

GEOG 684 L01 Fundamentals of Remote Sensing

GFC Hours 3-2

Fall 2022 classes: September 6th – December 7th, 2022

Section	Days	Time	Location
L01	TBA	Asynchronous	Web-based
B01	TBA	Asynchronous	Web-based

Instructor: Dr. Darren Sjogren	Office: ES 456
Telephone: 403-220-2575	Email: sjogren@ucalgary.ca
Email communication will be through your UCalgary email address.	Office hours: By appointment

The **Department of Geography** condemns the longstanding and continued injustices against those marginalized by racism, sexism, homophobia, transphobia, classism, xenophobia, able-bodied normativity, mental health profiling, and other forms of prejudice. We are pained by the fact that injustices are unevenly borne. <https://arts.ucalgary.ca/news/anti-racism-statement>

Territorial Acknowledgement

The Department of Geography would also like to acknowledge the traditional territories of the people of the Treaty 7 region in southern Alberta. The City of Calgary is also home to Métis Nation of Alberta, Region III. <https://www.ucalgary.ca/indigenous/cultural-protocol>

Official Course Description

Theoretical topics include physics of remote sensing data capture, sensor systems, representation, and data models, as well as the science behind techniques such as reflectance and radiance calibrations, atmospheric corrections, and image transformations. Applications include topics such as visual interpretation of imagery, supervised and unsupervised image classification, model validation, and accuracy assessment.

Course Objectives

The overall objective of the course is to develop a fundamental understanding of optical remote sensing technology and standard remote sensing techniques. The course will address many preprocessing and calibration techniques that are necessary for some remote sensing applications. Multiband image manipulations such as band compositing and contrast enhancements will be linked to visual interpretation. Other key techniques will be pixel- and object-based classification, image indices, neighbourhood operators, and Principal Components Analysis. The exercises and assignments in this course will primarily use Esri's ArcGIS Pro and ArcGIS Online software.

Course Learning Outcomes

The Department of Geography is committed to student knowledge and skill development. The table below lists the key learning outcomes for this course, the program-learning outcomes to which they contribute, and the expected level of achievement.

Course Learning Outcomes	PLO(s)*	Level(s)**
By the end of this course, a successful student will be able to:		
Manipulate data layers to create visualizations of multiband imagery	3,4,6,7	2
Describe EMR production and characteristics	2	2
Describe remote sensing historical development and its importance	2	2
Describe and interpret EMR-matter interactions	2,7	2
Explain and perform geometric and radiometric corrections	4,5,6	2
Perform and evaluate image transformation techniques	4,5,6	2
Perform and evaluate different image classification techniques	2,3,4,5,6	2

*PLOs = Program Learning Outcomes: 1 = reflect and communicate diverse human-environment perspectives, 2 = identify and explain human-environment processes, 3 = implement sampling, data collection, analyses and communication methods, 4 = analyze spatial and temporal aspects of human-environment systems, 5 = employ knowledge, arguments, and methodologies for solving human-environment problems, 6 = evaluate geospatial data and manipulate it to create cartographic products, 7 = communicate geographic concepts using oral, written, graphic, and cartographic modes, and 8 = demonstrate literacy skills.

**Levels: 1 = Introductory, 2 = Intermediate, and 3 = Advanced.

Prerequisites

Consent of the Department.

Course Format

All required course components are asynchronous.

1. There are no required scheduled online meetings for this course. However, online meetings will be scheduled by the instructor and TA, to host question-and-answer sessions, facilitate class discussion, or assist with assignments. Attendance at these online sessions is not mandatory and sessions will be recorded so that all students can access information provided in these meetings.
2. Lectures and lab introductions will be recorded and posted to Teams (more info below). Students will watch these on their own time.
3. Worksheets will be delivered through Teams and will focus on all components of the course. It will be specified what course material is covered by each worksheet.
4. Lab components will be completed individually and must be the student's own work. Consultation with other students is encouraged.
5. Students are expected to engage with each other in the Teams discussion boards and are encouraged to conduct online meetings for different course components when their schedules permit.
6. Although students are encouraged to consult with each other on most components, it is expected that no communication among students occurs during the midterm or final exam periods (see schedule).

Learning Resources

The following textbook is required. Testable readings will be provided out of this text.

Jensen, J.E., 2016. *Introductory Digital Image Processing: A Remote Sensing Perspective, 4th Edition.* Pearson.

Required readings from other sources will be assigned – notifications will be posted online, and additional readings will not require purchase and be available through the UofC Library.

Assessment Methods

The following online evaluation components will be used to determine the overall grade in this course.

