

GEOG 362 Image Analysis - Fall 2022

Instructor

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Lecture time: Monday Wednesday 11:15 AM – 12:05PM
Location: Walker Building 109
Office Hours: Wednesday 9:00 AM -11:00 PM, or by appointment

Teaching assistant

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Office Hours: Wednesday 2 PM – 4 PM, or by appointment
Lab location: Walker Building 123
Lab days/times:

- 001L: Tuesday 8:00AM – 9:55AM. **TA extra hour: 10:40AM – 11:40AM.**
- 002L: Thursday 3:35PM – 5:30PM
- 003L: Friday 10:10AM – 12:05PM. **TA extra hour: 1PM – 2PM.**

Course Description

Geography 362 is a course designed to introduce students to the field of remote sensing. Modern remote sensing is a multi-disciplinary and many-faceted subject encompassing knowledge from a broad array of areas. Remote sensing has steadily grown in importance since the early 1970s and continues to expand as sensing technology improves, as imagery becomes cheaper, as coverage becomes more widespread and as good software for processing the data become readily available. This course is not meant to be an exhaustive treatment of remote sensing. Rather, it is designed to provide an overview of the field. The field of remote sensing is vast and includes several inter-related themes. Remote Sensing as a science primarily involves the extraction of information contained within energy. The engineering component of remote sensing involves the design and construction of instruments and systems capable of capturing and recording energy from a target. Remote Sensing as a vital tool is expressed in myriad applications, from land cover change analysis to weather forecasting.

This course will be administered in two parts -The first part will focus on three broad topics (Fundamental Principles of Radiative Transfer and Energy-Matter, Remote Sensing Systems, and Applications). This part of the course will expect student to grasp the major laws describing the energy-matter interactions. Recitations will be devoted to reviewing homework problems designed to solidify understanding of radiation concepts central to the construction of remote sensing imagery. The remainder of the semester will be devoted to image analysis with an emphasis on digital remote sensing, i.e. analyzing data in digital form using computer software. This aspect of the course will have a practical focus on using imagery to analyze land cover and to construct land cover maps, with the expectation that students will be able to become proficient in the handling and processing of remote sensing imagery. Consequently, laboratory work will play a major role in this component of the course.

Course Prerequisite

Successful completion of GEOG 160 or GEOG 260. Students who do not meet these prerequisites [may be disenrolled according to Administrative Policy C-5](#) if they do not have the proper prerequisite override. Students who add the course after being disenrolled according to this

policy are [in violation of Item 15 on the Student Code of Conduct: https://studentaffairs.psu.edu/support-safety-conduct/student-conduct/code-conduct](https://studentaffairs.psu.edu/support-safety-conduct/student-conduct/code-conduct).

Course Objectives

- 1) Students will learn the theoretical principles of remote sensing and acquire the knowledge and skills of image analysis for various remote sensing applications.
- 2) Students will practice the use of remote sensing tools for different environmental applications, including data collection, image processing and analysis, results validation, and visualization.

Learning Outcomes

By the end of the term, students will be able to:

- 1) Articulate in written, visual, and oral formats the key concepts of remote sensing and the workflow of image analysis.
- 2) Work with different remote sensing products and apply practical knowledge and skills to solve real-world problems.

Textbook

Jensen, J.R. 2015. Introductory Digital Image Processing: A Remote Sensing Perspective, 4th Edition. Pearson Higher Ed USA. 544 pp.

Software

ENVI will be used as the major software for lab assignments. ENVI is available for all students in the computer lab. If you want to install ENVI on your own computer, student licenses are available for \$195. More information can be found at <https://www.harrisgeospatial.com/Industry-Solutions/Academic#students>.

Lab Reference Material

Lab Reference Material ENVI Tutorial: <http://www.harrisgeospatial.com/docs/tutorials.html>

Using ENVI: <http://www.harrisgeospatial.com/docs/routines-136.html>

Grading Components and Policies

The course grade will be determined by the following components:

1) Participation (10%)

There are **10 percentage points** for attendance and participation; I take attendance in every session. You are allowed **two excused absences** and then each absence reduces your possible participation grade by **5 percentage points**.

