

Fall 2007



Department of Geology & Geophysics University of Alaska Fairbanks

Geos 422 – Geoscience Applications of Remote Sensing

General information:

Title	: Geoscience Applications of Remote Sensing
Level	: Upper Undergraduate
Credits	: Three (3)
Lectures	: Two one-hour-lectures per week
Lab	: One three-hour lab per week
Meets	: Natural science degree requirements with lab
Prerequisites	: GEOS378, PHYS 104X or 212X, or permission of instructor
Instructor	: Anupma Prakash
Delivered	: Every Fall (Please note that the 2003-2004 printed catalog wrongly lists the course as a spring course).
Evaluation	: Grade letters
Web site	: http://www.gi.alaska.edu/~prakash/teaching/geos378/index.html
Important	: This class is not available for 'Audit'

Salient features of the GEOS 422 course:

The course 'Geoscience Applications of Remote Sensing' is tailored for an upper undergraduate audience and is designed to provide a balanced proportion of theoretical lectures and practical hands-on exercises to the students. The course starts with lectures explaining the physical principles underlying remote sensing. This is followed by an equally long session on the concepts and techniques of digital image processing of remote sensing data. The last part of the course is dedicated to presenting a variety of geoscience and environmental applications where remote sensing data are practically used.

Students from other disciplines, who are interested in studying large areas, changes occurring over time, or in handling of digital data, will also find this course very useful. The lab component of the course is computer intensive. The main software package used for image processing is Erdas IMAGINE version 8.7.

Evaluation is based on class participation, home work, quiz, theory exam and successful completion of an individual class project. Students work on this project in parallel with the regular lectures and labs. The assessment of the project work is based on the final report and presentation made by the student.

DEPARTMENT OF GEOLOGY AND GEOPHYSICS, UAF
GEOS 422: Geoscience applications of Remote Sensing (Instructor: Anupma Prakash)
 Class Schedule : Fall 2007 (Version: August 24, 2007)
(lectures 4.40 - 5.40 pm Reichardt Building 306; labs 3.40 - 6.50 pm Reichardt Building 316)

Date	Day	Lecture/Lab No.	Topic	Comments
Sep-06-07	Thursday		No lab this week	
Sep-10-07	Monday	Lecture 1	Introduction to Remote Sensing	Read chap. 1, pp. 1-23 (for lec 2-4)
Sep-12-07	Wednesday	Lecture 2	The Electromagnetic Spectrum	
Sep-13-07	Thursday	Lab 1	Remote sensing and image resources	web resources view and compilation
Sep-17-07	Monday	Lecture 3	Principles of Remote Sensing -1	Read chap. 6, pp.397-485 (for lec 5 & HW1)
Sep-19-07	Wednesday	Lecture 4	Principles of Remote Sensing -2	Read chap. 4, pp.193-205 (for lec 7)
Sep-20-07	Thursday	Lab 2	Introduction to projects + ERDAS Imagine	Discuss your ideas
Sep-24-07	Monday	Lecture 5	Sensors/platforms	
Sep-26-07	Wednesday	Lecture 6	Aerial Photography	
Sep-27-07	Thursday	Lab 3	EDG search + data mining	data from ASF, GINA, USGS, NASA, etc.
Oct-01-07	Monday	Lecture 7	Elements of Visual Image Interpretation	Lecturer: Bill Witte
Oct-03-07	Wednesday	Lecture 8	Digital Image Processing -1	Read chap 7 (for lec 8-14)
Oct-04-07	Thursday	Lab 4	Data import/export, display, management	time intensive lab! By TA and Bill Witte
Oct-08-07	Monday	Lecture 9	Digital Image Processing -2	HW assignment 2: satellites and sensors
Oct-10-07	Wednesday	Lecture 10	Operations on multiband images	
Oct-11-07	Thursday	Lab 5	Statistics and vector data handling	more practise with software interface
Oct-15-07	Monday		QUIZ	closed book quiz
Oct-17-07	Wednesday	Lecture 11	Image rectification (geometric)	
Oct-18-07	Thursday	Lab 6	Data stretching and arithmetic operations	apply techniques on your own data sets t
Oct-22-07	Monday	Lecture 12	Image rectification (radiometric)	
Oct-24-07	Wednesday	Lecture 13	Image Enhancements	
Oct-25-07	Thursday	Lab 7	Image rectification (radiometric + geometric)	carry out project work in parallel
Oct-29-07	Monday	Lecture 14	Test 2 (take home test)	Prakash at GSA
Oct-31-07	Wednesday	Lecture 15	Image Classification	
Nov-01-07	Thursday	Lab 8	Industry visit: ABR Inc.	
Nov-05-07	Monday	Lecture 16	Image fusion	Read chap 5, pp.347-393 (for lec 18-19)
Nov-07-07	Wednesday	Lecture 17	Radar remote sensing	also go through ASF outreach CD

