11-216-371 12373 Introduction to Remote Sensing Image Analysis Fall 2022

Class Meets: M - Th 12:10-1:30 PM Lecture: ENR 123 Lab: ENR 237
Instructor: Prof. Rick Lathrop (lathrop@crssa.rutgers.edu) Office Hours: M 9-11:30am
Room 162 ENRS

Objective: the course will introduce students to the principles of image interpretation, taking simple measurements and mapping from remotely sensed imagery with a focus on environmental applications. The course will be a mix of lecture and hands-on labs.

Students will need a laptop or desktop with reasonable Internet bandwidth to access Zoom, Rutgers VPN as well as Google Earth. Students should download a copy of Google Earth. Go to https://www.google.com/earth/versions/ Choose Google Earth Pro on desktop (or whatever appropriate for your computer).

There is a course website through the Rutgers Canvas platform:
https://rutgers.instructure.com/courses/70691

Course Learning Goals:
1) To recognize and understand basic terms and concepts in remote sensing.
2) To understand the basic physics determining how electromagnetic radiation is transmitted, reflected or absorbed and how various earth surface features differentially transmit, reflect or absorb EMR.
3) To understand how spatial/spectral/temporal/radiometric resolution impacts the remote sensing process.
4) To be able to interpret earth surface features (geology, terrain, land cover) from various types of remotely sensed imagery.
5) Be able to digitize and create well designed map products and use Pix4D SfM software to geo-register imagery and generate ortho-mosaics and Digital Surface Models.
6) To be able to write in scientific language appropriate to the field of remote, to evaluate peer-reviewed scientific articles for their scientific merit and summarize conclusions effectively.

Section A. Principles of Remote Sensing

Sept 8 Lecture 1/Quiz: Overview of Remote Sensing
Project 1: Review/critique of Remote Sensing Article start

Sept 12 Lecture 2/Quiz: EMR principles
Homework 1: EMR principles

Sept 15 Lecture 3/Quiz: Basics of Imaging
Homework 2: Imaging Basics

Sept 19 Lecture 4/Quiz: Camera Film/Sensor Systems

Sept 22 Lecture 5/Quiz: Principles of Photogrammetry: scale
Homework 3: Measurements from Imagery
Project 1: Article Review/Critique Due

Sept 26 Lecture 6/Quiz: Principles of Photogrammetry: stereoscopic parallax
No Class - Recorded Lecture

Sept 29 Lecture 7/Quiz: Acquisition of Airborne RS Imagery
No Class - Recorded Lecture
Homework 4: Photogrammetry & Imagery Acquisition

Section B. UAS Image Acquisition, Processing & Analysis

Oct 3 Lecture 8/Quiz: UAS Image Processing

Oct 6 Lab: Project 2 Pix4D Intro
No Class - Recorded Lecture
Reading: Pix4d Startup Instructions
Pix4d Video Academy **Getting Started with your First Project.**

Oct 10 Midterm Exam Review **(On material up through Sept 29)**
Lab Consulting: Pix4D
Project 2: Pix4D DSM/Mosaic

Oct 13 Midterm Exam: In person Room 123.

Section C. Image Interpretation

Oct 17 Lecture 9/Quiz: Principles of Land use/land cover interpretation: Feature Identification and Stereo Imagery
Homework 5: Cook Campus Field ID Tour

Oct 20 Lab: Google Earth Interpretation of LU/LC

Oct 24 Lecture 10/Quiz: Remote Sensing of Vegetation
Homework 6: GE Land Cover and Vegetation tour

Oct 27 Lab: Google Earth of LU/LC/Vegetation: Western Hemisphere Ecotour

Oct 31 Lab: On-screen digitizing using ArcMap
Project 2: Pix4D Project Due.

Project 3: On-screen LU/LC Mapping Project start

Nov 3 Remote Sensing of Cultural Features: lecture/ Google Earth lab

Nov 7 Lecture 11/Quiz: Remote Sensing of Water & Wetlands
Homework 7: Survey of Water & Wetlands

Nov 10 Lecture 12/Quiz: Soils/Hydrology mapping: lecture/lab

Nov 14 Lecture 13/Quiz: Geological Features – Bedrock Landforms Part A

Nov 17 Lecture 13 cont.: Geological Features - Bedrock Landforms Part B

Nov 21 Lecture 14/Quiz: Geological Features – Dynamic Processes Part A
Project 3: LU/LC Mapping project Due

Nov 22 (T as TH) Lecture 14 cont.: Geological Features – Dynamic Processes Part B
Homework 8: Survey of North American Geology

Nov 24 Thanksgiving Holiday

Nov 28 Lab: Geology of New Jersey Google Earth lab
Project 4: Geography Virtual Field Trip Project start

Dec 1 Lab: **Visual Interpretation of New Jersey from Space**
Test your VI skills.

Section D. Introduction to Satellite Remote Sensing

Dec 5 Lecture 15/Quiz: Space-borne Remote Sensing Systems: VIS-NIR

Dec 8 Lecture 16/Quiz: Space-borne Remote Sensing Systems: Thermal IR
Project 4: Geography Virtual Field Trip Project Due

Dec 12 Lecture 17/Quiz: Space-borne Remote Sensing Systems: Microwave

Dec21 noon-3pm Exam II **(Focus on material from Oct 1 through Dec 10) in person**

COURSEWORK EXPECTATIONS:

Lectures will be in-person and held in Room 123 ENRS. Labs will be held in Room 237 ENRS. Check the Syllabus. Lecture slide notes and videos of Labs are posted on Canvas.

Students are expected and encouraged to ask questions concerning the assignments and lecture material. **If you don't ask, I won't know you don't understand.**

Homework assignments have been designed to supplement the lecture material and give the student added reinforcement on some of the details. Homework will be due 1 week after it was assigned in class. Homework will be graded on a 5-10 point scale (depending on assignment). Late homework will be downgraded by 2 points. There will be one mid-term exam and one final exam. These exams will test on the material covered in lecture, lab and the reading. The final exam is cumulative. There will be 4 project assignments: 1) article review/critique; 2) digital land use/land cover map using the GIS/image processing software; 3) SfM image processing using Pix4D software; and 4) a virtual air photo/geography field trip. A separate handout concerning the projects will be distributed later in the semester.

The work to complete the project assignment will be done outside of normal class meeting times. Each student is expected to complete the project independently. You can confer with other students on different approaches, techniques used, etc., but the interpretation and final map product should be your own. Likewise, the article summary and critique should be your own work. You should not directly "cut and paste" from another source. If you do include direct quotes, use standard citation procedures.

GRADING:	Lecture Quizzes	80 points
	Homework(4-8pt/assign)	50 points
	Project I	35 points
	Project II	50 points
	Project III	45 points
	Project IV	40 points
	Midterm Lecture Exam	100 points
	Final Exam	100 points
	Total	500 points