

GEOM 4003: Remote Sensing of the Environment

Winter 2022

Department of Geography and Environmental Studies - Carleton University

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*Please include the course code ("GEOM4003") in the subject line.

Office: Loeb A301D

Office hours: TBD

TA: TBD

Lecture (blended): Tuesdays 8:35 - 10:35 am

Online (through Zoom)

Laboratory (blended): Wednesdays 12:35 pm - 14:25 pm

Online (through Zoom)

Note: *Online meetings (lecture and lab) will take place over "Zoom" with the zoom link posted in Brightspace. Students are required to setup a free Zoom account using their Carleton email address. During Zoom sessions, please make sure to enter your full (first and last name), as well as your preferred identifier.*

I. Course Description

Advanced image enhancement; land cover classification for thematic mapping; biophysical modeling; applications in resources, environment, and urban mapping. The focus of this course will be on analyzing environmental conditions and phenomenon using remotely-sensed imagery through spatial and statistical analysis. This course will use Google Earth Engine, a cloud based remote sensing progressing suite. Students will require access to the internet through a modern browser and a google account (i.e. gmail, Google Drive). No coding skills are required but students will be expected to use and develop their own python scripts in the labs.

II. Evaluation

10 Labs at 4% each = 40%

10 quizzes at 2% each = 20%

1 practical mid-term test = 20%

1 final group project = 20%

Standing in a course is determined by the course instructor subject to the approval of the Faculty Dean. This means that grades submitted by the instructor may be subject to revision. No grades are final until they have been approved by the Dean.

Late Policy: All assignments must be submitted through Brightspace by the due date and time. No late assignments will be accepted, with exception of cases where a student is sick or has already arranged for academic accommodation as described in subsequent sections of this syllabus. In the case of illness, you must make arrangements with the course instructor **prior** to the due date/time. In place of a doctor's note or medical certificate, students are advised to complete the self-declaration form available on the Registrar's Office website to request academic accommodation for missed coursework including exams and assignments.

Lecture/Lab attendance: Lectures will cover theoretical components of remote sensing and may also include software demonstrations. Lectures will be recorded and available through Brightspace. Labs will include software demonstrations and one-on-one help will be available for software and practical related questions. Virtual attendance will be required for some group project meetings to facilitate group discussion and collaboration. The dates and times of these meetings can be scheduled by the group members, but should conform to the general requirements of the project. The final project will be presented on the last day of class and online attendance is required.

Quizzes: Online quizzes (20%) are based primarily on the textbook readings and have firm due dates. If you miss a quiz due to an extenuating circumstance, please contact the instructor as soon as possible for accommodation.

Additional information: More details on the requirements for the Practical Mid-term (20%) and the Final Group Project (20%) will be explained in class and made available on Brightspace.

III. Required Reading

This course uses a free online textbook in combination with other assigned readings (journal articles, websites, etc.). The textbook can be accessed [here](#).

IV. Course Calendar (Tentative: dates and topics subject to change. Updates will be posted to the course Brightspace)

Week (Lecture Date)	Lecture	Lab
Week 1 (Jan 11)	Review of core RS concepts (EMR, atmosphere and surface interaction, sensor types, rasters)	Lab 1 - intro to Google Co-Lab and Earth Engine
Week 2 (Jan 18)	Basic image processing: atmospheric correction, Compositing, mosaicking, indices etc.	Lab 2 - Visualization of Change
Week 3 (Jan 25)	Basic image processing for SAR: types of SAR datasets/products, backscatter intensity to dB, speckle filter, shadow layover, foreshortening	Lab 3 - Visualizing SAR data
Week 4 (Feb 1)	Remote sensing project design - sensor temporal and spatial resolution, measurement characteristics	No lab - students write up project description and hand in for approval
Week 5 (Feb 8)	Thresholding - with manual thresholding and Otsu	Lab 4 - Water Extent and Flood Mapping using thresholding
Week 6 (Feb 15)	Supervised and Unsupervised Classification	Lab 5 - Land-use/Land-cover mapping
Week 7	None - Reading Week	None - Reading Week
Week 7 (March 1)	Multisensor Image Classification	Lab 6: Mapping Glacial Lakes with Sentinel-1 and Sentinel-2
Week 8 (March 8)	Challenges in Mapping over Space and Time	Lab 7: Transfer Learning
Week 9 (March 15)	Meet-up online/work on project	None
Week 10 (March 22)	Change Detection	Lab 8: Monitoring Forest Fire Damage with multi-spectral imagery
Week 11(March 29)	Time Series - Landsat Harmonization	Lab 9: Urban de-greening
Week 12 (April 5)	Time Series - Trend Detection	Lab 10: Sea Surface Temperatures
Week 13 (April 12)	Present Final Project in Class	None

V. Other important course information

Required Computer Software

During this course you will use Google Earth Engine through the Python API. This requires use of a modern browser (Chrome recommended), a google account (gmail) and access to Google Earth Engine. Students should request access to this tool immediately through this link: https://earthengine.google.com/new_signup/ **Access to Earth Engine will be required in the first week of class.**

Additionally, students will require access to basic computing tools like a word processor, spreadsheet software etc. Google Docs and Google Sheets are encouraged for collaborating and sharing purposes, however, Microsoft Office is also fine.

Use of Discord:

I expect that someone in the class will set up a Discord server where class members can chat and discuss class content and potentially manage your group project requirements. Please make sure that everyone in the class is aware of this server. If you are not familiar with the platform, please ask your classmates about it. The instructor or TA will not be part of this server, and this is not an official communication mechanism for the class. All official communications will take place on Brightspace.

Statement on Plagiarism

PLAGIARISM

The University Senate defines plagiarism as “presenting, whether intentionally or not, the ideas, expression of ideas or work of others as one’s own.” This can include:

- reproducing or paraphrasing portions of someone else’s published or unpublished material, regardless of the source, and presenting these as one’s own without proper citation or reference to the original source;
- submitting a take-home examination, essay, laboratory report or other assignment written, in whole or in part, by someone else;
- using ideas or direct, verbatim quotations, or paraphrased material, concepts, or ideas without appropriate acknowledgment in any academic assignment;
- using another’s data or research findings; and
- failing to acknowledge sources through the use of proper citations when using another’s works and/or failing to use quotation marks.

Plagiarism is a serious offence that cannot be resolved directly by the course’s instructor. The Associate Dean of the Faculty conducts a rigorous investigation, including an interview with the student, when an instructor suspects a piece of work has been plagiarized. Penalties are not trivial. They can include a final grade of "F" for the course.

VI. Requests for Academic Accommodations

You may need special arrangements to meet your academic obligations during the term. For an accommodation request the processes are as follows:

Pregnancy obligation

Write to the instructor directly 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.

Religious obligation

Write to the instructor directly 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.

Academic Accommodations for Students with Disabilities

The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or pmc@carleton.ca for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your Letter of Accommodation at the beginning of the term, and 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 me to ensure accommodation arrangements are made.

Please consult the PMC website for the deadline to request accommodations for the formally-scheduled exam (if applicable).

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 where 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: <https://carleton.ca/equity/sexual-assault-support-services>

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. Write to me 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.

<https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf>