Course: GIS Intelligence

Duration: 2 HOURS

This course is developed initiatively by Prof. Saied Pirasteh from the project entitled "AI-Enabled enhancing the geospatial information capabilities of countries to support the Sustainable Development Goals (SDGs)", under the 2026 ISPRS Education and Capacity Building Initiatives Project (ECBI2026).

Official Course Description

Geographical Information System (GIS) Intelligence topics include (e.g., basics of geospatial, GeoAI ethics, data structure and management, GIS machine learning, Google Earth Engine, GeoIME, Geographic Object Based Image Analysis (GEOBIA), Urban, remote sensing, etc.). Students will develop a GIS project with the potential to result in a commercial GIS product/service and formally present their ideas (in class) as if they were presenting to their business manager/supervisor.

Course Objectives

In collaboration with the instructor, students will explore their own remote sensing and GIS-based ideas/applications and Application Programming Interface (API) open source, codes, and open data from UN Open GIS, Geothings, GeoIME, ML Hub-Radiant and GitHub etc., to use it for various images and point clouds processing techniques, for example, labelling, segmentation, feature detection and information extraction applying ML-DL techniques. They will be encouraged to participate in scenarios from which they can identify and develop a GIS and remote sensing research opportunity that may result in the generation of a GIS and remote sensing-based product and/or service with real-world applications. Students will be guided to develop and present their ideas and write a research article to present to their business manager/supervisor and be willing to publish their work in journals or conferences.

Course Learning Outcomes

The Institute of Artificial Intelligence at Shaoxing 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)**
Determine challenges in Geospatial domains, GeoAI, DEM, satellite, drone and data collection, processing and analysing, utilizing ML and DL	2, 8	2, 3
Understand and identify the algorithms, GeoAI, GIS, open source codes and API used in data processing and analysis	3, 4, 5, 6	1, 2, 3
Explore theoretical and practical foundations of GIS, cartography, and remote sensing images, laser scanning	1, 2, 4	1, 2, 3
Explore research topics in GIS, GeoAI, GeoAI ethics, cartography, remote sensing technologies	1, 2, 4, 6	2, 3
Understand advances in the related disciplines and apply strategies for future trends of GeoAI (including remote sensing, UAV photogrammetry for a specific application)	3, 4, 5, 6	2, 3
Explore your research interest and determine specific research	3, 4, 5, 6	2, 3
Explore the impact of AI (ML, DL) in GIS, GeoAI, and remote sensing imageries and point clouds data and process them for shaping the future of the world smart	3, 4, 5, 7, 8	1, 2, 3
Collaboration and participation in joint presentations and publications	1, 2, 5, 7, 8	2, 3
Practice public presentation skills	1, 2, 4, 5, 7, 8	2, 3
Lead seminar presentation on your own topic interest	1, 2, 4, 5, 7, 8	2, 3
Write technical report and article for publication	5, 7, 8	2,3

**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

Students must have basic or intermediate to strong computer, GIS, and image processing or Remote Sensing skills, and they must be able to work with software like ArcGIS, ENVI or QGIS, Pix4D etc.

Course Format

All lectures and student presentations will be in-person, and materials will be given to students by the instructors. (a) The course method applies lectures, presentations, reading materials, questions, assignments, review papers and then asks students to brainstorm, explore issues and express opinions, discussion and reflection and post them on the WeChat or share them in the classroom for review and feedback.

Course outline

Week/Date/posting date	Topic	Assignment/test/Due date
W 1	1. Course overview and introduction 2. Student's introduction	Group sign-up and students' introduction- Online Post: Due date Sept
W 2	1. Overview of AI, GIS, and earth observation	A1- Online Post: Due date
W 3	1. AI Linkage to GIS and what's about today? Applications	Readings & reflection1- Online Post: Due date
W 4	1. WebGIS and ArcGIS online mapping: examples 2. Exploring QGIS and mapping online	No Assignment
W 5	1. Introduction to GeoAI, framework, solutions, and ethics 2. GeoAI empowers UN-GGIM from academia, industry and state members' perspective	No Assignment
W 6	1. Remote sensing image processing techniques: e.g. Support Vector Machine (SVM)	A2- Online Post: Due date
W 7	1. Remote sensing computer vision and GeoAI: satellite images for dynamic maps in agricultural mapping	No lecture/Lab/Office hours
W 8	Reading week	No lecture/Lab/Office hours
W 9	1. Midterm exam: **Test 1** 2. Image processing includes image classification, enhancement, and filtering techniques, change detection from time-series (Google Earth Engine)	Hands-on, Online Post: Due date
W 10	1. Exploring coding in Google Earth Engine for flood mapping	Hands-on, Group presentation by students- Online Post: Due date
W 11	1. GIS Spatial Analysis and Spatial Data Infrastructure 2. Future of the earth observation systems and how it may shape the world better	Group presentation by students- Online Post: Due date
W12	1. Geospatial Information Management Trends from SDGs 2. Interactive SDGs mapping, data explore, API	Hands-on, Group presentation by students- Online Post: Due date

W12	1. Geospatial Infrastructure Management Ecosystem (GeoIME) and automatic generate mapping and reports	Hands-on, Readings & reflection2-Online Post: Due date
W13	1. Exploring SATGPT 2. Agriwatch	Hands-on, Group presentation by students
W14	1. Midterm exam: **Test 2** 2. Python GIS and coding	Hands-on, Group presentation by students-Online post: Due date
W15	1. Python GIS and coding	Hands-on, Group presentation by students
W 16	Course wrap up and **Project**	Online Post: Due date

Note 1*: In week 1 (15 Sept) of the course, students are requested to provide a 2-3 minute introduction of "about me" presenting background, prior knowledge to the course contents, strengths, research interests, and say what does he/she expect to make the course effective? Students will post the introduction to WeChat Group created by the instructor. Option: (a) video, (b) audio, (c) in written, (d) figure, and (e) ppt slides (maximum 2 slides).*

Note 2*: Due to any unpredictable internet or device issues, or any questions related to the course, students may contact the instructor and TA either during office hours or at any time with an appointment.*

Learning Resources

No single textbook is required for this course. However, numerous remote sensing textbooks can be consulted, and put books on reserve at TFDL, or students may wish to purchase from any bookstore. The internet will serve as an invaluable resource for information in this course; published peer-reviewed journal articles will be from the bulk of the sources for topics. The instructor may recommend specific reading materials for every topic and lesson at the end of the class– notifications will be posted online, and additional readings will not require purchase. There are, however, several textbooks that make for good general reference material. It would be advantageous for students to own or gain access to one or more of the following texts:

- Amy E. Frazier and Kunwar K. Singh, 2022: Fundamentals of Capturing and Processing Drone Imagery and Data. ISBN 9780367245726, Published July 27, 2021 by CRC Press, 385 Pages 180.
- UN-GGIM United Nations committee of experts on global geospatial information management, (2020), Future trends in geospatial information management: the five-to-ten-year vision, 3rd Edition. https://ggim.un.org/meetings/GGIM-committee/10th-Session/documents/Future_Trends_Report_THIRD_EDITION_digital_accessible.pdf
- Rafael C. Gonzalez, Richard E. Wood., 2018: Digital Image Processing. 4th Edition. Pearson Education Limited. ISBN 13: 978-1-292-22304-9. Pages 1022.
- Lillesand, T. M, Keifer, R. W., and Chipman, J. W., 2015: Remote Sensing and Image Interpretation. 7th Edition. Wiley, pp 736.
- Northey, M. and D.B. Knight, 2012: Making Sense, A Student's Guide to Research and Writing in Geography and Environmental Sciences, Fifth Edition. Oxford University Press.
- Vosselman, G., and Hans-Gerd Maas, 2010: Airborne and Terrestrial, Laser Scanning. CRC Press LLC, Taylor and Francis Group, pp 342.

