

GEO6938: Cloud-Based Remote Sensing (3 Credit Hours)

Dr. Di Yang

Tuesday 12:50PM-3:50PM

3006 Turlington Hall

Spring 2025

Office Hours

Thursday 10:30 am - 12:00 pm, other times **BY APPOINTMENT ONLY**

Office: 3205 Turlington Hall

Email: yangdi1031@ufl.edu

Note: For best results – utilize office hours. If you are having trouble with the course, come and see me sooner rather than later so that I can help you.

Course Description

This course explores modern approaches to remote sensing analysis using cloud computing platforms, with a primary focus on Google Earth Engine and supplementary coverage of AWS and Microsoft Planetary Computer. Students will learn both theoretical foundations of remote sensing and practical implementations in cloud environments. The course integrates traditional remote sensing concepts from the ITC Handbook with cutting-edge cloud computing technologies, enabling processing and analysis of large-scale Earth observation data. Through a combination of theoretical lectures and hands-on labs, students will develop expertise in cloud-based remote sensing workflows, from basic image processing to advanced machine learning applications. A special emphasis is placed on operational implementation and real-world applications.

Student Learning Objectives

The primary objective of this course is to develop student knowledge and understanding of the principles, techniques, and applications of Cloud-Based Remote Sensing and Earth Observation Analysis. Assigned exercises promote a 'hands-on' approach for understanding, as well as a challenging avenue for exploration and creativity. Specifically, the course objectives are for the student to be able to:

- Describe the fundamental principles of remote sensing and cloud computing integration
- Explain the relationships between different cloud platforms (GEE, AWS) for Earth observation analysis
- Develop expertise in widely used cloud-based remote sensing tools and technologies
- Apply cloud computing techniques to different remote sensing questions and datasets
- Design and lead a presentation on the current state-of-the-art in cloud-based remote sensing and its limitations
- Demonstrate effective oral communication of a real-world example of cloud-based remote sensing application
- Implement practical solutions using Google Earth Engine and other cloud platforms
- Create automated workflows for large-scale satellite data processing

NOTE: This course is co-listed with GEO6938, which is an undergraduate course. While the two will meet together and complete similar assignments and exams, undergraduates and graduates will be evaluated on a different basis. Graduate students are also required to propose and execute a more rigorous independent data analysis project, complete a longer project report, and present their project to the class.

Course Resources

- 1) Required Textbook: Principle of Remote Sensing, free digital book by ITC.

[https://www.researchgate.net/publication/233793398 Principles of remote sensing an introductory textbook](https://www.researchgate.net/publication/233793398_Principles_of_remote_sensing_an_introduutory_textbook)

- 2) Optional Textbook: Cardille, J. A., Crowley, M. A., Saah, D., & Clinton, N. E. (Eds.). (2023). Cloud-based remote sensing with google earth engine: fundamentals and applications. Springer Nature.

Free digital copy: <https://link.springer.com/book/10.1007/978-3-031-26588-4>

Computer/Software Requirements

Students need access to a computer with a reliable internet connection. Required software/accounts include Google Earth Engine (free), AWS (free tier). A modern web browser (Chrome recommended) is required. While programming experience is helpful, all necessary coding skills will be taught during the course. This course will be held in TUR 3006, which is a flipped classroom with both desks and a discussion area and computer terminals. Students do not need to provide their own laptop computer as they will have full access to the geography computer lab for this course. Lab access will also be available outside class times and in evenings and weekends.

Grades and Grading Scale

Labs (8 labs): 40% (8 labs, 5% each)

Class Participation: 15%

Project Proposal: 5%

Project Presentation: 15%

Project Report: 20%

- **Labs and Class Participation:** Learning these techniques is challenging and weekly labs are reserved for in-class work and one-on-one instruction. For this reason, attendance in weekly labs is required. Labs missed without permission from the instructor will result in a zero for that week's lab assignment. Lab assignments are due at the end of the next lab period (one week after initial assignment). Late assignments will have 10 percent deducted from the possible total score for each day they are late (E.g. if you earn 80% on the lab but are one day late you receive a 70%).
- **Project:** Working individually, you will propose and execute an analysis of data using techniques learned in the class. You need to finish a final project using GEE on any topic. Students need to present their projects at the last course. The final project paper for GEO4938 students is a 5-page technical style report. Final project paper for GEO6938 students is a 8~10-page research paper, excluding references. This course is co-listed with GEO4938 which is an undergraduate course. While the two will meet and complete similar assignments and labs, undergraduates and graduates will be evaluated on a different basis. Graduate students are required to propose and execute a more rigorous independent cloud-based remote sensing analysis project, complete a longer project report (10 pages vs 5 pages for undergraduates), and present a more comprehensive technical analysis in their final presentation.

>=91.0% = A	90.0-90.9%= A-	87.0-89.9%= B+	81.0-86.9%= B
80.0-80.9%= B-	77.0-79.9%= C+	71.0-76.9%= C	70.0-70.9%= C-
67.0-69.9% = D+	64.0-66.9%= D	60.0-63.9%= D-	<60.0% = E

A grade threshold must be crossed in order to receive the letter grade indicated (no rounding). It is your responsibility to know your current grade. Grades will be posted to the course website.