Component #1 – Tests & worksheets

Worksheets	10%
Midterm (begins Oct 21 @08:00; ends Oct 22 @08:00)	15%
Take home final exam (begins Dec 07 @08:00; due Dec 14 @08:00)	20%

Component #2 – Lab Assignments & Term Project

Lab assignments	55%
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Notes:

1. There is NOT a registrar scheduled final exam in this course.
2. To successfully pass this course, students must earn a passing grade for both Component #1 –Tests & Worksheets **and** Component #2 – Lab Assignments. For passing grades see Grading System below.

Further details about each evaluation component, such as lecture topics, lab assignment topics and deadlines, online engagement expectations, etc., will be provided at the beginning of the course. The midterm will be scheduled during the term, and it is mandatory that you complete these tests on the scheduled date and time. The midterm will be open-book (computer and web resources allowed) and must be completed anytime within the 24-hour period (expected completion time is 50 minutes). You may not consult with other people about course content during the test 24-hour period.

Grading System

96 – 100	A+	77 – 80	B	59 – 61	C-
90 – 95	A	71 – 76	B-	55 – 58	D+
86 – 89	A-	65 – 70	C+	50 – 54	D
81 – 85	B+	62 – 64	C	0 – 49	F

Flexible Grade Option (CG Grade)

<https://www.ucalgary.ca/pubs/calendar/current/f-1-3.html>

Late Assignments and Missed Tests

- Missed tests (midterm, or final exam) will automatically receive a grade of zero (0). If a student has missed a test, they must contact the instructor immediately to discuss whether accommodations can be made. If extenuating circumstances contributed to a missed component, accommodations might include options such as assigning an alternate evaluation component or waiving the component and reweighting of the overall course grade, at the instructor's discretion (see the University Calendar – Academic Regulations section G.1.1 Course Assessments and Absences for procedures on missed term tests and assignments).
- You will be required to complete several laboratory assignments in this course. A due date and time will be posted for each assignment, and these deadlines are strict. If extenuating circumstances arise that will prevent you from completing an assignment by the deadline, contact your instructor or teaching assistant at least one business day before the deadline to discuss whether an extension can be granted. No extensions will be provided after the deadline. Late submissions will be accepted at a penalty of 10% per calendar day, or any portion thereof, past the deadline (e.g., 1 hour late = 10% penalty, 24+ hours late = 20% penalty).
- All assignments must be submitted online following the instructions provided. Submissions which do not follow the instructions will be penalized or rejected entirely (e.g., email submissions will not be accepted).

Exams & Deferrals <https://www.ucalgary.ca/registrar/exams>

Supplementary Fees

Not applicable

Referencing Standard

In written work presented in this class, the two accepted methods for referencing the work of others will be (1) Chicago Manual of Style: <https://www.chicagomanualofstyle.org/home.html> or (2) American Psychological Association: <https://apastyle.apa.org/products/publication-manual-7th-edition>

Important Dates

The last day to drop this course and receive a tuition fee refund is **Thursday, September 15th, 2022**. The last day to add or swap a course for Fall 2022 is **Friday, September 16th, 2022**. The last day to withdraw from this course is **Wednesday, December 7th, 2022**. Please note that the University is closed on Friday, September 30th; Monday, October 10th; and Friday, November 11th, 2022.

Learning Resources - Technologies and Requirements

To successfully engage in their learning experiences at the University of Calgary, students taking online, remote, and blended courses are required to have reliable access to the following technology:

- A computer with a supported operating system, as well as the latest security and malware updates
- A current and updated web browser
- Webcam (built-in or external)
- Microphone and speaker (built-in or external) or headset with microphone
- Broadband internet connection

Learning Resources - Teams for Education Learning Management System

This course will use the Microsoft Teams for Education online learning management system for most online course materials and interaction (e.g., video calls, text-based chat, posting of lecture materials, recorded videos, assignment submission, online gradebook, etc.). **To use Microsoft Teams, students are required to enable multi-factor authentication (MFA) on their UCalgary Office365 accounts.** For more information on multi-factor authentication and how to get started, see [LINK](#). For information on obtaining and installing Microsoft Teams, see [LINK](#). A Microsoft Teams software client capable of video calls will be required for some course components.

Enrolled students will receive an invitation to the course Microsoft Teams workspace during the first week of the term. Note that Microsoft Teams will largely replace Desire2Learn (D2L) and Zoom for the delivery of online content in this course.

Learning Resources – ArcGIS Pro and ArcGIS Online software

The exercises and assignments in this course will primarily use Esri's ArcGIS Pro and ArcGIS Online software. Students may obtain a licence to install ArcGIS Pro on their personal computers. ArcGIS Pro runs on the Windows operating system only, and system requirements for the software can be found on the software vendor's website [LINK](#).

