CIS*6320 — Section 01
Image Processing Algorithms and Applications

Spring 2023

School of Computer Science
College of Engineering and Physical Sciences

Credit Weight: 0.5

Course Details

Description

Visual perception is the brain's ability to interpret what is seen, which is estimated to account for 80-85% of all our senses. Correspondingly, visual computing studies how computers can be used to mimic the human visual system, the most fundamental part of which is image processing. Topics covered in this course include image representation, image filtering in both spatial and frequency domains, image analysis and synthesis, image understanding, and several image processing applications.

Time Slot: Monday & Wednesday, 1:00-3:45pm
Delivery Method: In-person @ Reynolds 1101

Instructor

                        Minglun Gong
Email: minglun@uoguelph.ca
Office: Reynolds 1117

Dr. Minglun Gong is a Professor and Director at the School of Computer Science, University of Guelph. Before moved to Guelph in 2019, he was a Professor and Head at the Department of Computer Science, Memorial University of Newfoundland. He obtained his Ph.D. from the University of Alberta in 2003, his M.Sc. from the Tsinghua University in 1997, and his B.Engr. from the Harbin Engineering University in 1994. Minglun's research interests cover various topics in the broad area of visual computing (including computer vision, computer graphics, visualization, image processing, and pattern recognition). So far, he has published 150+ referred technical papers in journals and conference proceedings, including 20+ articles in

ACM/IEEE transactions. Currently an associate editor for Signal Processing Letters and Pattern Recognition, he has also served as program committee member for many top-tier conferences and reviewer for prestigious journals.

Learning Resources

Textbook

The following textbooks are recommended for those with special interest in image processing, but none is required for the course:

Title:	Digital Image Processing
Author(s):	R. C. Gonzalez and R. E. Woods
Edition/Year:	4th Edition, 2017
Publisher:	Pearson

Title:	The Image Processing Handbook
Author(s):	J. C. Russ and F. B. Neal
Edition/Year:	7th Edition, 2017
Publisher:	CRC Press

Title:	Computer Vision: Algorithms and Applications
Author(s):	R. Szeliski
Edition/Year:	2nd Edition, 2022
Publisher:	Springer
Available at:	https://szeliski.org/Book/

Course Website

CourseLink (https://courselink.uoguelph.ca/, powered by D2L's Brightspace) is the course website and will act as your classroom. It is recommended that you log in to your course website every day to check for announcements, access course materials, and review the weekly schedule and assignment requirements.

Teaching and Learning Activities

Course Structure

This course contains the following 8 units:

- Unit 1: Introduction to Image Processing
- Unit 2: Image Representation, Compression, and Histogram
- Unit 3: Spatial and Frequency Domains Image Filtering
- Unit 4: Edge and Corner Detection, Template Matching
- Unit 5: Image Thresholding and Segmentation
- Unit 6: Geometric Warping, Retargeting, and Stitching
- Unit 7: Image Compositing and Matting
- Unit 8: Image Processing Applications

Tentative Schedule

Week	Start Date	Topics	
		Monday	Wednesday
1	15-May-2023	introduction	image representation
		human perception	image compression
		intensity & color	image histogram
2	22-May-2023	Holiday	histogram operation
			image filtering
			smoothing filter
3	29-May-2023	sharpening filter	edge detection
		Fourier transform	Hough transform
		frequency filter	template matching
4	5-Jun-2023	corner detection	Break
		intensity thresholding	
		morphology operation	
5	12-Jun-2023	distance transform	image retargeting
		region segmentation	feature descriptor
		geometric operation	image stitching
6	19-Jun-2023	image arithmetic	HDR imaging
		image compositing	image upsizing
		image matting	image deblurring
7	26-Jun-2023	image inpainting	Project Presentations
		Term Test	

Assessments

The grade determination for this course is indicated in the following table. A brief description of each assessment is provided below.

Assessment Item	Weight
Assignments (3)	30%
Term Test	25%
Project Presentation	10%
Project Report and Implementation	35%
Total	**100%**

Assignments

Three programming assignments are scheduled to give you hands-on practice on selected topics. They are scheduled for the following dates:

- Assignment 1: Hand out Wednesday, May 17th, due Sunday, May 28th.
- Assignment 2: Hand out Wednesday, May 31th, due Sunday, June 11th.
- Assignment 3: Hand out Wednesday, June 14th, due Sunday, June 25th.

Term Test

The term test will be delivered in class on Wednesday, June 28st. It will test all material covered in Units 1-7, with the goal of evaluating your comprehensive knowledge of the course including unit contents and assignments implementation.

