

## Course Outline

### COMP 4102A for Winter 2022 Computer Vision

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#### Course Information

**Instructor:** Dr. Mikhail Genkin

**Contact:** [michaelgenkin@cunet.carleton.ca](mailto:michaelgenkin@cunet.carleton.ca)

**Classroom:** Virtual classrooms will be set up on Brightspace and Discord.

**Lectures:** Mondays and Wednesdays from 1:05 p.m. to 2:25 p.m. EST, delivered via Zoom (the link to the Zoom meeting and the Discord server will be posted on Brightspace). Most lectures will be synchronous, but some may be pre-recorded. If the technology cooperates, recordings of all lectures will be made available for viewing as well.

**Assignments:** Assignments will be posted on Brightspace.

**Office Hours:** Arranged by request.

**Teaching Assistants:** Please see the *Introduction* module in Brightspace

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#### Course Description

This course introduces the fundamental principles and techniques of computer vision. Topics include:

- digital image formation and processing
- detection and analysis of visual features
- camera models and calibration
- structure from motion
- stereo
- segmentation
- object detection
- recognition
- applications.

#### Prerequisites

Basic linear algebra and calculus, programming in C/C++ or Python.

## Required Textbook(s) and Other Resources

- Course notes will be available via Brightspace.
- Computer Vision: Algorithms and Applications by Richard Szeliski, Springer, 2011. (available on MacOdrum online library)
- You will need to use OpenCV. You can download the latest version from here: <https://opencv.org/releases/>

## Topics Covered

The course will cover the following topics, although some material may be omitted due to time constraints:

1. Introduction
2. Image formation
3. Image filtering
4. Feature detection
5. Camera
6. Stereo and multi-view geometry and reconstruction
7. Structure from motion
8. Reconstruction and 3D shape
9. Object detection and face recognition

## Learning Outcomes

- At the end of this course, students will be able to:
- Explain the basic terms, concepts and applications of computer vision, including reference to at least one real-world system.
- Apply basic mathematical techniques to solve problems in computer vision.
- Develop software to solve problems in computer vision.

## Assessment Scheme

The following marking scheme will be used for this course:

Activity	Weight(%)	Comments
Assignments	30	There will be an assignment approximately every 3 weeks.
Midterm	15	Exact timing TDB, but usually either the week before or just after the Winter Break – do be discussed and

		settled during live lectures. Will be held during the regularly scheduled class time.
Course Project	30	The course project will be due on the last day of classes (April 12, 2022). Instructions will be posted in Brightspace and discussed during live lectures.
Final Exam	25	Will be held during the formal examination period.

This course will be delivered on-line, using the blended delivery model. The course will be organised in modules. The modules may be pre-recorded or may be recorded during the class lecture time. In either case the class lecture time will be used for interactive question and answer.

It is important to note that each student is expected to complete the assignments, the project proposal, and the project, individually. Students should feel free to ask questions pertaining to course material on-line via established communication channels for the course but should not share solutions to assignments.

If you are unsure of the expectations regarding academic integrity (how to use and cite references, how much collaboration with lab- or classmates is appropriate), ASK your instructor. Sharing assignment specifications or posting them online (to sites like Chegg, CourseHero, OneClass, etc.) is considered academic misconduct. You are never permitted to post, share, or upload course materials without explicit permission from your instructor. Academic integrity offences are reported to the office of the Dean of Science. Penalties for such offences can be found on the ODS webpage: <https://science.carleton.ca/academic-integrity/>.

## Important Considerations

Late assignments are never accepted for any reason. Assignment submissions are handled electronically (i.e., through Brightspace) and there is no "grace period" with respect to a deadline - an assignment submitted even one minute after the deadline is late and will receive a mark of zero.

Technical problems do not exempt you from this requirement, so if you wait until the last minute and then have issues with your connection, you will still receive a mark of zero. Consequently, you are advised to:

Periodically upload your progress (e.g. upload your progress at least daily), and attempt to submit your final submission at least one hour in advance of the due date and time.

For each assignment, you will be submitting one or more files that contain source code, and these files must be given the correct filename and be provided in the specified format. Assignments that are incorrectly named or in the incorrect format will be penalized and may receive a mark of zero.

If any of the source code files you submit does not run, it will receive a mark of zero. Consequently, after you upload your submission to Brightspace you should re-download it immediately and ensure that:

- your submission is the correct file type and has the correct filename
- each of your source code files can be run from the terminal on our official virtual machine
- each of your source code files can be viewed in a text editor (for marking purposes)

You are expected to demonstrate good programming practices at all times and your code may be penalized if it is poorly written. You are also expected to do the necessary preparatory work (i.e., devising an algorithm) before you start coding. You may be asked to present either pseudocode or a flowchart before you will receive any assistance from the instructor or a teaching assistant.

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## **Undergraduate Academic Advisor**

The Undergraduate Advisor for the School of Computer Science is available in Room 5302C HP; by telephone at 520-2600, ext. 4364; or by email at [undergraduate\\_advisor@scs.carleton.ca](mailto:undergraduate_advisor@scs.carleton.ca). The undergraduate advisor can assist with information about prerequisites and preclusions, course substitutions/equivalencies, understanding your academic audit and the remaining requirements for graduation. The undergraduate advisor will also refer students to appropriate resources such as the Science Student Success Centre, Learning Support Services and Writing Tutorial Services.

## **SCS Computer Laboratory**

SCS students can access one of the designated labs for your course. The lab schedule can be found at: <https://carleton.ca/scs/tech-support/computer-laboratories/>. All SCS computer lab and technical support information can be found at: <https://carleton.ca/scs/technical-support/>. Technical support is available by emailing [support@scs.carleton.ca](mailto:support@scs.carleton.ca).

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## University Policies

For information about Carleton's academic year, including registration and withdrawal dates, see [Carleton's Academic Calendar](#).

**Pregnancy Obligation.** Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit [Equity Services](#).

**Religious Obligation.** Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit [Equity Services](#).

**Academic Accommodations for Students with Disabilities** If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or [pmc@carleton.ca](mailto:pmc@carleton.ca) for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with your instructor as soon as possible to ensure accommodation arrangements are made. For more details, visit the [Paul Menton Centre](#) website.

**Survivors of Sexual Violence.** As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: [carleton.ca/sexual-violencesupport](http://carleton.ca/sexual-violencesupport)

**Accommodation for Student Activities.** Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, see [the policy](#).

**Student Academic Integrity Policy.** Every student should be familiar with the Carleton University student academic integrity policy. A student found in violation of academic integrity standards may be awarded penalties which range from a reprimand to receiving a grade of *F* in the course or even being expelled from the program or University. Examples of punishable offences include: plagiarism and unauthorized co-operation or collaboration. Information on this policy may be found [here](#).

**Plagiarism.** As defined by Senate, "plagiarism is presenting, whether intentional or not, the ideas, expression of ideas or work of others as one's own". Such reported offences will be reviewed by the office of the Dean of Science.

**Unauthorized Co-operation or Collaboration.** Senate policy states that "to ensure fairness and equity in assessment of term work, students shall not co-operate or collaborate in the completion of an academic assignment, in whole or in part, when the instructor has indicated that the assignment is to be completed on an individual basis". Please refer to the course outline statement or the instructor concerning this issue.