomes and Program Design

Students are able to review the relevant professional outcomes and program designs for their streams by going to the following link: https://www.unsw.edu.au/engineering/student-life/student-resources/program-design.

Note: This course outline sets out the description of classes at the date the Course Outline is published. The nature of classes may change during the Term after the Course Outline is published. Moodle or your primary learning management system (LMS) should be consulted for the up-to-date class descriptions. If there is any inconsistency in the description of activities between the University timetable and the Course Outline/Moodle/LMS, the description in the Course Outline/Moodle/LMS applies.

Academic Honesty and Plagarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW 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.*

Plagiarism is a type of intellectual theft. It can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgement. UNSW has produced a website with a wealth of resources to support students to understand and avoid plagiarism, visit: student.unsw.edu.au/plagiarism. The Learning Centre assists students with understanding academic integrity and how not to plagiarise. They also hold workshops and can help students one-on-one.

You are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting and the proper referencing of sources in preparing all assessment tasks.

Repeated plagiarism (even in first year), plagiarism after first year, or serious instances, may also be investigated under the Student Misconduct Procedures. The penalties under the procedures can include a reduction in marks, failing a course or for the most serious matters (like plagiarism in an honours thesis or contract cheating) even suspension from the university. The Student Misconduct Procedures are available here:

www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf

Submission of Assessment Tasks

Work submitted late without an approved extension by the course coordinator or delegated authority is subject to a late penalty of five percent (5%) of the maximum mark possible for that assessment item, per calendar day.

The late penalty is applied per calendar day (including weekends and public holidays) that the assessment is overdue. There is no pro-rata of the late penalty for submissions made part way through a day. This is for all assessments where a penalty applies.

Work submitted after five days (120 hours) will not be accepted and a mark of zero will be awarded for that assessment item.

For some assessment items, a late penalty may not be appropriate. These will be clearly indicated in the course outline, and such assessments will receive a mark of zero if not completed by the specified date. Examples include:

- Weekly online tests or laboratory work worth a small proportion of the subject mark;
- Exams, peer feedback and team evaluation surveys;
- Online quizzes where answers are released to students on completion;
- Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date; and,
- Pass/Fail assessment tasks.

Faculty-specific Information

Engineering Student Support Services – The Nucleus - enrolment, progression checks, clash requests, course issues or program-related queries

Engineering Industrial Training – Industrial training questions

UNSW Study Abroad – study abroad student enquiries (for inbound students)

UNSW Exchange – student exchange enquiries (for inbound students)

UNSW Future Students – potential student enquiries e.g. admissions, fees, programs, credit transfer

Phone

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

School Contact Information

CSE Help! - on the Ground Floor of K17

- For assistance with coursework assessments.

The Nucleus Student Hub - https://nucleus.unsw.edu.au/en/contact-us

- Course enrolment queries.

Grievance Officer - grievance-officer@cse.unsw.edu.au

- If the course convenor gives an inadequate response to a query or when the courses convenor does not respond to a query about assessment.

Student Reps - stureps@cse.unsw.edu.au

- If some aspect of a course needs urgent improvement. (e.g. Nobody responding to forum queries, cannot understand the lecturer)

You should **never** contact any of the following people directly:

- Vice Chancellor

- Pro-vice Chancellor Education (PVCE)

- Head of School

- CSE administrative staff

- CSE teaching support staff

They will simply bounce the email to one of the above, thereby creating an unnecessary level of indirection and a delay in the response.