GPEC 444: Remote Sensing
University of California San Diego
School of Global Policy and Strategy (GPS)

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[redacted]

Instructor:

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Teaching Assistant (TA):

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Description:

This course introduces students to the principles of remote sensing and the analysis of spatial imagery, including remotely-sensed and satellite data, in the Google Earth Engine (GEE) platform. Students will work in GEE to access, visualize, and analyze large scale geographic data, and learn to interpret basic temporal and spatial patterns in those data. Covered topics include: basic concepts of remote sensing, introduction to the GEE platform and code, basic data acquisition and processing, data visualization, change detection analysis, introduction to image classification, and research and policy applications of remote sensing.

Course Prerequisite:

GPEC 443: GIS & Spatial Data Analysis, or equivalent and permission of instructor. Students should have already gained beginning-level skill in working with at least one GIS program or platform (QGIS, ArcGIS, R and/or Python spatial analysis packages), and be familiar with geospatial data terminology.

Learning Objectives:

After studying all materials and resources presented in the course, students will be familiar with the use of remote sensing in policy-relevant applications. Students will develop the following skills:

1. Understand basic remote sensing concepts and data types
2. Perform basic data visualization and manipulation in the GEE Code Editor (JavaScript API)
    a. Calling, visualizing, and compositing images and image collections
    b. Image interpretation and change detection
    c. Band math, spectral indices, charts and time-series analysis
    d. Working with vector and raster data
    e. Exporting data
    f. Introduction to image classification
3. Gain familiarity with policy-relevant applications of remote sensing

Logistics:

This course is held in-person, and students are expected to attend in-person except in cases of illness or for another approved excuse (see Assessment). The class may be recorded via Zoom, but neither synchronous nor asynchronous virtual attendance is supported. Any changes in class modality will be communicated via Canvas Announcements. This course uses an online learning management system called *Canvas* to manage content and grades. Navigate to https://canvas.ucsd.edu/ to locate course content when the quarter commences.

Readings:

Course readings will include select book chapters, academic journal publications, websites, and/or instructor-provided notes. Copies of and/or links to all required readings will be posted on Canvas. There is no textbook for this class. Optional books include:

- Cardille, Jeffrey A., et al. Cloud-Based Remote Sensing with Google Earth Engine: Fundamentals and Applications. 2022. Available online.
- Campbell, James B., et al. Introduction to Remote Sensing. 6th ed. Guilford Publications, 2022. Available online from the UCSD Library (restricted to UCSD IP addresses).
- Goldstein, Jenny and Eric Nost. The Nature of Data: Infrastructures, Environments, Politics. University of Nebraska Press, 2022. Available online from the UCSD Library (restricted to UCSD IP addresses).

Software

Work in this class relies on the Google Earth Engine (GEE) platform, which operates through a browser and can be used on any computer platform. Students may also choose to use a GIS analysis program or platform of their choice (QGIS, ArcGIS, R, Python) to supplement their learning and coursework, but

use of a separate GIS platform is not required. The UCSD Library's GIS & Geospatial Technologies page offers information on campus-wide GIS offerings and resources, including ArcGIS License information.

The GEE platform used in this course is an interactive JavaScript coding platform. This course introduces and expects students to familiarize themselves with a set of well-documented JavaScript functions usable within the GEE platform. This is NOT a coding course, and prior coding experience is not required. Nevertheless, **working through GEE coding challenges with peers is an expectation of this course.**

When students are faced with GEE coding challenges outside of class, **students are expected to do the following, in the following order**: (1) consult with and collaborate with peers directly – form a study group of 2-5 students; (2) consult with and collaborate with peers indirectly – through Canvas discussions; (3) seek TA and instructor help *during office hours*; (4) directly email instructor and TA – *include/cc instructor and TA on emailed questions*. If the TA and/or instructor receive (4) before (1-3) have been completed, the student(s) will be instructed to complete prior steps first. **Students are responsible for appropriately managing their time so that they can follow these steps and submit assignments on time.**

Instructor and TAs are not expected to assist students with questions regarding the use of software other than the GEE API. For assistance with other software, students should request consultations through the UCSD Data & GIS Lab.

Assessment:

Assignments (take home):	50% of course grade
Final project (take home):	40% of course grade
Participation (Canvas, in class):	10% of course grade

Assignment and final project instructions will be posted to Canvas, and students are expected to submit completed assignments and the final project through Canvas, on time and as instructed.

Participation: The participation grade is based on attendance and engagement in class, engaging with the Canvas discussion section, and demonstrating evidence of having read this syllabus; students are expected to post one or more relevant or interesting resources (remote sensing-related papers, media, news, podcasts, etc.) during the quarter to the class Canvas discussion section. Students are expected to attend class in person except when the class is switched to a remote modality (as needed) or in cases of illness or for another approved excuse. Acceptable excuses include illness, which must be documented by the UCSD Student Health Services or another licensed medical provider, or a death or serious illness in the immediate family. Please notify the instructor in writing of your need to miss class, and email documentation to Nancy Gilson (ngilson@ucsd.edu), *not the instructor*. Students may be excused from

attending class in person and be provided a remote attendance option *prior to receiving documentation* upon the *onset* of illness or emergency; students should email the instructor to request this. Please note, accommodations will not be granted for missed work or class meetings due to overlapping course scheduling (registering for another course that meets at the same time as this one).