Information on current UF grading policies for assigning grade points may be found at <https://catalog.ufl.edu/graduate/regulations/>.

Late Work

Late assignments will have 10 percent deducted from the possible total score for each day they are late (E.g. if you earn an 80% on the work but are one day late you receive a 70%).

Canvas Course Website Information

This syllabus, announcements concerning exams, some lecture content, grades, and other course information will be posted on Canvas course management system. Access this page at <https://elearning.ufl.edu/>. If you miss a class, it is your responsibility to learn the material covered during your absence. Come see me if you have any questions. Students must activate their UF GatorLink account in order to use Canvas. If you need help learning how to perform various tasks related to this course or other courses that utilize Canvas, please consult the above webpage. You may also contact the UF Computing Help Desk at (352) 392- HELP(4357) or helpdesk@ufl.edu

Accommodations for Students with Disabilities

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, www.dso.ufl.edu/drc/) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester. After initial arrangements are made with that office, notify me in writing as soon as possible, and a minimum of one week before an exam.

Academic Honesty

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code." On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor code (<http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor.

Attendance and Proper Conduct

I have no policy of mandatory attendance. You are all adults and can decide to come to class or not. But you are also the only person responsible for attaining the grade you want. When you enter the lecture room you are doing so of your own will, not because you are being forced to. When you make the choice you are also agreeing to show respect to your fellow students by allowing them to hear the lecture materials without having to compete with background chit-chat. Turn off cell phones, put away newspapers, and refrain from casual conversation once class begins. If you have a question – please raise your hand or ask at the end of class.

Recordings and Notes: It is not permitted to sell or distribute notes or recordings from this class without written consent of the instructor. Nor are students permitted to disseminate recordings of the instructor lecturing or post copies of assignments or exams on the internet.

The University of Florida is committed to an ethical, inclusive community defined by respect and civility. The University of Florida prohibits discrimination against any person. The U Matter website (<https://umatter.ufl.edu/refer-or-report/>) provides a list of reporting channels that can be used to

report incidences of illegal discrimination, harassment, sexual assault, sexual violence, retaliation, threat assessment or fraud.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. [Click here for guidance on how to give feedback in a professional and respectful manner.](#) Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via ufl.bluera.com/ufl/. [Summaries of course evaluation results are available to students here.](#)

Your evaluations are used by faculty to improve their courses and teaching methods, and by department chairs and college deans to assess teaching effectiveness. Without your responsible input, we cannot effectively assess and improve teaching performance and student learning. Please be honest, fair, and constructive as you complete your evaluations.

Campus Resources

Health and Wellness

- U Matter, We Care: Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.
- Counseling and Wellness Center: <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.
- Sexual Discrimination, Harassment, Assault, or Violence: If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the Office of Title IX Compliance, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu
- Sexual Assault Recovery Services (SARS)
- Student Health Care Center, 392-1161.
- University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>

Academic Resources

- Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. <https://career.ufl.edu/>
- Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.
- Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. <https://teachingcenter.ufl.edu/>.
- Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. <https://writing.ufl.edu/writing-studio/>.
- Student Complaints Campus: <https://registrar.ufl.edu/complaint.html>.
- On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.

Course Schedule (Subject to Change)

Week	Topics (Tuesday)	Labs (Tuesday)
1 Jan. 14	Introduction to RS & Cloud Computing; EM Radiation Principles & Light-atmos Interaction	Platform Setup & Account Registration
2 Jan. 21	Physics of RS Theory: Path Radiance and Atmosphere Correction Principles	Lab 1-"Hello World" in GEE & JavaScript Basics
3 Jan. 28	Earth Engine Objects and Image Processing Fundamentals	Lab 2-Image Visualization & Band Operations in GEE
4 Feb. 4	Multispectral RS Systems: Landsat & Sentinel	Lab 3-Image Collection, Compositing, Filtering & Reducing
5 Feb. 11	Microsoft PC, Commercial RS & High-Resolution Imagery	Lab 4-Functional Programming & Vector Data in GEE
6 Feb. 18	Image Enhancement Methods, Convolutions & Morphology	Lab 5-Published Dataset Exploration & Image Export
7 Feb. 25	ML Classification Theory & Information Extraction	Lab 6-Cloud-based ML Classification Implementation
8 Mar. 4	Real-time Monitoring Systems & Cloud Data Fusion	Lab 7-GEE App Design & Publishing
9 Mar. 11	AWS Cloud Architecture & Satellite Data Processing	Lab 8-AWS Earth Observation Implementation
10 Mar 18	Spring Break	NO CLASS
11 March 25	AAG	NO CLASS
12 April 1	Guest Lecture: Dr. Qiusheng Wu - Geemap & Advanced Applications	No Lab
13 April 8	Future Trends & Course Wrap-up	Final Project Demonstrations
14 April 15	Final Presentations I	Project Presentations
15 April 22	Final Presentations II &	Project Presentations & Final Project Due
Final Project Due: April 29 th		