Assessment Methods

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

Component 1 – Examinations & assignments:	
Quiz/Test 1	10%
Quiz/Test 2	10%
Attendance/Participation/In-class/outside class assignments (readings' reflection, worksheets, quizzes, etc.)	10%
Component 2 –hands-on assignments:	
Minimum 3 assignments (weights vary with assignment)	10%
Group Oral presentation (to be scheduled during the course)	20%
Component 3 – Term project assignment:	
Comprehensive term project report/article	40%

***Note 1**: To successfully pass this course, students must earn a passing grade for each of Evaluation Components 1, 2, and 3 above (see Grading System above).*
***Note 2**: The instructor will make the assessment of the above components (assessment method) at the earliest time during the course period, and the instructor and TA will post the final assessment of the course within one to two weeks after completion of the course. If a student concerns about the assessments can contact the instructor for accommodation requirements.*

There is no final examination. Tests are scheduled on [Insert date], and it is mandatory that you complete these exams on the scheduled date and time. The midterm tests are a time-limited exam (75 minutes duration; expected completion time is 45 minutes) that must be completed within the class time [Insert time] period (see the schedule table above). The instructor will facilitate, review, and reflect on the presentations to enrich/empower the lesson learning outcomes. There are assignments and readings in-class and outside of the class. The completed assignments and readings' reflection will be posted on WeChat by students and reviewed and commented on by the instructor. Students will submit a final comprehensive term project/article on WeChat for review and assessment. The final assessment of all activities determines the overall grade of this course.

All written assignments and reports, oral presentations, and examinations in this course will be asynchronous and openbook. Students are welcome to consult any resource materials they like during examinations, including course notes, web pages, textbooks or other literature, etc. However, once a student has begun an examination, they may not communicate with another person, nor shall they consult shared notes regarding the substance of the exam until the exam period has closed.

- It is essential to pass all components to pass the course as whole.
- Open books for tests/quizzes etc., are allowed. Using any search engine like Google engine etc., is not allowed.
- Tests/quizzes and all assignments etc., must be completed in one sitting and the given restricted time window (see course outline).
- While we recognize that cameras are a poor substitute for an actual classroom, however, to help create a genuine sense of community, the instructor may request all students keep the camera on where and when possible. If students feel unexpected issues where it is impossible or inappropriate for some of us to have our cameras on, students can consult the instructor. This will be particularly important when attempting the tests/quizzes or, students do group work and class activities.
- During the tests/quizzes, students are not allowed to use another device, for example, a laptop or smartphone, or use the second monitor to switch between screen and answers. Do not share the screen with anyone. Students are prohibited from sharing questions with another person or attempting the tests/quizzes by another person. Presentations and exercises are allowed to attempt individually or in a group collaboration (with your group assigned) when instructed (see course outline section).
- Late assignment policy: Late assignments will be assessed a penalty of 10% per day or a portion thereof past the assigned deadline. If you anticipate that you will not meet a deadline for an assignment, 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. Missed term tests or assignments will automatically receive a grade of zero (0). If a student has missed a required component of the course, 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, Course Assessments and Absences for procedures on missed term tests and assignments).

Exemptions to the Examination and Tests Regulations (if applicable)

If there are exempted to the Examination and Tests regulations which are made on pedagogical grounds (with the approval of the Dean or the Dean's designate) they must be clearly stated here.

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

A+	4.00	Outstanding performance
A	4.00	Excellent performance
A-	3.70	Approaching excellent performance
B+	3.30	Exceeding good performance
B	3.00	Good performance
B-	2.70	Approaching good performance
C+	2.30	Exceeding satisfactory performance
C	2.00	Satisfactory performance
C-	1.70	Approaching satisfactory performance.
D+	1.30	Marginal pass. Insufficient preparation for subsequent courses in the same subject
D	1.00	Minimal Pass. Insufficient preparation for subsequent courses in the same subject.
F	0.00	Failure. Did not meet course requirements.