Late Policy: For assignments turned in late, there will be a 10% point reduction (from the maximum per-assignment points) per day late, for the first 5 calendar days. For example, for an assignment worth a total of 10 points: an assignment turned in 1 day late would receive a maximum of 9 points; an assignment turned in 2 days late would receive a maximum of 8 points, etc. No assignments will be accepted more than 5 calendar days after the due date/time without an approved and documented excuse. Acceptable excuses include illness, which must be documented by the UCSD Student Health Services or another licensed medical provider, or a death or serious illness in the immediate family. No other excuses aside from those recognized by standing University policy are acceptable. Please notify the instructor in writing of your need for an extension on assignments and/or the final project, and email documentation to Nancy Gilson (ngilson@ucsd.edu), *not the instructor*.

Grade Changes: If you believe there has been an error or oversight in the grading of your work, you may petition the instructor to have your grade changed. To do so you must submit a written memo of no more than 200 words explaining the error and request that your grade be reevaluated. Grade change requests must be received no later than 5 calendar days after the graded assignment has been returned to you.

Extra Credit: Assignments for extra credit may be made available at the instructor's discretion and will be offered to all students in the class. Assignments for extra credit are *not* available upon request (i.e., extra credit cannot be used to make up for late or missed assignments).

Academic Integrity:

Students are expected to submit individual and original work for all assignments and the final project. In submitted work, students must appropriately recognize and cite all sources of data or information used, including any code obtained from a source *other than* the class code repository. Working in groups on assignments, discussing the final project with peers, and using AI as an information source are all allowable, but every student must write up and submit their own work, and appropriately cite and reference collaborators, tutors, and/or automated tools (see "Automated Tools" below).

GPS takes academic honesty seriously and does not tolerate plagiarism or other forms of cheating or dishonesty. Evidence of information-sharing, non-independent work, and/or plagiarism (including of automated tools) on the final project will be referred to the Office of Academic Integrity. More information is available at: https://academicintegrity.ucsd.edu/.

Students agree that by taking this course, all required papers may be submitted for textual similarity and plagiarism review via Turnitin.com. All submitted papers will be included as source documents in the

Turnitin.com reference database solely for the purpose of detecting plagiarism of such papers. Use of the Turnitin.com service is subject to the terms of use agreement posted on Canvas and the Turnitin.com site.

Automated Tools:

Any system (of humans, Generative Artificial Intelligence or GAI, or both) that generates text or code that you could copy and paste as part of an assignment should be treated as a source or collaborator/tutor and *cited or acknowledged as such*.

- Every assignment should have a section (i.e., References and/or Acknowledgements) where you describe and cite automated text/code generation systems and human collaborators or tutors you relied upon.
- If you use GAI, you must share a history link (e.g., for ChatGPT) and/or print the entire conversation to PDF and include that history printout in your assignment submission.
- No GAI will be considered a reliable, authoritative, definitive source for any fact or claim; citing a GAI is like citing an email from a fellow student or friend.
- Automated translation is allowed (with citation), but students are responsible for any mistranslations
- If a GAI writes an essay or code for you, and you just change and rearrange a few words, this is the same as changing and rearranging a few words from a published essay/code or an essay/code that you bought.
- If you ask GAI to produce an outline, some code, to brainstorm, edit, etc., this is like asking a friend or hiring a tutor for help.
- Collaboration – with peers and/or GAI – may be allowed or restricted depending on the assignment, so pay attention to assignment instructions carefully.

The above is a modified version of UCSD Prof. Stuart Geiger's syllabus policy.

Course schedule outline:

This schedule outline provides an approximate timeline for the material covered in the course and is subject to change. Updates to the schedule will be communicated through Canvas.

Week #	Topic	Date	Day	Assign Released	Assign Due (11:59pm PT)	Readings
1	Introduction	1/7/25	Tuesday			Donaldson and Storeygard, 2016; SDSN TReNDS, 2018; Campbell at al., 2022 Ch. 3.5 and 7
1	Principles of remote sensing	1/9/25	Thursday			
2	"	1/14/25	Tuesday			Campbell et al., 2022 Ch. 2; Hansen et al., 2013; Cuaresma et al, 2017; Jain et al., 2020
2	"	1/16/25	Thursday	Assign 1		
3	GEE Code Editor	1/21/25	Tuesday			Gorelick et al., 2017; Cardille et al., 2022 Section F1 (https://www.eefabook.org/); GEE "Beginner's Cookbook" (https://developers.google.com/earth-engine/tutorials/community/beginners-cookbook)
3	"	1/23/25	Thursday			
4	"	1/28/25	Tuesday			Cardille et al., 2022 Section F2.0 (https://www.eefabook.org/)
4	"	1/30/25	Thursday		Assign 1	
5	"	2/4/25	Tuesday			Michalopoulos and Papaioannou, 2018; Ying et al., 2019
5	Clouds, geometries, charts	2/6/25	Thursday		Assign 1 PR	
6	"	2/11/25	Tuesday			Weiss et al., 2020; Allen et al., 2018; Solano-Villarreal et al. 2019; Cooper et al., 2019
6	Feature operations	2/13/25	Thursday	Assign 2		
7	"	2/18/25	Tuesday			McNally et al., 2017; Wired.com, 2025
7	Reducers and exports	2/20/25	Thursday			
8	"	2/25/25	Tuesday			Cardille et al., 2022 Section F4.0-F4.2 (https://www.eefabook.org/)
8	"	2/27/25	Thursday		Assign 2	
9	Reducers and exports review; Image classification 1	3/4/25	Tuesday	Final Project		Cardille et al., 2022 Section F2.1-F2.2 (https://www.eefabook.org/); Towards Data Science 2019; Burke et al., 2021
9	Image classification 2	3/6/25	Thursday			
10	GEE debugging	3/11/25	Tuesday			
10	TBD	3/13/25	Thursday			
11	No class (Finals week)	3/18/25	Tuesday			
11	Final project due	3/20/25	Thursday		Final Project	

