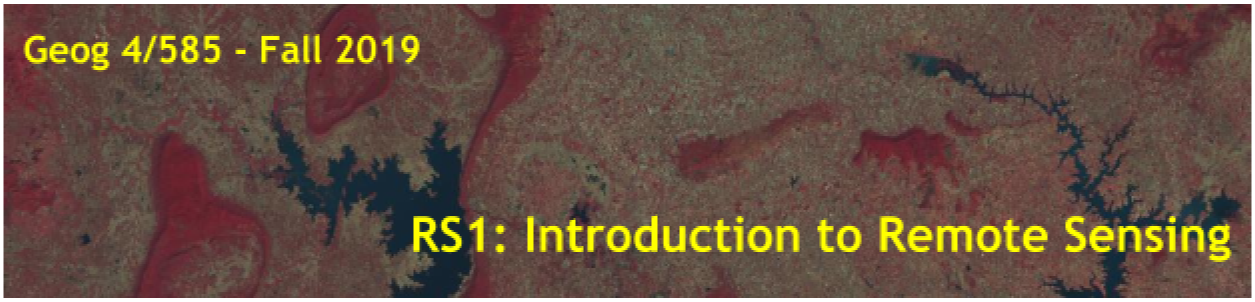

Lecture - 9:00-9:50 Monday and Wednesday in 233 Tykeson
Lab - 11-12:50 Mondays or 14:00-15:50 Tuesdays in McKenzie 442 (SSIL)

Instructor: Dr. Nicholas Kohler (nicholas@uoregon.edu)
Office Hours - Wednesday 10-11am, or by appointment, in *107e Condon Hall*

GTF: Adriana Castillo (adrianau@uoregon.edu) **Office Hours:** TBA

Geog 4/585 is an introduction to remote sensing - the acquisition of data about the world from afar. Often this is in the form of digital imagery acquired by aircraft or satellites, but a variety of other types of remote sensing exist (see below) and are discussed in the class.

The course provides an overview of the physical science principles involved in remote sensing, the instruments and platforms used to collect data, and the analysis/visualization of the acquired information. Topics includes data acquisition and pre-processing, image enhancement, data classification and visualization. While the emphasis of the class is on raster spectral data (such as satellite or drone imagery), other types of remote sensing information - such as lidar, radar, and structure-from-motion (SfM) are also addressed in lectures and lab exercises.

Course Operations

'Active learning' is encouraged in the course in both lecture and lab session. This is intended to encourage the ability to interpret new information (particularly from digital imagery) and to develop spatial reasoning reasoning skills. Using a variety of group and individual exercises, both during and after class, students are encouraged to find and evaluate relevant content and to solve problems in the application of remote sensing concepts.

This requires the students to engage with each other and the course instructors while exploring the course topics through problem solving, group work, and interaction - to *learn how to learn* in the field of the mapping sciences.

Lab sessions focus on understanding how digital data can be translated into effective visualizations of the environment (image enhancement), on techniques for correcting problems with the imagery (image restoration), and on approaches for land cover mapping with remotely sensed imagery (image classification). Learning to navigate through the image processing software and tools used for remote sensing will be an important part of each lab.

Both open-source (primarily QGIS and SNAP Desktop) and commercial (ArcGIS Desktop) spatial analysis software is used in the course, reflecting the variety of tools available to process, analyse, and visualize remote sensing information.

Labs provide practical experience that is typical of what you will encounter on most any remote sensing project. Early labs focus on the basic structure of the software and characteristics of remote sensing data. Later labs introduce image enhancement and visualization techniques, techniques for adding geographical coordinates to images, data transformation approaches to extract specific types of information, and classification approaches for mapping land cover.

You are encouraged to collaborate on labs and help one another out, but do not copy other's' written answers. Lab questions and writeups are due electronically on Canvas, with your lab data stored in your SSIL userspace - if you are working with data stored elsewhere, let your lab instructor know.

Lectures cover the broad range of knowledge needed to understand and interpret remote sensing data including:

- the visual interpretation of remote sensing images;
- the electromagnetic spectrum and interactions between electromagnetic energy and matter (including atmospheric and surface effects);
- the varieties of remote sensing data and the basic concepts behind the devices used to record (and sometimes project) electromagnetic signals, and their respective advantages and disadvantages;
- the components of a digital image processing, including:
    - sources of image distortion, and techniques used for image restoration;
    - techniques for enhancing images to better visualize spectral signals and patterns;
    - the use of digital data for classification, mapping, and monitoring environmental processes and environmental change.
- sources of existing remote sensing imagery.

Workload and Grading

Tests and lecture assignments are 50% of the grade, with two in-class quizzes and a take-home final. This grade also includes presentations, group exercises during lecture time, or individual take home exercises given out in lecture.

