GEOG652 Syllabus
Digital Image Processing and Analysis

Course Details:
Session: Fall 2024
Format: In-person and remote
Classroom: TWS 0201
Lecture and Lab Times: Mon/Tue 5:30 pm – 8:00 pm

Instructor: Xin Tao (xtao@umd.edu)
Office: LEF 1167
Office hours: By appointment
Teaching assistant: Ruichen Wang (ruichenw@umd.edu)
Office: 4600 River Road
Office hours: By appointment

Course Objectives:
Digital image processing and analysis applied to satellite and aircraft land remote sensing data. We will introduce the principles and applications of remote sensing and contemporary methods of digital image processing. Remote sensing technology is essential for modern spatial analysis in order to identify features and phenomena at the surface of the Earth. This course should benefit students who are interested in pursuing careers in a wide range of disciplines such as engineering, geology, geography, urban studies, forestry, agriculture, archaeology, and homeland security.

The format of this course will consist of lectures, lab assignments, readings, and a final project. The lectures will be presented online via the Live Classroom on the Zoom. All lectures involve the interaction between students and the instructor in real time. Lectures will be archived into videos that will be made available. Please note that video recordings are intended for occasional or backup use in case students have to miss lectures due to personal, business, or medical reasons. Real time, online participation is strongly recommended. The readings and lab assignments will also be posted in a timely manner.

Learning Outcomes
The specific objectives of this course are that students are expected to learn the following:

- Understand the principles of remote sensing and its applications
- Exposed to popular software for data processing
- Can elaborate image processing process
- Can develop remote sensing related project
- Apply digital image processing techniques to real world

Prerequisites
Remote Sensing and Geographic Information Systems or equivalent.

Course Outline:

Remote sensing and image processing…….. 1 week
Image enhancement…….. 1 week
Image geometry and earth registration…….. 1 week
Radiometry and calibration…….. 1 week
Spectral transformation …….. 1 week
Thematic information extraction…….. 1 week
Accuracy assessment…….. 1 week
Change detection…….. 2 weeks
Advanced topics …….. 2 weeks

References

Jensen, J.R. *Introductory Digital Image Processing: A Remote Sensing Perspective*. Prentice Hall, Upper Saddle River, New Jersey ISBN-10: 0131453610.

Mather, P.M. and Magaly Koch. *Computer Processing of Remotely Sensed Images*. John Wiley & Sons Ltd, Chichester, West Sussex, England. ISBN: 978-0-470-74238-9.

Grading:
It is strongly encouraged to attend each lecture and actively participate in the online discussion board as well as in class. Students are required to post a reply on the forums posted by the instructor. Lab assignments will be given weekly to help students gain practical experience in developing websites. Students need to complete final projects to design and process digital image.

There will be 7 labs and 1 final project. The lowest lab score will be dropped and the highest six is worth 66% of the final grade. The final project score will be worth 24% of the final grade. 10% will be based on attendance and participation.

Grade Policy:

- Project, online class activities, and labs:

	% of total grade	Due date
Project	24%	11/12
Online class activities	10%	In class
Labs	66% (11% × highest 6 labs)	9/9 (Lab 1), 9/16 (Lab 2), 9/23 (Lab 3), 9/30 (Lab 4), 10/7 (Lab 5), 10/14 (Lab 6), 10/21 (Lab 7)

Letter Grade Distribution:

The plus/minus grading system will be used to assign student grades. Minor adjustments to this scale might be made based on the performance of the class as a whole.

95-100.0 = A+
90-94.99 = A
85-89.99 = A-
81-84.99 = B+
78-80.99 = B
75-77.99 = B-
70-74.99 = C+
65-69.99 = C
60-64.99 = C-
57-59.99 = D+
54-56.99 = D
50-53.99 = D-
<50 = F

All students must have a UMD email account for communication. All assignments should be submitted through email or on ELMS. Details about the ELMS will be provided in the class.

Academic Honesty: The University of Maryland, College Park, has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student, you are responsible for upholding these standards for this course. You need to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism.

Within our class, students may work together to review class notes and home assignments. However, assignments must be done individually. Each student must turn in his or her own work, from his or her personal computer. Any discussion or problem solution must be his or her alone, without assistance from any other person.

Accessibility Resources: Any student with a disability is encouraged to meet with the instructor privately during the first week of class to discuss accommodations. I will make every effort to accommodate students who are registered with the Disability Support Services (DSS) Office and provide a DSS accommodation form. Please refer to the Online Undergraduate Catalog Policy on Religious Observance.

Email: Both the TA and the instructor will always be available by email. The professor may not always reply to emails after 6pm or on weekends. Normally, an email would be replied within 24 hours. Emails sent over weekend may not be replied until next work day. E-mails should be respectful and professional.

Course schedule
The weekly coverage is subject to change as it depends on the progress of the class. However, you must keep up with the reading assignments.

Week	Date	Topics	Readings	Assignments
1	8/26 8/27	Digital image processing No lab	Ch. 1	
2	9/2 9/3	No class (holiday) Image visualization and enhancement	Ch. 2	Lab 1* out
3	9/9 9/10	Image geometry Earth registration	Ch. 8	Lab 1 due Lab 2** out
4	9/16 9/17	Radiometry Calibration	Ch. 7	Lab 2 due Lab 3*** out
5	9/23 9/24	Spectral transformation Spatial transformation	Ch. 6	Lab 3 due Lab 4**** out Project Proposal out
6	9/30 10/1	Thematic information extraction Classification	Ch. 11	Lab 4 due Lab 5***** out
7	10/7 10/8	Pattern recognition methods Accuracy assessment	Ch. 9	Lab 5 due Lab 6****** out
8	10/14 10/15	Objected based feature extraction Land cover change detection	Ch. 13	Lab 6 due Lab 7******* out
9	10/21 10/22	Advanced topics Case studies	Ch. 10	Lab 7 due Proposal due
10	10/28 10/29	IDL programming IDL programming	W3schools	
11	11/4 11/5	Review Independent study for final project		
12	11/11 11/12	Final project presentation Independent study for final project		Final Project due

*Lab 1: Landsat image visualization
**Lab 2: Geo-registration and resampling
***Lab 3: Radiance and reflectance calibration
****Lab 4: Multispectral image evaluation and spectral vegetation indices
*****Lab 5: Classification
******Lab 6: Error analysis
*******Lab 7: Land cover change