

CSC320H1 F

Introduction to Visual Computing

Fall 2024 Syllabus

Course Meetings

CSC320H1 F

Section	Day & Time	Delivery Mode & Location
LEC0101	Tuesday, 1:00 PM - 3:00 PM	In Person: BA 1190
	Thursday, 1:00 PM - 2:00 PM	In Person: UC 140
LEC2501	Tuesday, 6:00 PM - 9:00 PM	In Person: BA 1190
LEC5101	Tuesday, 6:00 PM - 9:00 PM	In Person: BA 1190

Refer to ACORN for the most up-to-date information about the location of the course meetings.

Course Contacts

Course Website: <https://www.cs.toronto.edu/~kyros/courses/320/>

Instructor: Kyros Kutulakos

Email: kyros@cs.utoronto.ca

Phone: 416-946-8045

Office Hours and Location: Tuesdays 3:30-4:30 (zoom link on Quercus) Wednesdays 11am-noon (BA7270)

Additional Notes: Office hours begin the week of Sept 9.

Course Overview

A first-principles introduction to the acquisition and computational processing of 2D images, aimed at students interested in computer vision, digital photography and computer graphics. The course serves as a stepping stone for tackling more advanced courses in those subjects and covers four broad themes: (1) mathematical and engineering foundations: introducing key concepts from geometry; multivariate calculus; linear algebra; image and signal processing; and human vision, (2) algorithms for low-level computer vision: image warping, morphing and stitching; image enhancement; image scissoring and inpainting; color image processing and display; face recognition; and 2D image matching, (3) implementing several such tools in Python, and (4) a first taste of vision and graphics research. Understanding how to turn algorithmic descriptions in research papers into working computer vision code—and how to evaluate its performance—will be key skills acquired in the course.

This course is a first-principles introduction to the acquisition and computational processing of 2D images. It is aimed at undergraduates interested in learning about computer vision, digital photography and computer graphics, and serves as a stepping stone for tackling more advanced courses on those subjects.

The course has four main goals: (1) *Mathematical and engineering foundations*: Introducing key concepts from geometry; multivariate calculus; linear algebra; image and signal processing; and human vision that are fundamental to delving deeper into vision, graphics and photography. (2) *Algorithms for early vision*: Putting these concepts to use in real-world applications, with an emphasis on the "early" stages of 2D visual processing. Specific topics include image warping, blending and stitching; image enhancement; image scissoring and inpainting; color image processing and display; modern smartphone camera processing pipelines; edge and feature detection; face recognition; and 2D image matching. (3) *Visual programming*: Providing hands-on experience with implementing several such early visual processing tools, through programming assignments. (4) *First look at vision and graphics research*: Most of the course's assignments involve reading a research paper and completing the starter code provided to fully implement the paper's technique. Understanding how to turn such algorithmic descriptions into working computer vision code--and how to evaluate its performance--will be key skills acquired in the course.

Prerequisites: CSC263H1/ CSC265H1/ [ECE345H1](#)/ [ECE358H1](#)/ MIE335H1, MAT223H1/ MAT240H1/ [MAT185H1](#)/ [MAT188H1](#), (MAT136H1 with a minimum mark of 77)/ (MAT137Y1 with a minimum mark of 73)/ (MAT157Y1 with a minimum mark of 67)/ MAT235Y1/ MAT237Y1/ MAT257Y1/ [MAT291H1](#)/ [MAT292H1](#)

Corequisites: None

Exclusions: CSC320H5. NOTE: Students not enrolled in the Computer Science Major or Specialist program at A&S, UTM, or UTSC, or the Data Science Specialist at A&S, are limited to a maximum of 1.5 credits in 300-/400-level CSC/ECE courses.

Recommended Preparation: MAT235Y1/ MAT237Y1/ MAT257Y1/ (MAT232H5, MAT236H5)/ (MAT233H5, MAT236H5)/ (MATB41H3, MATB42H3)

Credit Value: 0.5

Marking Scheme

Assessment	Percent	Details	Due Date
Midterm	15%	Midterm (1hr)	2024-10-15
Programming Assignment #1	13%		2024-10-03
Programming Assignment #2	13%		2024-10-24
Programming Assignment #3	13%		2024-11-14
Programming Assignment #4	11%		2024-12-02

Assessment	Percent	Details	Due Date
In-Person Final Exam	35%		Final Exam Period

Best 3 of 4 assignments will be count for 13% of mark, the fourth for 11%

Late Assessment Submissions Policy

Late penalty for assignments is 15% per day for up to five days. No late assignments will be accepted after that. A total grace period of 60 minutes over the entire term is available to all students, to account for last-minute upload issues. The grace period is not applicable to assignments submitted more than 60 minutes late. Student must petition to have the grace period applied to a particular assignment, via a web form linked on Quercus.

Policies & Statements

Religious Accommodations [Personalized]

As a student at the University of Toronto, you are part of a diverse community that welcomes and includes students and faculty from a wide range of cultural and religious traditions. For my part, I will make every reasonable effort to avoid scheduling tests, examinations, or other compulsory activities on religious holy days not captured by statutory holidays. Further to University Policy, if you anticipate being absent from class or missing a major course activity (such as a test or in-class assignment) due to a religious observance, please let me know as early in the course as possible, and with sufficient notice (at least two to three weeks), so that we can work together to make alternate arrangements.