Course Project

This assessment is designed to help you explore and implement one course-related topic in-depth. It involves gathering additional resources related to this topic (e.g. academic peer-reviewed publications), implementing a selected algorithm, and presenting it in a multimedia fashion through both an oral presentation and a written report. Your project must include programming implementation of a related technique. The instructor will accommodate your preference regarding the topic (e.g., image compression, HDR imaging, region segmentation), but makes the final decision. You may choose to implement a group project with a single

teammate with mutual agreement, but each member needs to demonstrate his/her own contribution.

The oral presentations will be scheduled for the last day of the course. The written report, in the form of a conference style paper, should be submitted along with programming implementation and proper documentation before the due date of Sunday, July 9th.

Course Technology Requirements and Technical Support

CourseLink System Requirements

You are responsible for ensuring that your computer system meets the necessary system requirements (http://spaces.uoguelph.ca/ed/system-requirements/). Use the browser check tool (https://courselink.uoguelph.ca/d2l/systemCheck) to ensure your browser settings are compatible and up to date. (Results will be displayed in a new browser window).

Technical Skills

As part of your learning experience, you are expected to use a variety of technology as part of your learning:

- Manage files and folders on your computer (e.g., save, name, copy, backup, rename, delete, and check properties);
- Install software, security, and virus protection;
- Use office applications (e.g., Word, PowerPoint, Excel, or similar) to create documents;
- Be comfortable uploading and downloading saved files;
- Communicate using email (e.g., create, receive, reply, print, send, download, and open attachments);
- Navigate the CourseLink learning environment and use the essential tools, such as **Dropbox**, **Quizzes**, **Discussions**, and **Grades** (the instructions for this are given in your course);
- Access, navigate, and search the Internet using a web browser (e.g., Edge, Chrome); and
- Perform online research using various search engines (e.g., Google) and library databases.

Technical Support

If you need any assistance with the software tools or the CourseLink website, contact CourseLink Support.

CourseLink Support
University of Guelph, Day Hall, Room 211
Email: courselink@uoguelph.ca
Tel: 519-824-4120 ext. 56939
Toll-Free (CAN/USA): 1-866-275-1478
Walk-In Hours (Eastern Time):
Monday thru Friday: 8:30 am–4:30 pm
Phone/Email Hours (Eastern Time):
Monday thru Friday: 8:30 am–8:30 pm
Saturday: 10:00 am–4:00 pm
Sunday: 12:00 pm–6:00 pm

Course Specific Standard Statements

Acceptable Use

The University of Guelph has an Acceptable Use Policy (https://www.uoguelph.ca/ccs/infosec/aup), which you are expected to adhere to.

Communicating with Your Instructor

During the course, your instructor will interact with you on various course matters using the following ways of communication:

- **Announcements:** The instructor may make announcements in class or use **Announcements** on the Course Home page to provide you with course reminders and updates. Please check this section frequently for course updates from your instructor.

- **Email:** All students are required to check their <uoguelph.ca> email account regularly. They must use their <uoguelph.ca> account (not any other account) to contact the instructor and should start the subject of each message with the course code. The instructor will respond to your email within 48 to 72 hours.

- **Office hours:** If you have a complex question you would like to discuss with your instructor, you may book either an in-person or an online Teams meeting. Meeting time slot depends on the availability of you and the instructor.

Submission of Assignments to Dropbox

A number of assignments for this course should be submitted electronically via the online **Dropbox** tool. When submitting your assignments using the **Dropbox** tool, do not leave the page until your assignment has successfully uploaded. To verify that your submission was complete, you can view the submission history immediately after the upload to see which files uploaded successfully. The system will also email you a receipt. Save this email receipt as proof of submission.

Be sure to keep a back-up copy of all of your assignments in the event that they are lost in transition. In order to avoid any last-minute computer problems, your instructor strongly recommend you save your assignments to a cloud-based file storage (e.g., Google Drive), or send to your email account, so that should something happen to your computer, the assignment could still be submitted on time or re-submitted.

It is your responsibility to submit your assignments on time as specified on the Schedule. Be sure to check the technical requirements and make sure you have the proper computer, that you have a supported browser, and that you have reliable Internet access. Remember that **technical difficulty is not an excuse not to turn in your assignment on time.** Don't wait until the last minute as you may get behind in your work.

If, for some reason, you have a technical difficulty when submitting your assignment electronically, please contact your instructor or CourseLink Support: http://spaces.uoguelph.ca/ed/contact-us/

Late Policy

The due dates for both the assignments and the course project are firm. Late submissions will not be accepted.

Extensions will be considered for medical reasons or other extenuating circumstances. If you require an extension, discuss this with the instructor as soon as possible and well before the due date. Barring exceptional circumstances, extensions will not be granted once the due date has passed. These rules are not designed to be arbitrary, nor are they inflexible. They are designed to keep you organized, to ensure that all students have the same amount of time to work on assignments, and to help to return marked materials to you in the shortest possible time.

Obtaining Grades and Feedback

Unofficial assessment marks will be available in the **Grades** tool of the course website.

