

Syllabus

Geography 5110/6110 – Environmental Analysis through Remote Sensing

Spring 2022

Instructor: Tim Edgar, M.S., Associate Professor (Lecturer)

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Office Hours: Monday 9:30 AM – 10:30 AM,
Tuesday & Thursday 10:30 AM – 11:30 AM, or by appointment

Class Times: Mondays & Wednesdays 8:05 AM - 9:25 AM

Class Location: GC 1855

Credit Hours: GEOG 5110/6110 is a three-credit hour course. At the University of Utah, it is assumed that there is at least one hour in class and two hours outside of class per week or the equivalent combination connected to every credit hour.

Prerequisites: For the undergraduate section (5110), completion of Geography 3110.

Graduate Section (GEOG 6110)

Graduate and undergraduate sections of the class are evaluated separately. Students enrolled in the graduate section of the course will be required to answer additional lab questions, take on a more difficult classifier for the classificathon, and complete a more difficult final project.

Course Description

High-resolution multispectral data, coupled with expanding computing power and increasingly sophisticated image processing software, provides a large set of quantitative, graphic and science visualization tools for solving science-based environmental problems using remote sensing data. The theory and application of image-processing techniques such as: data corrections, enhancements, transformations, and classification are aimed at specific environmental problems in the natural and human domains. Hands-on experience is gained through image processing laboratory techniques, field-based measurements and real-world science projects.

Learning Outcomes

After successful completion of this course, students should be able to:

1. Apply methods for image storage, correction, enhancement, manipulation, and classification.
2. Prepare an image for classification and assess the accuracy of the classification results.
3. Choose appropriate methods for the above tasks and apply them within the ENVI software environment.
4. Perform integrated data processing to produce a complete remote sensing analysis.
5. Produce a professional quality research report based on their course project.

Required Text: Jensen, John R. 2015. *Introductory Digital Image Processing (4th ed.)*, Pearson Prentice-Hall. ISBN-13: 978-0134058160. Other readings may be provided on Canvas.

Important dates:

Last day to add, drop, audit, and elect CR/NC

Friday, 21 January

Last day to withdraw from classes

Friday, 4 March

Course Grading and Assessments

Percentage Points:

Labs	55 %
Classificathlon	15 %
Final Project	30 %
Total	100 %

Grade Scale:

A	93-100%
A-	90-93%
B+	87-90%
B	83-87%
B-	80-83%
C+	77-80%
C	73-77%
C-	70-73%
D+	67-70%
D	63-67%
D-	60-63%
E	<60%

Table of Grades

Grades	Points	Explanation
A	(4.0 points)	Excellent performance, superior achievement
A-	(3.7 points)	
B+	(3.3 points)	Good performance, substantial achievement
B	(3.0 points)	
B-	(2.7 points)	
C+	(2.3 points)	Standard performance and achievement
C	(2.0 points)	
C-	(1.7 points)	
D+	(1.3 points)	Substandard performance, marginal achievement
D	(1.0 points)	
D-	(0.7 points)	
E	(0.0 points)	Unsatisfactory performance and achievement

Lab Assignments

The eleven (11) lab assignments contain questions that relate lab activities, lecture, and/or the textbook readings for that week. You encouraged to discuss questions with your peers, but are expected to submit your own work. Labs are due at 8:00 AM one week after they are assigned. Labs submitted late (after 8:00 AM) will lose 10% of their value each day they are late. Labs that have been wholly or partially plagiarized will receive a score of zero. Lab assignments will be submitted to Canvas as a MS Word document.

Classificathlon

This is our opportunity as a class to compare multiple classification methods applied to the same datasets. You will be assigned a classification method to apply to one or more datasets, and then document features such as sensitivity to inputs, accuracy, and runtime. You will present your findings to the class in a 10-minute presentation on **Monday or Wednesday, 18 or 20 April**. Your score for the classificathlon will be based on the thoroughness of your investigation and the content of your presentation.

Final Projects

The final project will use remotely sensed data to analyze some environmental issue. Students will be responsible for defining a research problem or question, gathering and organizing remotely sensed data, performing an analysis, and assessing the results (5110: Individually or group of 2, 6110: Individually). Project proposals are due **Wednesday, 23 February** (Proposal Sections: *Team Member(s)*, *Project Title*, *Objectives/Questions*, *Data Sources*, *Methods*, *Expected Results/End Products*, *Timeline to Completion*, *Backup Plan*, *References*, ..., 1-2 pages). Students will present their final projects as “work in progress” in informal, short presentations on **Monday or Friday, 25 or 29 April**. The presentations will allow students to receive feedback from their classmates. Finally, a written project report will be due on **Wednesday, 4 May**.