2) Exams (30%)

Two exams (15% for the first exam, 15% for the second exam) will be held during the semester. No make-up exams will be given unless a student misses an exam for a valid and verified reason (prior consent from me is required). An unexcused absence for an exam will result in a zero score for that exam.

3) Lab assignments (60%)

Eight lab assignments will be handed out through the class. You will be asked to submit lab reports and other necessary files. When you submit your assignments on Canvas, please include your name, course number, and lab number in the file names. You must submit your lab report as a **pdf** file. All the other required files should be combined into a single **zipped** folder. Please keep a copy of all your work.

This course uses the following grading scale:

- A: 93-100%
- A-: 90-92%
- B+: 87-89%
- B: 83-86%
- B-: 80-82%
- C+: 77-79%
- C: 70-76%
- D: 60-69%
- F: less than 60%

Course Schedule and Deliverables (subject to change)

Week	Content	Deliverables
1	Introduction to remote sensing	
2	Group activities	
3	Electromagnetic radiation principles	Lab #1 ENVI Basics. <i>Due Sep 25</i>
4	Orbits	
5	Sensors	
6	Radiometric correction	Lab #2 Radiometric calibration. <i>Due Oct 9</i>
7	Geometric correction	Lab #3 Image Co-registration. <i>Due Oct 16</i>
8	Image enhancement	Lab #4 Image enhancement. <i>Due Oct 23</i>
9	Review and Exam I	
10	Spatial filtering	Lab #5 Spatial filtering and edge enhancement <i>Due Nov 6</i>
11	Image transformation	Lab #6 Image transformation <i>Due Nov 20</i>
12	Image classification	Lab #7 Image classification <i>Due Dec 4</i>
13	Thermal remote sensing I	
14	No class – Thanksgiving holiday	
15	Thermal remote sensing II	Lab #8 Thermal image interpretation <i>Due Dec 11</i>
16	Review and Exam II	

Assignment Due Date Policy

Due dates are announced at the outset of the course in the course calendar and are enforced. **All written deliverables should be turned in on Canvas, to your appropriate section links.** Late assignments will be penalized unless they are accompanied by a doctor's, court-date note, or by other official documentation detailing a serious matter. There will be a penalty for late reports, with a loss of 10% per day the report is late. Reports that are late by more than 5 days will not be accepted (they will receive a zero).

Academic Integrity

Students in this class are expected to write up their problem sets individually, to work the exams on their own, and to write their papers in their own words using proper citations. Class members may work on the problem sets in groups, but then each student must write up the answers separately. Students are not to copy problem or exam answers from another person's paper and present them as

their own; students may not plagiarize text from papers or websites written by others. Students who present other people's work as their own will receive at least a 0 on the assignment and may well receive an F or XF in the course. Please see: Earth and Mineral Sciences Academic Integrity Procedures: <https://www.ems.psu.edu/undergraduate/academic-integrity/academic-integrity-undergraduates>, which this course adopts. To learn more, see Penn State's "[Academic Integrity Training for Students](#)."

Course Copyright

All course materials students receive or to which students have online access are protected by copyright laws. Students may use course materials and make copies for their own use as needed, but unauthorized distribution and/or uploading of materials without the instructor's express permission is strictly prohibited. University Policy AD 40, the University Policy Recording of Classroom Activities and Note Taking Services addresses this issue. Students who engage in the unauthorized distribution of copyrighted materials may be held in violation of the University's Code of Conduct, and/or liable under Federal and State laws.

For example, uploading completed labs, homework, or other assignments to any study site constitutes a violation of this policy.

Accommodations for Students with Disabilities

Penn State welcomes students with disabilities into the University's educational programs. Every Penn State campus has an office for students with disabilities. The Student Disability Resources (SDR) website provides contact information for every Penn State campus: (<http://equity.psu.edu/student-disability-resources/disability-coordinator>). For further information, please visit the Student Disability Resources website (<http://equity.psu.edu/student-disability-resources>).

In order to receive consideration for reasonable accommodations, you must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: <http://equity.psu.edu/student-disability-resources/applying-for-services>. If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with an accommodation letter. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. You must follow this process for every semester that you request accommodations.

