

## Fall 2025 - Introduction to Remote Sensing - GEOM3002

### Department of Geography and Environmental Studies

**Instructor:** Emily Lindsay, PhD [emilylindsay@cmail.carleton.ca](mailto:emilylindsay@cmail.carleton.ca)

**Office Hours:** Mondays 17:30 – 18:00, Loeb A200 – or virtually (by appointment).

**Lecture Time:** Mondays 18:05 – 19:55

**Labs:** Mondays 20:05 – 21:55

**Location (Lecture and Lab):** TBA

**Course Brightspace:** [GEOM 3002](#)

**TA:** Yasaman Amini

**Office Hours:** NA

### 1. Course Description

Principles and methods of remote sensing; visual interpretation of air photos and satellite imagery; digital image processing, analysis and classification for thematic mapping; introduction to various active and passive remote sensing imagery types such as optical, hyperspectral, RADAR and LiDAR. We will use a variety of software in the course. Google Earth Engine is an online free cloud processing software. Other software (QGIS, SNAP, WebODM are all available in our lab). You will require familiarity with the Windows operating system. It is also assumed that students will be able to use word processors and other utilities (Acrobat Reader, Winzip/7Zip, Notepad, Explorer etc). No coding skills are required, but students should be ready to learn how to use and develop some basic scripts in the labs.

This course will run online using a blended approach. Some lectures will be pre-recorded and available through Brightspace. Lecture periods will be used to cover additional lecture materials, facilitate group discussions and group exercises. Labs will be demonstrated through pre-recorded videos, uploaded in advance of the lab time slots. The TA will also demo parts of the lab in the official lab timeslot and the rest of the lab period will be informal and allow you to ask questions and get technical help. Quizzes will be assigned before specific lecture periods, to be completed in class, and are designed to be used for you to gauge your understanding of the reading material.

### 2. Preclusions

GEOG3002 (no longer offered)

### 3. Learning Outcomes

- Understand the conceptual and technical background related to image formation and spectral reflectance theory, types of remote sensors currently in use
- Use theoretical understanding to determine the appropriate sensor to observe specific geographic phenomenon

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- Perform visual interpretation of images, image enhancement, thematic mapping using remotely sensed imagery
- Use theoretical understanding to determine the best workflow for processing and analyzing remotely sensed imagery

### 4. Texts & Course Materials

**Textbook:** Readings from the web + Remote Sensing, A. Knudby (2021) online (free and open access): <https://ecampusontario.pressbooks.pub/remotesensing/>

### 5. Course Calendar

Lecture Date	Lecture Topic	Lab Topic	Lab Due	Quiz Due
September 8	Welcome; Intro to the course; what is remote sensing? what can it be used for? brief history of remote sensing.  Introduction to the electromagnetic spectrum and black body radiators; radiation and target interactions; atmospheric windows	No Lab		Quiz 1
September 15	Introduction to remote sensing data; raster images, types of resolution, pixel types, bit depth, review of projections and coordinate systems	Lab 1: Part 1: Downloading imagery and working with imagery locally in QGIS		Quiz 2
September 22	Optical Remote Sensing 1 - common sensors, uses, orbit types	Lab 1: Part 2: working with imagery in Google Earth Engine and Google Co-lab		
September 29	Optical Remote Sensing 2 - what is an "image", images as radiometric measurements, types of imaging, image enhancement, atmospheric and radiometric correction, orthorectification. Midterm Introduced	Open lab period (work on Lab 1 recommended!)		Quiz 3
October 6	Optical Remote Sensing 3 - image interpretation, indices, texture, cloud masks, composites, mosaics. Final Group Project Introduced	Lab 2: Part 1: explore different processing levels and image enhancements in GEE/Colab	Lab 1	
October 13	University closed, no class.	No Lab		

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October 20	Fall Break, no class.	No Lab		
October 27	Active Remote Sensing - SAR1 - speckle filtering, polarizations and polarimetry, (basics of SAR and SAR sensors, data collection).	Lab 2: Part 2: explore cloud masking, compositing and mosaicking in GEE/Colab		Quiz 4
November 3	Intro to SAR Guest Lecture – Sarah Banks – ECCC Midterm work period	Lab 3: Part 1: Working with Sentinel-1 in GEE/Colab	Lab 2	
November 10	Active Remote sensing - SAR 2 - InSAR, coherent change detection and sensor comparisons. Group project discussions  <i>**Midterm exam due</i>	Lab 3: Part 2: processing Sentinel-1 imagery in SNAP		Quiz 5
November 17	Active Remote Sensing – LiDAR Group project work period  <i>**Final project proposals due</i>	Lab 4: Working with Point Clouds	Lab 3	
November 24	Aerial Photography, UAVs and Structure from Motion Group Project work period	Open lab (Work on Lab 4 recommended!)		Quiz 6
December 1	Final project presentations	No lab	Lab 4	
December 5	<i>**Final project report due</i>			

### 6. Evaluation:

- 4 labs (variable weighting) = 40%
- Mid term @ 20% (take home - i.e. not timed)
- 6 Quizzes @ 10% (graded based on on-time, in-class completion)
- Final group project @ 30%

Peer feedback will be used to grade the mid term and part of the group project. For the midterm, you will also evaluate the feedback you receive and these evaluations will together make up your grade for the midterm.

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.

