Geologic Remote Imaging - Geology 212
Syllabus– Spring 2010

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Geology Room 1001
Email via SacCT web site
Office Hours: Mon & Tue 3:30-4:20AM

Course Schedule (approximate):
Lecture: M-Tu 5:30 – 6:30 PM
Lab: M-Tu 6:50 – 8:20 PM

Course Content and Objectives

Overview

This course is designed as an introduction to the use of remote imaging in geologic applications. The basic concepts of image production, processing, and interpretations are covered. Students with a background in basic geologic concepts will gain a new tool with which to observe and study geology features. Remotely sensed image information is more and more widely available in our "Information Age". As the availability of imagery with ever increasing spatial and spectral resolution, remote image analysis becomes an evermore important and efficient tool for geologic and environmental investigations.

The course is divided into two parts: Aerial Photography and Digital Image Processing. Students in this course will become familiar with classic and modern use of air photos as a reconnaissance and mapping tool. They will also gain an understanding of theory and practical use of digital remote imaging as applied to geologic interpretation of the surface of the Earth. We will also learn the basics of GIS (Geographic Information Systems) as a tool to display and use remote sensing images with other geologic data. Our introduction to GIS will in no way be comprehensive, but will be extremely useful to you.

Expected Learning Outcomes

- -using air photos for mapping geologic features
- -familiarization with spectral imaging and sources of imagery
- -affect of the atmosphere on the electromagnetic spectrum
- -structure and processing techniques of digital imagery
- -application of digital imagery for interpretation of lithology, structure, geomorphology, and geologic activity
- -familiarity with computer programs: ENVI, ArcGIS, Google Earth

Course Format and Requirements

This class is designed as a 4 unit course, including two to three hours of lecture and three hours of laboratory each week. Background information needed for this course is found in the following courses:

Physics 5B or 11B
Geology 110A Structural Geology
Proficiency using a personal computer

Attendance and participation in class discussion and laboratory exercises are required of each student. There will be a midterm and final exam as well as quizzes on lecture materials approximately every other week. Each laboratory will have a required lab write-up. A term project is required of each student.

Evaluation
Your final grade will be calculated from grades compiled in each of these areas. The percentages given are approximate and may change a minor amount if our lecture and lab schedule changes.

Includes:	
Midterm Exam (take home)	10%
Final Exam (lec, lab, reading materials)	10%
Lab Exercises - graded on the write-up	50%
Individual Project - Report	25%
Individual Project – Oral Presentation	5%

Class Email and SacCT(campus login course web site)
The SacCT (WebCT) system will be used for email and distribution of course information. You must have a saclink account to access SacCT.

Required Textbook
Sabins, Floyd, 1997(3rd edition), Remote Sensing - Principles and Interpretation:
Waveland Press Inc., 494p.
10-digit ISBN: 1-57766-507-4
13-digit ISBN: 978-1-57766-507-6
You may also be able to find used copies of the same 3rd edition published by W.H. Freeman and Company

An online NASA text, "Remote Sensing Tutorial" by Nicholas Short, updated through 2009 will be used with this course.
http://rst.gsfc.nasa.gov/

Other Texts of interest, but not required:
Jensen, John R., 2007, Remote Sensing of the Environment - An Earth Resource Perspective: Prentice Hall, 2nd Edition, 592 p.

Price, Maribeth, 2008, Mastering ArcGIS, (3rd edition): McGraw Hill Publishers

Geology 212
Individual Projects

Objective: This individual term project will give the student a chance to use theory and techniques in a geologic interpretation of a selected target area.

Tools:
Satellite Images (mostly ASTER)
ENVI, ArcGIS, Google Earth
Research resources: journals, texts, internet

Write Up:
7-15 page typed (double spaced, not including figures)
Concentrate your write up on YOUR new work, not previous workers' interpretations (although they may or may not overlap)

Include:

- -Abstract
- -Introduction to area and data set characteristics
- -Previous work (synopsis of published geology and previous remote sensing analyses done on the area).
- -Digital Processing (steps, parameters, results of each step). Include a flow-chart of your processing steps.
- -Geologic Interpretations (based on multispectral analysis: rock types, structures, geologic history, etc; concentrate on what YOU interpret from your image processing). Try to derive a "geologic map" from your imagery processing. Make sure it is clear how you derived this.
- -Conclusions.
- -Critique of your study. What are the limitations and advantages of your approach? What was mapped better than previously and what came out worse?

During the last two weeks of class you will present an oral summary of your study to the class. Use PowerPoint to illustrate your study.

How to select a project site:
1) Must be of real interest to you; could be your thesis site.
2) Area must be moderately well exposed (deserts are best).
3) Better to have high contrast in rock type.
4) Background information available (publications or your own research).
5) If you cannot select an area on your own, BH has some ideas.
6) You must select a project by the 3rd week of classes (at least a tentative project)

Proposal paragraph (what, where, how) – Feb 12
Progress report/summary: background research & bibliography (1-2 pages):April 13
Written Report Due: May 14, midnight

Geologic Remote Imaging - Schedule

Wk	Dates	Lecture	Lab	Readings from Sabins (also consult RST*)
1	Jan 25-26	-Introductory Concepts -Aerial Photos 1	-Mon: No Lab -Tue: Air Photos (Intro)	Ch 1 & 2
2	Feb 1-2	-Aerial Photos 2 -Intro GIS & Coordinate Systems & Datums	-Intro. Google Earth -Intro to ArcGIS	Do exercises, p 4-7 of http://serc.carleton.edu/files/NAGTWorkshops/intro/activities/StevensIntroGoogleEarth.pdf
3	Feb 8-9	-Guest Speaker: Tim McCrink: NAIP digital air photos - Satellite Imaging	-CSUS air photo & GIS -Discussion Individual Projects *(due Feb 12)* -Search ASTER data	Read: http://www.fsa.usda.gov/FSA/apfoapp?area=home&subject=prog&topic=nai Ch 3 & 4
4	Feb 15-16	-Image Data Sources -Sources of GIS Data	--Mono Basin air photos: faults & shorelines	
5	Feb 22-23	-GIS Georectification -DEM Sources and uses	--Mono Basin air photos: glaciers	
6	March 1-2	-Digital Image Processing 1&2; lec-lab Intro to ENVI; Spectral curves	--Sierran air photos: landslides (tentative)	Ch 8
7	March 8-9	-Digital Image Processing 3 -Tue: no lecture	-ENVI Hyperspectral techniques -Tue: Midterm Exam (take home)	
8	March15-16	TBA	-Contrast Stretching -ROI and Classification	
9	March22-23	Radar and InSAR???	--Spectral Angle Mapping Classification	Ch 6 & 7
March 29 – April 2 Spring Break				
10	April 5-6	FURLOWS No class	FURLOWS No class	
11	April 12-13	-Thermal Remote Imaging	-ASTER data organization -Thermal Infrared Images *Individ. Progress Report due April 13*	Ch 5

12	April 19-20	-No class April 19. April 20-Guest Speaker: Gerald Bawden: LIDAR	--Work on Individual Projects	
13	April 26	TBA	-Work on Individual Projects	
April 27 – AEG Student Night – Attendance Required				
14	May 3-4	Student Oral Presentations	Student Oral Presentations	
15	May 10-11	Mon: Oral Presentations Tue: Final Exam 5:30-7:30pm	*Term Paper due May 14 by midnight*	

*Remote Sensing Tutorial home page – http://rst.gsfc.nasa.gov/