

CSCI 3162: Digital Media

Winter Term 2022/2023 — Course Syllabus

Instructor and Class Information

Instructor: Dirk Arnold (dirk@dal.ca)
Teaching Assistant: Behzad Moradi (bh461104@dal.ca)
Lectures: Goldberg 127, Tuesdays and Thursdays, 10:05–11:25
Labs: Goldberg 134, Wednesdays, 10:35–11:25
or Mona Campbell 1201, Fridays, 13:35–14:25
Course Homepage: <https://dal.brightspace.com>

Important Dates

- Classes begin: January 10
- Last day to withdraw without a “W”: February 6
- Last day to withdraw with a “W”: March 13
- Study break (no classes): February 20–24
- Assignment deadlines (tentative): January 31, February 14, March 16, April 6
- Midterm test (tentative): February 16, 10:05–11:25
- Final exam: to be scheduled by the Registrar’s (April 13–25)

Course Description

This class covers technical aspects of digital media, including images, video, and sound. Topics covered include digital representation, processing, and compression.

Course Rationale

Digital media have become ubiquitous. A technical understanding of their foundations is crucial for many tasks that require working with audio, image, and video data.

Learning Outcomes

- Understand and compare basic algorithms and techniques for lossless compression of digital data.
- Manipulate pulse code modulated audio data and raster images in MATLAB.
- Understand the basics of digital signal processing, including the effects of sampling and quantization, frequency domain analysis of digital signals, and the functioning of linear, time invariant systems.
- Transform digital signals between the time and frequency domains.
- Design, analyze, and implement linear, time invariant systems.
- Implement image processing operations in both the spatial and frequency domains.
- Understand the occurrence of aliasing, and approaches to reduce its effects.
- Understand the basics of lossy digital audio compression based on auditory masking.
- Understand the nature of colour, and how to represent it.
- Understand the basics of lossy digital image and video compression.

Tentative Schedule

Date	Event	Topic	
January 10	Lecture 1:	Introduction	
January 12	Lecture 2:	Image Basics I	
January 13	Lab 1:	MATLAB Programming I	
January 17	Lecture 3:	Image Basics II	
January 18	Lab 1:	MATLAB Programming I	
January 19	Lecture 4:	Audio Basics I	
January 20	Lab 2:	MATLAB Programming II	
January 24	Lecture 5:	Audio Basics II	
January 25	Lab 2:	MATLAB Programming II	
January 26	Lecture 6:	Complex Numbers and Lossless Compression I	
January 27	Lab 3:	Complex Numbers	
January 31	Lecture 7:	Lossless Compression II	Assignment 1 due
February 1	Lab 3:	Complex Numbers	
February 2	Lecture 8:	Analog and Digital Signals I	
February 7	Lecture 9:	Analog and Digital Signals II	
February 8	Lab 4:	Midterm Review	
February 9	Lecture 10:	Frequency Domain Analysis I	
February 10	Lab 4:	Midterm Review	
February 14	Lecture 11:	Frequency Domain Analysis II	Assignment 2 due
February 15	TBD		
February 16	Lecture 12:	Midterm Test	
February 17	TBD		
February 28	Lecture 13:	Linear Time Invariant Systems I	
March 1	Lab 5:	Frequency Domain Analysis	
March 2	Lecture 14:	Linear Time Invariant Systems II	
March 3	Lab 5:	Frequency Domain Analysis	
March 7	Lecture 15:	Discrete Fourier Transform I	
March 8	Lab 6:	Linear Time Invariant Systems	
March 9	Lecture 16:	Discrete Fourier Transform II	
March 10	Lab 6:	Linear Time Invariant Systems	
March 14	Lecture 17:	Digital Audio: Analysis and Processing	Assignment 3 due
March 15	Lab 7:	Discrete Fourier Transform	
March 16	Lecture 18:	Digital Audio: Compression	
March 17	Lab 7:	Discrete Fourier Transform	
March 21	Lecture 19:	Digital Images: Compression	
March 22	Lab 8:	Digital Audio	
March 23	Lecture 20:	Deconvolution	
March 24	Lab 8:	Digital Audio	
March 28	Lecture 21:	Colour I	
March 29	Lab 9:	Deconvolution	
March 30	Lecture 22:	Colour II and Video	
March 31	Lab 9:	Deconvolution	
April 4	Lecture 23:	Tone Mapping	Assignment 4 due
April 5	Lab 10:	Final Review	
April 6	Lecture 24:	Superresolution	
April 10	Lab 10:	Final Review	
Exam period		Final Exam	

Course Format and Communication

Barring any unforeseen circumstances, all instruction is in-person. No accommodations will be provided to students who are not on campus. Final exams will be conducted in-person. Course announcements and information on how to access course materials will be posted on *Brightspace*. It is the student's responsibility to check their Dalhousie email and *Brightspace* daily.