Attendance

Regular attendance is critical for building the skills and knowledge developed throughout the class. Students who participate have a more complete understanding of the material presented and are more likely to succeed in the class. The University recognizes that, on exceptional occasions, students may miss a class meeting to participate in a regularly scheduled university-approved curricular or extracurricular activity (such as field trips, debate trips, choir trips, and athletic contests), or due to unavoidable or other legitimate circumstances such as illness, injury, military service, family emergency, religious observance, participation in local, state, and federal government elections, or post-graduate, career-related interviews when there is no opportunity for students to re-schedule these opportunities (such as elections or employment and graduate school final interviews). In all cases, you should inform me in advance, when possible. In all cases, you should inform me in advance, when possible. Missing class, even for a legitimate purpose, may mean there is work that cannot be made up, hurting your grade in this class. Students who encounter serious family, health, or personal situations that result in extended absences should contact the Office of the Assistant Vice President for Student Affairs (AVPSA) and Student Care and Advocacy for help: <http://studentaffairs.psu.edu/studentcare>. You should be prepared to provide documentation for participation in University-approved activities, as well as for career-related interviews. You should submit to the instructor a Class Absence Form: https://undergrad.psu.edu/aappm/class_absence_v3.pdf, at least one week prior to the activity.

Change in Normal Campus Operations

Campus emergencies, including weather delays and closures, are announced on [Penn State News](#) and communicated to cell phones, email, the Penn State Facebook page, and Twitter via PSUAlert ([sign up at: https://psualert.psu.edu/psualert/](https://psualert.psu.edu/psualert/)). [Include course instructions for a campus closure, with information about how you will communicate changes in exam procedures, assignment deadlines, submission procedures, and any other necessary instructions. For reference, plans must adhere to [policy 45-00](#), which states that when a campus closes, faculty may not move a cancelled residential instruction class meeting to a synchronous online meeting. However, faculty may provide asynchronous online instruction to make up for the cancelled class as long as students are given a reasonable time after the closure to complete it. If the closure causes an in-class exam to be rescheduled, the faculty will administer the exam no sooner than the next regularly scheduled class period. If the exam is taking place outside of class, students will be given a reasonable and timely notice to reschedule the exam. In the case of an exam administered through an online learning management system on the day of the closure, faculty will communicate an opportunity to make up the exam to students who are unable to take it that day. The same considerations will be given to previously announced assessments and/or assignments with submission deadlines on the day of a closure.]

Reporting Educational Equity Concerns

Penn State takes great pride to foster a diverse and inclusive environment for students, faculty, and staff. Acts of intolerance, discrimination, or harassment due to age, ancestry, color, disability, gender, gender identity, national origin, race, religious belief, sexual orientation, or veteran status are not tolerated (<https://policy.psu.edu/policies/ad29>) and can be reported through Educational Equity via the [Report Bias webpage](#).

Counseling and Psychological Services

Many students at Penn State face personal challenges or have psychological needs that may interfere with their academic progress, social development, or emotional wellbeing. The university offers a variety of confidential services to help you through difficult times, including individual and group counseling, crisis intervention, consultations, online chats, and mental health screenings. These services are provided by staff who welcome all students and embrace a philosophy respectful of clients' cultural and religious backgrounds, and sensitive to differences in race, ability, gender identity and sexual orientation. Services include the following:

[Counseling and Psychological Services at University Park \(CAPS\)](#): 814-863-0395

Counseling and Psychological Services at [Commonwealth Campuses](#)

Penn State Crisis Line (24 hours/7 days/week): 877-229-6400

Crisis Text Line (24 hours/7 days/week): Text LIONS to 741741

Penn State E-mail Accounts

All official communications from Penn State are sent to students' Penn State e-mail accounts. Be sure to check your Penn State account regularly, or forward your Penn State e-mail (see https://pennstate.service-now.com/sp?id=kb_article_view&sys_kb_id=76e0cebc1bff90d413b599ba234bcbec) to your preferred e-mail account, so you don't miss any important information.