Your instructor will have grades posted online within 2 weeks of the submission deadline, if the assignment was submitted on time. Once your assignments are marked you can view your grades on the course website by selecting **Grades** from the **Tools** dropdown menu on the navbar. Your course will remain open to you for seven days following the last day of the final exam period.

University of Guelph degree students can access their final grade by logging into WebAdvisor (https://webadvisor.uoguelph.ca, using your U of G central ID). Open Learning program students should log in to the OpenEd Student Portal (https://courses.opened.uoguelph.ca/portal/logon.do?method=load) to view their final grade (using the same username and password you have been using for your courses).

Plagiarism Detection Software

Students should be aware that faculty have the right to use software to aid in the detection of plagiarism or copying and to examine students orally on submitted work. For students found guilty of academic misconduct, serious penalties, up to and including suspension or expulsion from the University can be imposed.

Copyright

All content within this course is copyright protected. Third party copyrighted materials (such as book chapters and articles) have either been licensed for use in this course, or have been copied under an exception or limitation in Canadian Copyright law.

The fair dealing exemption in Canada's Copyright Act permits students to reproduce short excerpts from copyright-protected materials for purposes such as research, education, private study, criticism and review, with proper attribution. Any other copying, communicating, or distribution of any content provided in this course, except as permitted by law, may be an infringement of copyright if done without proper license or the consent of the copyright owner. Examples of infringing uses of copyrighted works would include uploading materials to a commercial third party web site, or making paper or electronic reproductions of all, or a substantial part, of works such as textbooks for commercial purposes.

Students who upload to CourseLink copyrighted materials such as book chapters, journal articles, or materials taken from the Internet, must ensure that they comply with Canadian Copyright law or with the terms of the University's electronic resource licenses.

For more information about students' rights and obligations with respect to copyrighted works, review Fair Dealing Guidance for Students:
http://www.lib.uoguelph.ca/sites/default/files/fair_dealing_policy_0.pdf

Graduate Student Responsibilities

From the choice of Advisor, choice of research project and through to degree completion, graduate students must recognize that they carry the primary responsibility for their success. The responsibilities assigned to Advisors, Advisory Committees and Departments provide the framework within which students can achieve success. Students should take full advantage of the knowledge and advice that the Advisor and Advisory Committee have to offer and make the effort to keep the lines of communication open. The Graduate Student Responsibilities are located in the Graduate Calendar:
https://www.uoguelph.ca/registrar/calendars/graduate/current/

University Standard Statements

University of Guelph: Graduate Policies

As a student of the University of Guelph, it is important for you to understand your rights and responsibilities and the academic rules and regulations that you must abide by.

If you are a registered **University of Guelph Degree Student**, consult the Graduate Calendar (https://www.uoguelph.ca/registrar/calendars/graduate/current/) for the rules, regulations, curricula, programs and fees for current and previous academic years.

If you are an **Open Learning Program Student**, consult the Open Learning Program Calendar (http://opened.uoguelph.ca/student-resources/open-learning-program-calendar) for information about University of Guelph administrative policies, procedures and services.

Email Communication

As per university regulations, all students are required to check their <uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

When You Cannot Meet Course Requirements

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. See the Undergraduate Calendar for information on regulations and procedures for Academic Consideration :
https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/academic-consideration-appeals-petitions/

Drop Date

Courses that are one semester long must be dropped by the end of the last day of classes; two-semester courses must be dropped by the last day of classes in the second semester. The regulations and procedures for Dropping Courses are available in the Graduate Calendar: https://www.uoguelph.ca/registrar/calendars/graduate/current/

Copies of Out-of-Class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required, however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to make a booking at least 14 days in advance, and no later than November 1 (fall), March 1 (winter) or July 1 (summer). Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time.

More information: www.uoguelph.ca/sas

Academic Misconduct

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community – faculty, staff, and students – to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an

environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

The Academic Misconduct Policy is outlined in the Graduate Calendar:
https://www.uoguelph.ca/registrar/calendars/graduate/current/

Recording of Materials

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings, changes in classroom protocols, and academic schedules. Any such changes will be announced via Courselink and/or class email.

This includes on-campus scheduling during the semester, mid-terms and final examination schedules. All University-wide decisions will be posted on the COVID-19 website (https://news.uoguelph.ca/2019-novel-coronavirus-information/) and circulated by email.

Illness

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g., final exam or major assignment).

COVID-19 Safety Protocols

For information on current safety protocols, follow these links:
https://news.uoguelph.ca/return-to-campuses/how-u-of-g-is-preparing-for-your-safe-return/
and https://news.uoguelph.ca/return-to-campuses/spaces/#ClassroomSpaces. Please note,

IMPROVE LIFE.

that these guidelines may be updated as required in response to evolving University, Public Health or government directives.