For Apple Mac users, it may be possible to install the Windows operating system on a Mac computer using either Apple's [Boot Camp](#) or a commercial virtualization client, such as [Parallels Desktop](#) or [VMware Fusion for Mac](#), although these options are supported by the University of Calgary, and students must obtain and install necessary software themselves (student discounts are often available to offset the cost of purchasing commercial virtualization software and a licence for the Windows operating system). Interested students are advised to contact their instructor for more information.

Anyone with a University IT account can create an Esri Account for access to ArcGIS Online, Esri Training and ArcGIS Pro *without having to submit a request*. Updated instructions are available in the following articles, previous instructions have been removed.

- [ArcGIS – Esri Account](#) (How to access ArcGIS Online, ArcGIS Pro and Esri Training)
- [ArcGIS Pro - Personal Computer](#) (How to install and license ArcGIS Pro on a personal computer)

Existing ArcGIS Online users have a couple of options; continue to use their existing Esri Account or create a new Esri Account accessible through their University IT login. For details, please see the '[ArcGIS – Esri Account Options](#)' article.

For students who are unable to run ArcGIS Pro on their home computers, shared access to a campus computer via a remote connection will be available. For remote access, students will require a Windows or Mac-based computer and a reliable broadband connection. Details on how to schedule time on a shared computer using a remote desktop session will be provided at the beginning of the course.

Resources and Writing support

Please note writing support resources provided by the Student Success Centre <https://ucalgary.ca/ssc/resources/writing-support> and the library <https://libguides.ucalgary.ca/guides/>

University of Calgary Academic Integrity Policy

Academic integrity is the foundation of the development and acquisition of knowledge and is based on values of honesty, trust, responsibility, and respect. We expect members of our community to act with integrity. The University Calendar includes a statement on the principles of conduct expected of all members of the university community (including students, faculty, administrators, any category of staff, practicum supervisors, and volunteers), whether on or off university property. This statement applies in all situations where members of the university community are acting in their university capacities. All members of the university community have a responsibility to familiarize themselves with the principles of conduct statement, which is available at: www.ucalgary.ca/pubs/calendar/current/k.html.

Plagiarism, Cheating, and Student Misconduct

The University of Calgary is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect.

Academic dishonesty is not an acceptable activity at the University of Calgary, and students are **strongly advised** to read the Student Misconduct section in the University Calendar at: www.ucalgary.ca/pubs/calendar/current/k-3.html. Often, students are unaware of what constitutes academic dishonesty or plagiarism. The most common are (1) presenting another student's work as your own, (2) presenting an author's work or ideas as your own without adequate citation, and (3) using work completed for another course. Such activities will not be tolerated in this course, and students suspected of academic misconduct will be dealt with according to the procedures outlined in the calendar at: <https://www.ucalgary.ca/legal-services/university-policies-procedures/student-academic-misconduct-procedure>

For students wishing to know more about what constitutes plagiarism and how to properly cite the work of others, the Department of Geography recommends that they attend Academic Integrity workshops offered through the Student Success Centre: <https://www.ucalgary.ca/student-services/student-success/learning/academic-integrity>

Instructor Intellectual Property

Information on Instructor Intellectual Property can be found at <https://www.ucalgary.ca/legal-services/university-policies-procedures/intellectual-property-policy>

Freedom of Information and Protection of Privacy

Freedom of Information and Protection of Privacy (FOIP) legislation in Alberta disallows the practice of having students retrieve assignments from a public place, such as outside an instructor's office, the department office, etc. Term assignments will be returned to students individually, during class or during the instructor's office hours; if students are unable to pick up their assignments from the instructor, they must provide the instructor with a stamped, self-addressed envelope to be used for the return of the assignment.

Posting of Grades and Picking-up of Assignments

Graded assignments will be returned by the instructor or teaching assistant digitally through Microsoft Teams. Grades and assignments will not be available at the Department of Geography's main office and assignments cannot be dropped off at the Department Office.

Academic Accommodations

It is the student's responsibility to request academic accommodations, according to the university policies and procedures listed in the University Calendar.

The student accommodation policy can be found at: <https://www.ucalgary.ca/pubs/calendar/current/b-6-1.html>

Students needing an accommodation because of a disability or medical condition should communicate this need to Student Accessibility Services in accordance with the Procedure for Accommodations for Students with Disabilities:

<https://www.ucalgary.ca/legal-services/university-policies-procedures/accommodation-students-disabilities-procedure>

Students needing an accommodation based on a protected ground other than disability should communicate this need, preferably in writing to their instructor or the Department Head (email: freeman@ucalgary.ca).

Use of internet and electronic devices in class

Use of internet and electronic devices is essential for this course.

Guidelines for Teams Conferencing Sessions

Teams is a video conferencing program which will allow us to meet at specific times for a "live" video conference, so that we can have the opportunity to meet each other virtually and discuss relevant course topics as a learning community.