Intellectual Property:

Lectures and course materials (including those of any guest lecturers), including slides/presentations, problem sets, exams, and similar materials, are protected by U.S. copyright law and by university policy. Instructors are the exclusive owners of the copyrights of the materials they create. You may take notes and make copies of course materials for your own use. You may also share those materials with another student who is enrolled in or auditing this course. You may not reproduce, distribute or display (post/upload) lecture notes or recordings or course materials in any other way —whether or not a fee is charged — without the appropriate express prior written consent of the instructor. You also may not allow others to do so. If you do so, you may be subject to student conduct proceedings under the UC San Diego Student Code of Conduct. Similarly, you own the copyright to your original writing (your submitted problem sets, reading discussion posts, and exams). If the instructor is interested in posting your submitted assignments to the course web site (e.g., as an example), the instructor will ask for your written permission. See: https://copyright.universityofcalifornia.edu/resources/systemwide-resources.html.

Commitment to Open Discussion and Privacy:

Please note that class sessions may be recorded and posted to Canvas. The instructor is committed to free inquiry and open discussion. However, with everything recorded and made available online, please be aware that your record of in-class participation may be accessible to unintended audiences. If you are concerned about this, please contact the instructor to discuss alternative ways of participation for privacy protections during class.

Accommodations:

If you have a disability for which you are or may be requesting accommodations, please contact the Office for Students with Disabilities (OSD) (https://osd.ucsd.edu/). Students requesting accommodations for this course due to a disability must have a current Authorization for Accommodation (AFA) letter issued by the Office for Students with Disabilities (OSD: http://disabilities.ucsd.edu), which is now located on the 3rd Floor of Pepper Canyon Hall. AFA letters are now provided to Faculty electronically by OSD, per student request. Requests for accommodation must be made at least two weeks in advance of the date upon which the student would like to receive accommodations. Contact Nancy Gilson (ngilson@ucsd.edu), *not the instructor*, for further information.

GPS Writing Tutor:

For general questions, brainstorming, and discussion of your work: Any student may drop by during office hours for general questions or discussion. If you would like to discuss a draft of your written work, you may schedule an appointment during office hours. Please use the Calendly link in Canvas or send an email with your preferred date and time, and a calendar invitation will be sent to confirm our appointment. Please email your draft at least 24 hours before the appointment to ensure a meaningful and constructive discussion.

Immediate feedback: If you seek immediate feedback or are working on a tight deadline, you are welcome to drop-in during office hours. Note that feedback may be less thorough given that less time is available to review your work in advance.

Written feedback on drafts: For detailed feedback on structure, clarity, language, and/or citation protocols, **please email the prompt/guidelines, your draft, and the due date** to Lyric Greif (lgreif@ucsd.edu). Feedback will be provided over email within 48 hours of receiving the draft. Please note that since it may take up to 48 hours to review, it is your responsibility to submit your draft for review in advance of the deadline.

Office hours: The office hours listed below are for appointments or drop-ins. Please note that appointments will be given priority. If you plan to drop-in to office hours, you may have to wait until previously scheduled appointments are completed. Please note that Monday and Thursday office hours

will be in-person. Friday office hours will be held virtually over Zoom. Please either use the Calendly link posted on Canvas to schedule a time to meet or send an email with your preferred time.

Times and Locations:
Monday: 1-5pm, Room 3132
Thursday: 1-5pm, Room 1301
Friday: 4-6pm, over Zoom

Satisfactory Academic Progress (SAP):

SAP refers to the academic standards students must maintain to remain eligible for federal, state, and institutional financial aid. If you are receiving financial aid, please ensure you review the SAP requirements and the appeals process.

Other Resources:

Other resources available to students, in-person and/or remotely, include:

- UCSD Teaching and Learning Commons (https://commons.ucsd.edu/for-students/)
- UCSD Mental Health Services (https://caps.ucsd.edu/)
- UCSD Food Support through CalFresh (benefitscal.com/r/ucsandiegocalfresh) and The Hub Basic Needs Center (basicneeds.ucsd.edu)