Course Schedule and Topics

Week	Date	Topic	Reading
1	Mon 10 Jan	Syllabus & Course Introduction	
	Wed 12 Jan	LAB 01: Python Working Environment	Ch 1
2	Mon 17 Jan	No Class – Martin Luther King Jr. Day Holiday	
	Wed 19 Jan	Data Formats, Data Display	Ch 2 p 37, 108 Ch 5 p 156-164
3	Mon 24 Jan	LAB 02: Data Acquisition and Management	
	Wed 26 Jan	Radiometric Correction	Ch 6 p 187-204, 208-222, 230-232
4	Mon 31 Jan	LAB 03: Radiometric Correction	
	Wed 2 Feb	Image Enhancement, Filtering	Ch 8 p 282-288, 293-302
5	Mon 7 Feb	LAB 04: Image Enhancement	
	Wed 9 Feb	Band Indices and Principal Component Analysis	Ch 8 p 288-291, 308-340
6	Mon 14 Feb	LAB 05: Band Indices and Principal Component Analysis	
	Wed 16 Feb	Unsupervised Classification	Ch 9 p 361-362, 402-412
7	Mon 21 Feb	No Class – Presidents' Day Holiday	
	Wed 23 Feb	LAB 06: Unsupervised Classification Project Proposals Due by 11:59 PM via CANVAS	
8	Mon 28 Feb	Traditional Supervised Classification Methods	Ch 9 p 362-402
	Wed 2 Mar	LAB 07: Supervised Classification	
9	Mon 7 Mar	SPRING BREAK	
	Wed 9 Mar		
10	Mon 14 Mar	Accuracy Assessment	Ch13
	Wed 16 Mar	LAB 08: Accuracy Assessment	
11	Mon 21 Mar	Texture and Spatial Frequency	Ch 4 p 148-151 Ch 8 p 340-350
	Wed 23 Mar	LAB 09: Texture Measures	
12	Mon 28 Mar	Objected Oriented Image Analysis	Ch 9 p 413-421
	Wed 30 Mar	LAB 10: Object-Based Image Analysis	
13	Mon 4 Apr	Change Analysis	Ch 12
	Wed 6 Apr	LAB 11: Change Analysis	
14	Mon 11 Apr	Advanced Classification Methods	Ch 9 p 412-413 Ch 10 p 433-453
	Wed 13 Apr	No class – Prepare for Clasificathlon	
15	Mon 18 Apr	Classificathlon Presentations (6110)	
	Wed 20 Apr	Classificathlon Presentations (5110)	
16	Mon 25 Apr	Informal Final Project Presentations	
	Fri 29 Apr	Informal Final Project Presentations	
17	Wed 4 May	Final Project Report Due by 11:59 PM to Canvas	

*Note that the above schedule is subject to change.

General Computer Guidelines

CSBS Accounts

Students need a CSBS user account to access the CSBS network. To provision a new CSBS user account, complete the CSBS Computing [UNID Provisioning Agreement](#). A CSBS user account enables your U card to access CSBS computing facilities on campus and provides access to the CSBS network.

Network Drives

Students have the responsibility to save and keep track of their own work. Students can save their work on their personal CSBS network drive (N: Drive). These drives are only accessible on the CSBS Computing network.

Data Storage

It is highly recommended that you backup your work on an external storage device such as a dedicated flash drive (16 GB or more) or portable hard drive to store remotely sensed data for the lab assignments and final project. Your N: Drive may not have enough storage space to manage multiple labs between multiple courses. Network drives have minimal available space and have failed in the past, resulting in lost data; **such an occurrence will not be an acceptable excuse for turning work in late. Saving often and backing up is very important!** Keep in mind, when saving to your N: Drive that CSBS Computing has implemented data storage limits of 20 GB for student accounts. When you near your storage limit, you will receive a warning message. If you go over your limit, you may be locked out of the system. This will not be an acceptable excuse for turning work in late, so please be aware of your disk space! Some of you may be enrolled in several lab-based courses. If you find that you are continually running up against storage limits, you can request additional disk space from CSBS Computing. Questions about disk space quotas can be addressed to the CSBS Computing [Helpdesk](#).

Many different students use the CSBS computer labs. Please protect your accounts by making sure you log off every time you finish using the computer, and DO NOT share your CSBS account log-on information. Also, be aware that the CSBS computers will automatically log you out after approximately 15 minutes of idle time – keep this in mind if you decide to take a break.

