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  

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

Dec 21 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.

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