**Late Policy:** All assignments must be submitted through the Brightspace dropbox by the due date and time. No late assignments will be accepted, with the exception of those cases where a student is sick or if you have 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. Some lectures will be recorded and available through Brightspace whereas others will take place in the lecture period. Some lecture periods will also be used for group exercises and will be graded using peer feedback, with the highest 7 grades being averaged (i.e. lowest 3 dropped). Some exercises may require us to go outside - but you will be given advanced warning on what clothing you will require. Labs will include software demonstrations and one-on-one help will be available for software and practical related questions. Lab periods marked as "open lab periods" are times for you to work on your labs or group projects and get the help of the TA, but not formal demonstrations are scheduled. In person or virtual attendance may be required to some group project meetings to facilitate group discussion and collaboration, as decided by the group.

## 7. Generative Artificial Intelligence (AI)

Students may use AI tools for sharing ideas, clarifying challenging concepts, or getting started on projects. Some acceptable uses include:

- You may use Generative AI to summarize/explain concepts to you (e.g. "can you explain how passive and active remote sensing differ?") or explain the general steps that would be required to solve a problem (e.g. "can you explain how to collect GCPs with WebODM?").
- AI may be used for coding / debugging assistance (e.g., utilizing Copilot or other AI for GEE lab assignments and final project debugging / code assistance)
- Creating outlines (e.g., using AI to structure an essay or presentation flow, using Microsoft Word's Outline View with AI suggestions)
- Brainstorming ideas (e.g. generating final project topics with ChatGPT, using Microsoft Word's Smart Lookup to find inspiration and related topics).
- Providing definitions or explanations of complex course concepts (e.g., using AI to explain a concept or theory, or find relevant additional literature/links)

**Documenting use of AI:** It is necessary to document your use of AI in this course, using the following guidelines:

- Provide a detailed description of AI usage and proper citation (e.g., 'AI-assisted data analysis performed using Excel's Ideas tool/Python with AI-driven libraries)
- Ensure critical thinking and personal insight are evident in all submitted work
- AI-generated content should not replace core analysis or primary arguments in written work. AI should not be used to produce any written content for the final project deliverables, and should be properly cited for any code generated components or deliverables and should not copy or paraphrase the text it produces.

**Why have I adopted this policy?** This policy supports the use of AI as a supplementary tool, helping students develop ideas and structure their work while emphasizing the importance of transparency and personal engagement with the content. AI can be used for inspiration and foundational support and can encourage students to critically assess and refine AI-generated material.



As our understanding of the uses of AI and its relationship to student work and academic integrity continue to evolve, students are required to discuss their use of AI in any circumstance not described here with the course instructor to ensure it supports the learning goals for the course.

## 8. Statement on Academic Integrity

### **PLAGIARISM**

The University Academic Integrity Policy defines plagiarism as “presenting, whether intentionally or not, the ideas, expression of ideas or work of others as one’s own.” This includes 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. Examples of sources from which the ideas, expressions of ideas or works of others may be drawn from include but are not limited to: books, articles, papers, literary compositions and phrases, performance compositions, chemical compounds, artworks, laboratory reports, research results, calculations and the results of calculations, diagrams, constructions, computer reports, computer code/software, material on the internet and/or conversations.

**Examples of plagiarism include, but are not limited to:**

- any submission prepared in whole or in part, by someone else, including the unauthorized use of generative AI tools (e.g., ChatGPT);
- using ideas or direct, verbatim quotations, paraphrased material, algorithms, formulae, scientific or mathematical concepts, or ideas without appropriate acknowledgment in any academic assignment;
- using another’s data or research findings without appropriate acknowledgement;
- submitting a computer program developed in whole or in part by someone else, with or without modifications, as one’s own; and
- failing to acknowledge sources through the use of proper citations when using another’s work and/or failing to use quotations marks.

Plagiarism is a serious offense 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.

## 9. Statement on Student Mental Health

As a student you may experience a range of mental health challenges that significantly impact your academic success and overall well-being. If you need help, please speak to someone. There are numerous resources available both on- and off-campus to support you. For more information, please consult <https://wellness.carleton.ca/>

### **Emergency Resources (on and off campus)**

- Crisis/Urgent Counselling Support: 613-520-6674 (Mon-Fri, 8:30-4:30)
- Suicide Crisis Helpline: call or text 9-8-8, 24 hours a day, 7 days a week.

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- For immediate danger or urgent medical support: call 9-1-1

### Carleton Resources

- Mental Health and Wellbeing: <https://carleton.ca/wellness/>
- Health & Counselling Services: <https://carleton.ca/health/>
- Paul Menton Centre: <https://carleton.ca/pmc/>
- Academic Advising Centre (AAC): <https://carleton.ca/academicadvising/>
- Centre for Student Academic Support (CSAS): <https://carleton.ca/csas/>
- Equity & Inclusivity Communities: <https://carleton.ca/equity/>

### Off Campus Resources

- Distress Centre of Ottawa and Region: call 613-238-3311, text 343-306-5550, or connect online at <https://www.dcottawa.on.ca/>
- Mental Health Crisis Service: call 613-722-6914 or toll-free 1-866-996-0991, or connect online at <http://www.crisisline.ca/>
- Good2Talk: call 1-866-925-5454 or connect online at <https://good2talk.ca/>
- The Walk-In Counselling Clinic: for online or on-site service <https://walkincounselling.com>

## 10. Requests for Academic Accommodations

Carleton is committed to providing academic accessibility for all individuals. You may need special arrangements to meet your academic obligations during the term. The accommodation request processes, including information about the Academic Consideration Policy for Students in Medical and Other Extenuating Circumstances, are outlined on the Academic Accommodations website ([students.carleton.ca/course-outline](https://students.carleton.ca/course-outline)).

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 me with any requests for academic accommodation as soon as possible after the need for accommodation is known to exist.

**Religious obligation:** 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.

**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](mailto: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). More Information:

<https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf>

### **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>