To help ensure Teams sessions are private, do not share Teams link or password with others, or on any social media platforms. Teams' links and passwords are only intended for students registered in the course. Teams' recordings and materials presented in Teams, including any teaching materials, must not be shared, distributed, or published without the instructor's permission.

The use of video conferencing programs relies on participants to act ethically, honestly and with integrity; and in accordance with the principles of fairness, good faith, and respect (as per the [Code of Conduct](#)). When entering Teams, you play a role in helping create an effective, safe, and respectful learning environment.

Please be mindful of how your behavior in these sessions may affect others. Participants are required to use names officially associated with their UCID (legal or preferred names listed in the Student Centre) when engaging in these activities.

Instructors/moderators can remove those whose names do not appear on class rosters. Non-compliance may be investigated under relevant University of Calgary conduct policies (e.g., Student Non-Academic Misconduct Policy). If participants have difficulties complying with this requirement, they should email the instructor of the class explaining why, so the instructor may consider whether to grant an exception, and on what terms.

If you are unable to attend a Teams session, please contact your instructor to arrange an alternative activity for the missed session (e.g., to review a recorded session). Please be prepared, as best as you are able, to join class in a quiet space that will allow you to be fully present and engaged in Teams sessions. Students will be advised by their instructor when they are expected to turn on their webcam (for group work, presentations, etc.).

The instructor may record online Teams class sessions for the purposes of supporting student learning in this class – such as making the recording available for review of the session or for students who miss a session. Students will be advised before the instructor initiates a recording of a Teams session. These recordings will be used to support student learning only and will not be shared or used for any other purpose.

Media Recording (if applicable)

Optional meetings will occur throughout the course to allow for face-to-face discussions and Q&A. These meetings will be recorded in Teams. Students can opt out or shut off their cameras & mics.

Course evaluations and student feedback

Student feedback will be sought at the end of the course through the standard University Student Ratings of Instruction (USRI) and Faculty course evaluation forms.

Accessibility

All recorded lectures or demonstrations will be done in YuJa, with the auto-captioning turned on. This will allow students to access the information using both visual and auditory modes.

Copyright Legislation

All students are required to read the University of Calgary policy on Acceptable Use of Material Protected by Copyright <https://www.ucalgary.ca/legal-services/university-policies-procedures/acceptable-use-material-protected-copyright-policy> and requirements of the copyright act (<https://laws-lois.justice.gc.ca/eng/acts/C-42/index.html>) to ensure they are aware of the consequences of unauthorised sharing of course materials (including instructor notes, electronic versions of textbooks etc.). Students who use material protected by copyright in violation of this policy may be disciplined under the Non-Academic Misconduct Act.

Wellness and Mental Health Resources

The University of Calgary recognizes the pivotal role that student mental health plays in physical health, social connectedness, and academic success and aspires to create a caring and supportive campus community where individuals can freely talk about mental health and receive supports when needed. We encourage you to explore the mental health resources available throughout the university community, such as counselling, self-help resources, peer support, or skills-building available through the SU Wellness Centre (Room 370, MacEwan Student Centre, <https://www.ucalgary.ca/wellnesscentre/services/mental-health-services>) and the Campus Mental Health Strategy website (<http://www.ucalgary.ca/mentalhealth/>).

Students requiring assistance are encouraged to email the **Student at Risk line** if they or others appear to need wellness assistance: sar@ucalgary.ca For more immediate response, please call: 403-210-9355 and select option #2.

Sexual Violence Policy

The University recognizes that all members of the University Community should be able to learn, work, teach and live in an environment where they are free from harassment, discrimination, and violence. Please see the policy available at <https://www.ucalgary.ca/legal-services/university-policies-procedures/sexual-and-gender-based-violence-policy>

Contact Information for Student and Faculty Representation

- Student Union VP Academic 403-220-3911, suvpaca@ucalgary.ca
- Students Union Representatives for the Faculty of Arts – 403-220-3913, arts1@su.ucalgary.ca, arts2@su.ucalgary.ca, arts3@su.ucalgary.ca, arts4@su.ucalgary.ca
- Student Ombuds Office information can be found at: www.ucalgary.ca/ombuds/

Emergency Evacuation/Assembly Points

Assembly points for emergencies have been identified across campus. Assembly points are designed to establish a location for information updates from the emergency responders to the evacuees; from the evacuated population to the emergency responders. For more information, see the University of Calgary's Emergency Management website: <https://www.ucalgary.ca/risk/emergency-management>

Campus Safewalk

Campus Security, in partnership with the Students' Union, provides the Safewalk service, 24 hours a day, to any location on Campus, including the LRT station, parking lots, bus zones, and university residences. Contact Campus Security at 220-5333 or use a help phone, and Safewalkers or a Campus Security officer will accompany you to your campus destination.