Assessment

The course grade will be computed based on four assignments, a midterm test, and a final exam as indicated below:

1. Assignments (35%)
 - Four assignments, each worth 8.75%.
 - Late assignments will not be accepted. Exception: each student has up to three free late days.
 - Assignments must be submitted on *Brightspace*.
 - No collaboration is permitted on the assignments.
2. Midterm test (25%)
 - To be held during class time.
3. Final Exam (40%)
 - Scheduled by the Registrar's.
 - Will cover all material in the course.
 - A minimum of 50% on the final exam is required to pass the course.

For students who achieve at least 50% on the final exam, the course grade is computed by forming the weighted sum of the three grade components and then using the grade conversion scale in Section 17.1 of the Academic Regulations, Undergraduate Calendar, to convert the numerical score to a letter grade.

Academic Standards

Failure to properly attribute sources in your work will be treated as an academic standards issue and points may be deducted for not following citation requirements. Examples may include forgetting to quote text taken from external sources, failure to include in-text citations, or a failure to include required information in the citations or references. Please see the resources on proper citation provided by the [Dalhousie Writing Center](#). If it appears that the error was made with intent to claim other people's work as your own, such as a lack of both citations and references, an allegation of plagiarism will be submitted to the Faculty Academic Integrity Officer, which could result in consequences, such as a course failure.

Further Requirements

All students are required to comply with health and safety requirements on campus, and should be considerate of others' health concerns. Non-compliance may be reported under the Code of Student Conduct.

It is up to the discretion of the instructor to use remote proctoring in online testing. Students may be required to download proctoring software onto their devices. Students who cannot meet system requirements for remote proctoring need to contact the instructor for an alternate assessment. (Typical system requirements are: (i) Mac OS or Windows, (ii) a webcam, and (iii) an internet connection.)

Students are required to install MATLAB on the computer they use for their course work. MATLAB is available to current Dalhousie students at <https://software.library.dal.ca/>.

Copyright Notice

All course materials are designed for use as part of the courses and are the property of the instructor unless otherwise stated. Third party copyrighted materials have either been licensed for use in this course or fall under an exception or limitation in Canadian Copyright law. Copying the course material for distribution (e.g., uploading material to a commercial third party website) is expressly prohibited and may be a violation of copyright law.

University Statements

This course is governed by the academic rules and regulations set forth in the University Calendar and the Senate.

Territorial Acknowledgment: Dalhousie University is located in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq. We are all Treaty people.

Academic Integrity: At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect. As a student, you are required to demonstrate these values in all of the work you do. The University provides **policies and procedures** that every member of the university community is required to follow to ensure academic integrity.

Accessibility: The **Student Accessibility Centre** is Dalhousie's centre of expertise for matters related to student accessibility and accommodation. If there are aspects of the design, instruction, and/or experiences within this course (online or in-person) that result in barriers to your inclusion please contact the Centre.

Conduct in the Classroom — Culture of Respect: Substantial and constructive dialogue on challenging issues is an important part of academic inquiry and exchange. It requires willingness to listen and tolerance of opposing points of view. Consideration of individual differences and alternative viewpoints is required of all class members, towards each other, towards instructors, and towards guest speakers. While expressions of differing perspectives are welcome and encouraged, the words and language used should remain within acceptable bounds of civility and respect.

Diversity and Inclusion — Culture of Respect: Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our **Strategic Direction** prioritizes fostering a culture of diversity and inclusiveness.

Student Code of Conduct: Everyone at Dalhousie is expected to treat others with dignity and respect. The **Code of Student Conduct** allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner—perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution.

Responsible Computing Policy: Usage of all computing resources in the Faculty of Computer Science must be within the **Dalhousie Acceptable Use Policies** and the **Faculty of Computer Science Responsible Computing Policy**.

Fair Dealing Policy: The **Dalhousie University Fair Dealing Policy** provides guidance for the limited use of copyright protected material without the risk of infringement and without having to seek the permission of copyright owners. It is intended to provide a balance between the rights of creators and the rights of users at Dalhousie.

Student Use of Course Materials: Course materials are designed for use as part of the CSCI courses at Dalhousie University and are the property of the instructor unless otherwise stated. Third party copyrighted materials (such as books, journal articles, music, videos, etc.) have either been licensed for use in this course or fall under an exception or limitation in Canadian Copyright law. Copying this course material for distribution (e.g. uploading material to a commercial third party website) may lead to a violation of Copyright law.

Learning and Support Resources: Please see https://www.dal.ca/campus_life/academic-support.html.