Additional Information

Scheduling Conflicts: Please speak with the instructor within the first two weeks of class regarding any known conflicts you may have with the course schedule.

Academic Integrity:

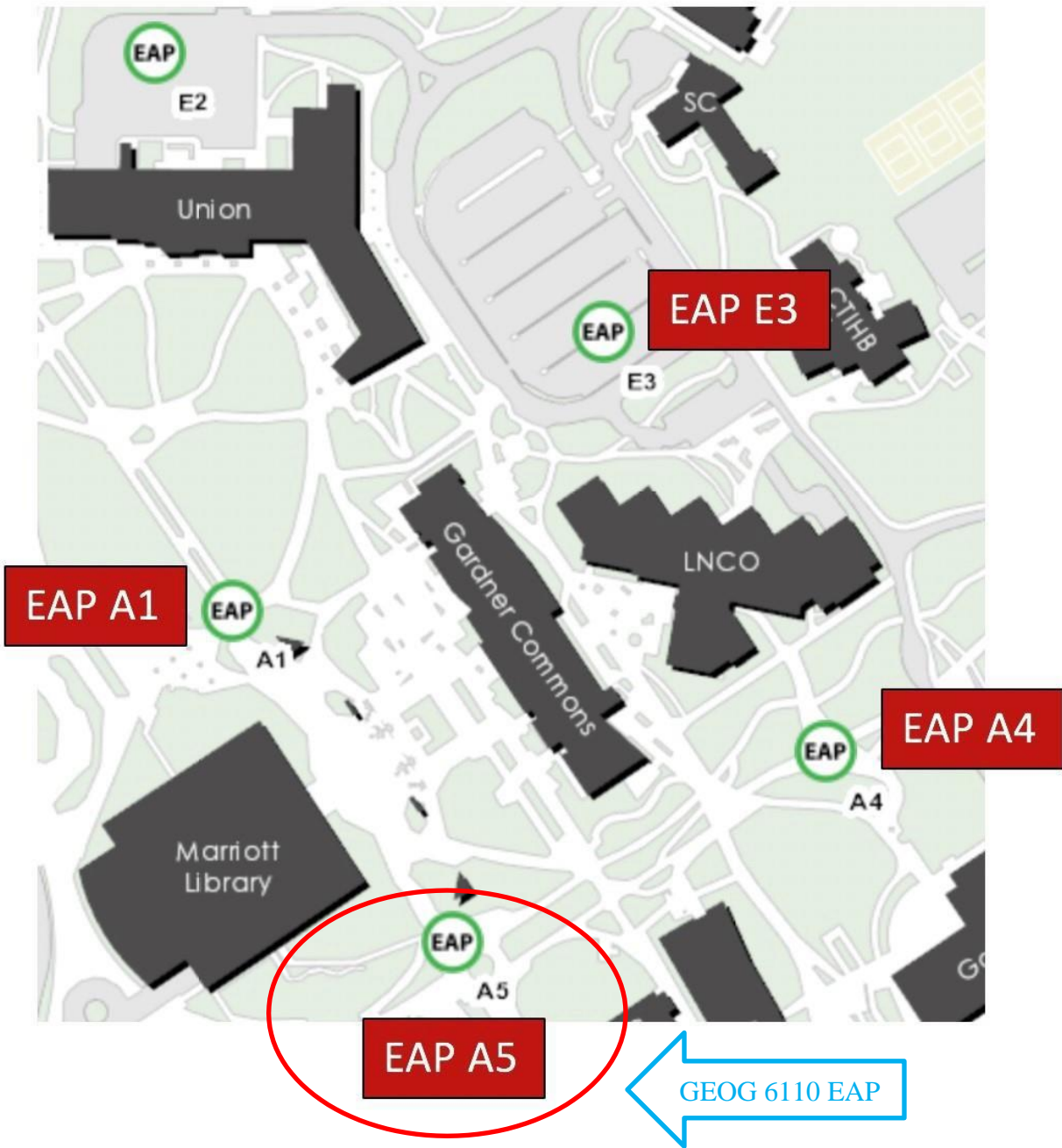
As stated in the [Student Code](#); “Academic misconduct’ includes, but is not limited to, cheating, misrepresenting one’s work, inappropriately collaborating, plagiarism, and fabrication or falsification of information, as defined further below. It also includes facilitating academic misconduct by intentionally helping or attempting to help another to commit an act of academic misconduct.”