Academic Integrity [Personalized]

All students, faculty and staff are expected to follow the University's guidelines and policies on academic integrity. For students, this means following the standards of academic honesty when writing assignments, collaborating with fellow students, and writing tests and exams. Ensure that the work you submit for grading represents your own honest efforts. Plagiarism—representing someone else's work as your own or submitting work that you have previously submitted for marks in another class or program—is a serious offence that can result in sanctions. Speak to me or your TA for advice on anything that you find unclear. Consult the Code of Behaviour on Academic Matters for a complete outline of the University's policy and expectations.

For more information, please see <https://www.artsci.utoronto.ca/current/academic-advising-and-support/student-academic-integrity> and <http://academicintegrity.utoronto.ca>

Each assignment will have a written component and a programming component. The course policy is as follows. Written components: All reports submitted as part of your assignments in CSC320 are strictly individual work. No part of these reports should be shared with others, or taken from others. This includes verbatim text, paraphrased text, and/or images used. You are, however, allowed to discuss these components with others at the level of ideas, and indeed you

are welcome to brainstorm together. Programming components: Collaboration on a programming component by individuals (whether or not they are taking the class) is encouraged at the level of ideas. Feel free to ask each other questions, brainstorm on algorithms, or work together on a (virtual or real) whiteboard. Be careful, however, about copying the actual code for programming assignments or merely adapting others' code. This sort of collaboration at the level of artifacts is permitted if explicitly acknowledged, but this is usually self-defeating. Specifically, you will get zero points for any portion of an artifact that you did not transform from concept into substance by yourself. If you neglect to label, clearly and prominently, any code that isn't your own or that you adapted from someone else's code, that's academic dishonesty for the purpose of this course and will be treated accordingly.

The use of generative artificial intelligence (AI) tools is strictly prohibited in all programming assignments. This includes, but is not limited to, ChatGPT, GitHub Copilot, and open-source models that you have trained and/or deployed yourself. You may not interact with, nor copy, paraphrase, or adapt any content from any generative AI for the purpose of completing programming assignments in this course. Use of generative AI will be considered use of an unauthorized aid, which is a form of academic misconduct under the Code of Behavior on Academic Matters. This course policy is designed to promote your learning and intellectual development and to ensure that our evaluations are a fair and accurate assessment of your learning. To that end, you will be required to include detailed comments along with the code you submit, and a random subset of students may be selected by a TA to explain their implementation in a live 1-1 meeting.

Lastly, you should never hand down assignment code to students taking the course in later years, or post it on sites such as GitHub.

Students with Disabilities or Accommodation Requirements

Students with diverse learning styles and needs are welcome in this course. If you have an acute or ongoing disability issue or accommodation need, you should register with Accessibility Services (AS) at the beginning of the academic year by visiting <https://studentlife.utoronto.ca/departments/accessibility-services/>. Without registration, you will not be able to verify your situation with your instructors, and instructors will not be advised about your accommodation needs. AS will assess your situation, develop an accommodation plan with you, and support you in requesting accommodation for your course work. Remember that the process of accommodation is private: AS will not share details of your needs or condition with any instructor, and your instructors will not reveal that you are registered with AS.

Quercus Info (if using)

This Course uses the University's learning management system, Quercus, to post information about the course. This includes posting readings and other materials required to complete class activities and course assignments, as well as sharing important announcements and updates. New information and resources will be posted regularly as we move through the term. To access the course website, go to the U of T Quercus log-in page at <https://q.utoronto.ca>. SPECIAL NOTE ABOUT GRADES POSTED ONLINE: Please also note that any grades posted are for your information only, so you can view and track your progress through the course. No grades are considered official, including any posted in Quercus at any point in the term, until

they have been formally approved and posted on ACORN at the end of the course. Please contact me as soon as possible if you think there is an error in any grade posted on Quercus.

Assignment Submission Method

The course will be using MarkUs for all assignment submissions.

Late/Missed Assignments

All assignments are due at midnight on the due date. There will be a 15% marks deduction for each day late (e.g., if an assignment is submitted anytime between 12:01am on the due date and 11:59pm the next day the penalty will be 15%). *No assignments will be accepted more than 5 days late.*

To account for unexpected technical last-minute issues with submissions, each student is allocated a one-hour grace period "budget". If submission of A1 or any other assignment is only a few minutes late, these minutes can be deducted from the grace period budget. Once that budget goes to zero, submitting a future assignment even a minute late will incur the full one-day lateness penalty. Assignments submitted more than 1 hour late are not eligible for grace periods and do not affect the grace period budget.

Students who wish to apply all or part of their grace period budget for an assignment submitted a few minutes late, must submit the online CSC320 special consideration request form (link available on Quercus). No grace period will be given without such a submission.

Aside from this budget, requests for special consideration can only be made for health conditions, injury, personal or family emergency, or bereavement. *All such requests must be made by submitting the online CSC320 special consideration request form (link available on Quercus).* This form must be submitted even if an absence declaration request has already been made on Acorn. Requests made over email to an instructor or TA instead of a form submission will not be honored.

Video Recording and Sharing (Download and Re-use Prohibited)

This course, including your participation, will be recorded on video and will be available to students in the course for viewing remotely and after each session.

Course videos and materials belong to your instructor, the University, and/or other sources depending on the specific facts of each situation and are protected by copyright. Do not download, copy, or share any course or student materials or videos without the explicit permission of the instructor.

For questions about the recording and use of videos in which you appear, please contact your instructor.