



Earth Observation and Analysis
Department of Geography and the Environment
Winter 2024

Instructor Information

Instructor: Dr. Muditha Heenkenda
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Lab Instructor Information

Instructor: Mr. Jason Freeburn
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Teaching Assistant (TA) Information: NA

Course Identification

Course Number: GEOG 2215
Course Name: Earth Observation and Analysis
Course Location: RC 2003 & ATAC 3009
Class Times: Monday & Wednesday, 9.30 am to 10.30 am (lectures); Tuesday,
10.30 am to 12.30 pm (lab)
Prerequisites: GEOG 2232 or a similar course

Course Description/Overview - Introduces principles of photogrammetry, develops plans for aerial image acquisition using remotely piloted aircraft systems (drones) and Light Detection And Ranging (LiDAR) technology. Digital photogrammetry emphasizes the concept of vertical and oblique photography, photo scale, photo interpretation, stereo vision and generating 2D/3D products from photography and LiDAR such as Digital Elevation Models (DEM), Digital Surface models (DSM), and orthoimages. State-of-the-art techniques for data processing, visualization, and online publishing will be discussed.

Course Learning Objectives

Upon successful completion of this course, students will be able to:

- understand the basic principles of photogrammetry/remote sensing and LiDAR;
- identify photo interpretation techniques, including stereo viewing and their applications;
- demonstrate competency in using ArcGIS Pro software for digital image processing;
- generate different products from aerial images and LiDAR;
- visualize/publish these products using ArcGIS Online and;
- describe the general procedure of aerial photography/RPAS mission planning and data processing workflow.

Course Resources

Course Website(s)

- A D2L site will be accessible upon course registration

Required Course Text(s)

- **Recommended (Chapters 2 and 3):** Lillesand, T.M., Kiefer, R.W., and Chipman, J.W., 2015. Remote Sensing and Image Interpretation, 6th Edition (New Jersey: Wiley), ISBN 978-1-118-34328-9

ebook for renting: <https://www.wiley.com/en-us/Remote+Sensing+and+Image+Interpretation,+7th+Edition-p-9781118343289>

- Reading materials from the course website

Course Schedule/Outline

Week starting from	Monday (lecture) (09.30 am to 10.30 am)	Wednesday (lecture) (09.30 am to 10.30 am)	Lab exercise (Tuesday 10.30 am to 12.30 pm)
Jan. 08	Introduction to the course; Introduction to photogrammetry (history)	Four types of aerial photos (Panchromatic, B&W IR, Color IR, True colour)	Lab 1: Explore air photo archives and identify different features and changes over time
15	Transition from analogue to digital photography (photographic films, multispectral images)	Geometry of aerial photography (vertical/oblique, photo scale, relief displacement)	NO LAB THIS WEEK
22	Geometry of aerial photography (vertical/oblique, photo scale, relief displacement)	Digital photography (scale and GSD), different types of cameras (pixel size, CCD, flying height and DSD)	Lab 2: Compare different types of photographs and digital cameras
29	Visual image interpretation and map making	Image orientation (block adjustment)	Lab 3: Photo characteristics, calculate scale and relief displacement, and display multispectral images on screen
Feb. 5	Image orientation – improve accuracy using Ground Control Points	Midterm test review	Lab 4: Image interpretation (create a map)
12	Midterm test	Stereo vision and stereo photo measurements (photo base, parallax, height)	Lab 5: Create ortho mapping workspace; interior orientation and block adjustment in ArcGIS Pro
19	Study break		
26	Surface modelling using overlap photos – DEM, DSM	Ortho photos, characteristics and applications	Lab 5 cont.: Add GCP and improve the accuracy, create a stereo pair; and stereo vision and 3D digitizing
Mar. 4	DEM/DSM visualization and applications	Introduction to RPAS and mission planning (no. of flight lines, photos, overlaps)	Lab 5 cont.: Ortho, DEM and DSM visualization (Map and scene) and publish in ArcGIS Online
11	3D products and 3D visualization from RPAS imagery	Introduction to RPAS (Regulations)	Lab 6: Developing a flight plan (ground coverage, no. of flight lines & images, overlap) using MissionPlanner
18	Introduction to Light Detection And Ranging (LiDAR)	3D products and 3D visualization from LiDAR	Lab 7: LiDAR data visualization
25	3D products and 3D visualization from LiDAR	Final exam review	Lab 8: Generating different products from LiDAR & publishing
Apr 1	Easter Monday (No class)	Lab 8 cont.: Generating different products from LiDAR & publishing	Lab 8 cont.: Generating different products from LiDAR & publishing

Assignments and Evaluations

Item	Date(s)	Value
Lab Assignment(s)	Every Tuesday before 10.30 am	45%
Quizzes	TBA	5%
Midterm Test	Feb. 12, 2024	25%
Final Examination	TBA	25%
Total		100%

Late Assignments

Late assignments will automatically receive a deduction of 10% per day unless an extension is agreed upon with the instructor before the due date.

Course Policies

(relevant University/Faculty or Program regulations/policies)

- The link to the behavioral standards (this could be a reference to the [Code of Student Behaviour and Disciplinary Procedures](#) also known as The Code),
- Attendance is expected for each lecture and lab unless communicated with the instructor ahead of time,
- Participation is expected in all class discussions, group work and collaborative efforts,
- Exams (a) absences from illness, compassionate reasons or representing the university off-campus, supported by written documentation, will be accepted as sufficient evidence to allow a rewrite of a missed test.
(b) If you miss an exam for any reason other than those deemed acceptable in the Lakehead University calendar, then you will be given the opportunity of an essay-based makeup exam that is significantly longer and more difficult.

Regulations – General Information from the [Academic Calendar](#)

“It is the responsibility of each student registered at Lakehead University to be familiar with, and comply with all the terms, requirements, regulations, policies and conditions in the Lakehead University Academic Calendar. This includes, but is not limited to, Academic Program Requirements, Academic Schedule of Dates, University and Faculty/School Policies and Regulations and the Fees and Refund Policies and Schedules.”

Collaboration/Plagiarism

Plagiarism is defined in [University Regulation IX](#) with additional examples in Article I, Section 1 of The Code. Sanctions associated with Academic Misconduct are defined in Article II of The Code and Enforcement Procedures are outlined in Article III of The Code.

Students wishing to learn more about Academic Misconduct are encouraged to read the [University and relevant Faculty Regulations](#) and The Code (noted above) and access other resources on the [Teaching Commons](#) website.

University Policies – all University Policies can be found [here](#). Pay particular attention to those found under the Category of “Regulations” and “Student-Related”. If you have a question, please let me know by email or in-class. If you have a question, it is likely that at least a few others in the class are wondering the same thing.

Supports for Students – there are many resources available to support our students. These include but are not limited to:

- [Health and Wellness](#)
- [Student Success Centre](#)
- [Student Accessibility Centre](#)
- [Library](#)
- [Academic Support Zone](#) (Writing and Math Tutoring Centre)

Lakehead University is committed to achieving full accessibility for persons with disabilities. Part of this commitment includes arranging academic accommodations for students with disabilities and/or medical conditions to ensure they have an equitable opportunity to participate in all of their academic activities. If you are a student with a disability and think you may need accommodations, you are strongly encouraged to contact Student Accessibility Services (SAS) and register as early as possible. For more information, please contact Student Accessibility Services <http://studentaccessibility.lakeheadu.ca> (SC0003, 343-8047 or sas@lakeheadu.ca)