Deferred Grades

If you are prevented from completing this course within the prescribed amount of time for reasons that are beyond your control, it is possible to have the grade deferred with the concurrence of the instructor, following Penn State Deferred Grade Policy 48-40 (<http://senate.psu.edu/policies-and-rules-for-undergraduate-students/47-00-48-00-and-49-00-grades/#48-40>). To seek a deferred grade, you must submit a written request (by e-mail or U.S. post) to the instructor describing the reason(s) for the request. Non-emergency permission for filing a deferred grade must be requested

before the beginning of the final examination period. It is up to the instructor to determine whether or not you will be permitted to receive a deferred grade. If permission is granted, you will work with the instructor to establish a communication plan and a clear schedule for completion. If, for any reason, the course work for the deferred grade is not complete by the assigned time, a grade of "F" will be automatically entered on your transcript.

Military Personnel

Veterans and currently serving military personnel and/or spouses with unique circumstances (e.g., upcoming deployments, drill/duty requirements, disabilities, VA appointments, etc.) are welcome and encouraged to communicate these, in advance if possible, to the instructor in the case that special arrangements need to be made.

Technical Requirements

For this course, we recommend the minimum technical requirements outlined on the Dutton Institute Technical Requirements page (<https://www.e-education.psu.edu/techspecs>), including the requirements listed for same-time, synchronous communications. If you need technical assistance at any point during the course, please contact the ITS Help Desk (<http://its servicedesk.psu.edu>).

Netiquette

The term "Netiquette" refers to the etiquette guidelines for electronic communications, such as e-mail and bulletin board postings. Netiquette covers not only rules to maintain civility in discussions, but also special guidelines unique to the electronic nature of forum messages. Please review some [general Netiquette guidelines](#) that should be followed when communicating in this course.

Disruptive Behavior

Behavior that disrupts normal classroom activities will not be tolerated, in accordance with Items 9 and 14 in the [Student Code of Conduct](#).

Safety

In the case of an emergency, we will follow the College of Earth and Mineral Sciences Critical Incident Plan (https://www.ems.psu.edu/sites/default/files/documents/about/cip_fall_2018-spring_2019.pdf). In the event of an evacuation, we will follow posted evacuation routes and gather at the Designated Meeting Site. Evacuation routes for all EMS buildings are available at <http://www.ems.psu.edu/resources-faculty-and-staff/safety-and-emergency-information>. For more information regarding actions to take during particular emergencies, please see the [Penn State Emergency Action Guides](#).

Mandated Reporting Statement

Penn State's policies require me, as a faculty member, to share information about incidents of sex-based discrimination and harassment (discrimination, harassment, sexual harassment, sexual misconduct, dating violence, domestic violence, stalking, and retaliation) with Penn State's Title IX coordinator or deputy coordinators, regardless of whether the incidents are stated to me in person or shared by students as part of their coursework. For more information regarding the University's policies and procedures for responding to reports of sexual or gender-based harassment or misconduct, please visit Penn State's [Office of Sexual Misconduct Prevention & Response](#) website.

Additionally, I am required to make a report on any reasonable suspicion of child abuse in accordance with the [Pennsylvania Child Protective Services Law](#).

Diversity, Inclusion, and Respect

In EMS, inclusivity is one of our core values. We prioritize fostering a diverse and equitable community in which each member knows that they belong here and is inspired to succeed. We

encourage everyone in our EMS community to be actively engaged with fostering this ideal, and all members of this class should contribute to a respectful, welcoming, and inclusive environment and interact with civility. Our commitment to inclusivity is in alignment with Penn State's values and policies.

To learn more, visit the EMS Educational Equity website <https://www.ems.psu.edu/diversity>. Here, you will find information about the EMS ALLWE initiative, the Rainbow EMS Network, Anti-Racism, active ally-ship, bystander intervention, and much more. The site also has resources for where to turn if you need assistance, as well as links to University references. Also, contact your EMS department's Associate Head for DEI for more information about department initiatives.

Disclaimer Statement

Please note that the specifics of this Course Syllabus can be changed at any time, and you will be responsible for abiding by any such changes. Changes to the syllabus shall also be given to the student in written (paper or electronic) form.