Labs make up the remaining 50% of the grade for undergraduates, and 45% of the grade for graduates. Laboratory sessions will be in SSIL, and usually some materials are due by the end of each lab. You are expected to attend all labs sessions - please make arrangements with your lab instructor if you cannot make a session. Labs must be turned by the time they are due for full credit.

Graduate students will produce a small final project with a short writeup or a research paper / annotated bibliography on a remote sensing topic that makes up 5% of their grade, and will give a brief presentation on their project or research to the class sometime during the latter half of the term. The project is of the students' own design, or the paper reviews research articles on a specific remote sensing application topic (ideally related to their graduate work), have at least 5 academic references, and follow standard formatting guidelines.

Course work outside of class includes readings and work on the materials assigned in lab, so you are expected to do work on labs outside of scheduled lab time.

Work load distribution over the term…

Lecture Attendance:	20 hours (20 x 1 hour meetings)
Lecture assignments:	25 hours (average)
Readings:	25 hours (@ 25-60 pages per week, average)
Lab Attendance:	20 hours (10 weeks X 2 hours per week)
Lab work - unsupervised:	30 hours (average)
Total	120 hours (40 required attendance, 80 average remaining)

* Graduate Students additional 40 hours on projects and presentations

Late work policy

- Lecture and lab assignments: 10% off per full day late, 50% after 5 days.
- In-class exams and assignments: make prior arrangements or zero if not taken on time.
- Final Take-Home Exam and Final Lab 30% off per day late

Readings

Principles of Remote Sensing - and materials are linked to in lecture notes and lab materials.

Suggested: *Introduction to Remote Sensing*, 5th Edition. Campbell and Wynne, 2011.

Schedule - Draft Oct.2

readings are expected to be done by the lecture following the day they are listed

Day	Lecture (9-9:50)	Reading	Lab (10-11:50)
Week 1 M, Sep 30	No class		
W, Oct 2	Course and Topic Introduction	Remote Sensing Interactives (warning - runs Flash) - *Spectral curves and sensor band* - *Comparing scale* - *What a sensor sees* - *Image footprint comparison* *Ch. 1 - Introduction to Earth Observation by Remote Sensing* *Ch. 7 - Visual Image Interpretation*	
Week 2 M, Oct 7	Electromagnetic Radiation / Interactions with the Atmosphere and surface	Ch.2 - *Electromagnetic Radiation and Remote Sensing*	1. Remote Sensing Software and Data: Examples from Lane County, Oregon.
W, Oct 9	Radiation Continued /Digital Imagery	Ch.3 - *Spatial Referencing*	
Week 3 M, Oct 14	Mapping Cameras and Electro-optical scanning / Land Observation Satellites	Ch.4 - *Platforms and passive electro-optical sensors.*	2. Image type comparison, interpretation/displ ay issues
W, Oct 16	Quiz 1 Review	*REVIEW NOTES AND READINGS*	
Week 4 M, Oct 21	**Quiz 1 - Remote Sensing Principles and Raster Digital Data**	*Ch. 5 - Visualization and radiometric operations*	3.Filters and Indices
W, Oct 23	Image enhancements, Resolution,	*Ch. 12 - Thermal Remote Sensing* *Ch. 6 - Geometric Operations*	
Week 5 M, Oct 28	Digital Image Processing; Geometric errors and corrections	*Ch. 11 - Image restoration and atmospheric corrections*	4. Image Interpretation and Enhancement
W, Oct 30	Atmospheric corrections Spectral preprocessing	Ch. 8 - *Digital Image Classification*	
Week 6	Image Classification	*Land Cover Classification Methods*	5. Image

M, Nov 4	Introduction		Classification - unsupervised
W, Nov 6	Image classification / preprocessing wrap-up	Land Cover Change Methods https://www.amnh.org/research/center-for-biodiversity-conservation/capacity-development/biodiversity-informatics/remote-sensing-guides/land-cover-change-methods	
Week 7 M, Nov 11	Preprocessing / Change Detection lab intro	*Readings TBA*	6. Image Classification - supervised
W, Nov 13	Indices and spectral transformations	*Readings TBA* PCA, & the Tasseled-Cap Transform	
Week 8 M, Nov 18	Change Detection/ Accuracy Assessment	*Ch. 10 - Active Sensors* Accuracy Assessment TBA	7. Change Detection with spectral indices and classification
W, Nov 20	Active (and Fun!) Remote Sensing	*Reading TBA*	
Week 9 M, Nov 25	Lidar, Microwave, Radar...		8. Active Remote Sensing.
W, Nov 27	**Test 2 In-Class**		
Week 10 M, Dec 2	Remote Sensing in the Cloud, Future Directions	*Reading TBA*	***Finish lab 8***
W, Dec 4	Student Presentations	***Take Home Assignment***	
Week 11 Tuesday, Dec 5	**Final Take-Home Assignments and Lab 8 Due** 10:15 Wednesday, December 11		