- “‘Cheating’ involves the unauthorized possession or use of information, materials, notes, study aids, or other devices in any academic exercise, or the unauthorized communication with another person during such an exercise.”
- “‘Misrepresenting one’s work includes, but is not limited to, representing material prepared by another as one’s own work, or submitting the same work in more than one course without prior permission of both faculty members.”
- “‘Plagiarism’ means the intentional unacknowledged use or incorporation of any other person’s work in, or as a basis for, one’s own work offered for academic consideration or credit or for public presentation. Plagiarism includes, but is not limited to, representing as one’s own, without attribution, any other individual’s words, phrasing, ideas, sequence of ideas, information or any other mode or content of expression.”
- “‘Fabrication’ or ‘falsification’ includes reporting experiments or measurements or statistical analyses never performed; manipulating or altering data or other manifestations of research to achieve a desired result; falsifying or misrepresenting background information, credentials or other academically relevant information; or selective reporting, including the deliberate suppression of conflicting or unwanted data. It does not include honest error or honest differences in interpretations or judgments of data and/or results.”

This course has a zero-tolerance policy for academic misconduct. For any coursework in which it is demonstrated that a student engaged in academic misconduct the resulting academic sanction will be a score of zero for the coursework. Additionally, the student will be required to meet with the academic advisor from the Department of Geography and/or your respective department, and the instance of academic misconduct will be entered into a university database. See the Student Code for additional information on academic sanctions.

Disability Accommodation: The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the [Center for Disability & Access](#) (CDA), 162 Olpin Union Building, 801-581-5020. CDA will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in alternative format with prior notification to the Center for Disability & Access.

Emergency Assembly Point for Lecture and Lab



Safety & Wellness

Your safety is our top priority. In an emergency, dial 911 or seek a nearby emergency phone (throughout campus). Report any crimes or suspicious people to 801-585-COPS; this number will get you to a dispatch officer at the University of Utah [University Safety Department](#) (USD). If at any time, you would like to be escorted by a security officer to or from areas on campus, USD will help — just give a call. For more information regarding safety and to view available training resources, including helpful videos, visit [SAFEU](#).

The University of Utah seeks to provide a safe and healthy experience for students, employees, and others who make use of campus facilities. In support of this goal, the University has established confidential resources and support services to assist students who may have been affected by harassment, abusive relationships, or sexual misconduct. A detailed listing of University Resources for campus safety can be found on the Office of the Registrar's [Campus Safety / Responding to Harassment](#) page.

Your well-being is key to your personal safety. If you are in crisis, call [Community Crisis Intervention & Support Services](#) at 801-587-3000; help is close.

The university has additional excellent resources to promote emotional and physical wellness, including the [Counseling Center](#), the [Wellness Center](#), and the [Women's Resource Center](#). Counselors and advocates in these centers can help guide you to other resources to address a range of issues, including substance abuse and addiction.

COVID-19 Guidelines

University leadership has urged all faculty, students, and staff to **model the vaccination, testing, and masking behaviors** we want to see in our campus community.

These include:

- Vaccination
- Masking indoors
- If unvaccinated, getting weekly asymptomatic coronavirus testing

Vaccination

- **Get a COVID-19 vaccination** if you have not already done so. Vaccination is proving highly effective in preventing severe COVID-19 symptoms, hospitalization and death from coronavirus. Vaccination is the single best way to stop this COVID resurgence in its tracks.
- Many in the campus community already have gotten vaccinated:
 - More than 80% of U. employees
 - Over 70% of U. students
- Visit [MyChart](#), [Campus Alert-Vaccine](#), or [Vaccines.gov](#) to schedule your vaccination.

Masking

- Salt Lake County Health Department presently requires everyone to wear a well-fit mask that completely covers their nose and mouth while inside any indoor space open to the public, including buildings on campus, through February 7th.
 - Check the [CDC website](#) periodically for masking updates
 - Treat masks like seasonal clothing (i.e. during community surges in COVID transmission, masks are strongly encouraged indoors and in close groups outside).

Testing

- If you are not yet vaccinated, get weekly asymptomatic coronavirus tests. This is a helpful way to protect yourself and those around you because asymptomatic individuals can unknowingly spread the coronavirus to others.
 - Asymptomatic testing centers are open and convenient:
 - Online scheduling Saliva test (no nasal swabs)
 - Free to all students returning to campus (required for students in University housing)
 - Results often within 24 hours
 - Visit [Campus Alert-Testing](#)
- **Remember: Students must self-report if they test positive for COVID-19** via [COVID-19 CENTRAL @THEU](#).

Note: The syllabus is not a binding legal contract. It may be modified by the instructor when the student is given reasonable notice of the modification, particularly when the modification is done to rectify an error that would disadvantage the student.