Nov-08-07	Thursday	Lab 9	Image Classification	
Nov-12-07	Monday	Lecture 18	Thermal remote sensing	HW assignment 3: image interpretation
Nov-14-07	Wednesday	Lecture 19	Hyperspectral remote sensing	
Nov-15-07	Thursday	Lab 10	Model Maker - Temp estimation	Also go through image fusion tutorial
Nov-19-07	Monday	Lecture 20	Application: geologic mapping	
Nov-21-07	Wednesday	Lecture 21	Application: volcanoes	Guest: John Dehn
Nov-22-07	Thursday	Lab 11	Thanksgiving	
Nov-26-07	Monday	Lecture 22	Final Project: Report, Presentation	Past examples
Nov-28-07	Wednesday	Lecture 23	Application: Planetary Science	Guest: Robby Herrick
Nov-29-07	Thursday	Lab 12	Visit to ASF and AVO	Gather near GI Globe Room - 4.40 sharp
Dec-03-07	Monday	Lecture 24	Application: natural hazards	
Dec-05-07	Wednesday	Lecture 25	Application: Landcover and habitat mapping	
Dec-06-07	Thursday	Lab 13	Image fusion + mapmaking + Project work	
Dec-10-07	Monday	Lecture 26	Applications: SAR InSAR and/or Project work	AGU? : Possible supervised project work
Dec-12-07	Wednesday	Lecture 27	Recap + discussions + any other concerns	AGU? : Possible supervised project work
Dec-13-07	Thursday		Make project presentation and backup	
Dec-17-07	Monday		Final Exam	Time and schedule TBA

Basic Principles
Digital Image Processing
Applications
Exam
No Class

Text Book: Remote Sensing and Image Interpretation, fifth edition
by Lillesand, Kiefer and Chipman

HW :Homework; GSA :Geological Society of America; AGU :American Geophysical Union

Grading criteria for GEOS 422 Final Project (40 points)

Criterion: The student was able to	Professional quality	Above average	Satisfactory	Needs much improvement	No evidence
<u>Problem definition</u> : define an appropriate problem/application where remote sensing can be put to use	2	1.5	1	0	0
<u>Data acquisition</u> : identify the data needed to address the problem and acquire relevant/available data (web data portals, personal contacts, library, etc.)	4	3	2	1	0
<u>Method outline</u> : outline an appropriate and feasible data processing and analysis strategy, given the available data	2	1.5	1	0.5	0
<u>Data processing</u> : carry out the processing successfully. If not, the student was able to demonstrate where and why the proposed strategy did not work and adopted an alternate strategy	8	7	5	2	0
<u>Analysis and presentation of results</u> : analyze the results and present the results effectively with the help of processed images (appropriately labelled), tables, graphics, and or explanatory text.	8	7	5	2	0
<u>Discussion</u> : discuss the advantages, limitation, future directions of the work. <u>Specific to presentation</u> : satisfactorily respond to the questions from peers and audience.	2	1.5	1	0.5	0
<u>Specific to presentation</u> : deliver a presentation that was well structured, well timed, conveyed important information and conformed to the guidelines provided.	4	3.5	2.5	1	0
<u>Specific to report</u> : prepare a final report that was professionally put together with respect to content, structure, layout, neatness, spelling, grammar, references, etc. (conformed to guidelines provided)	4	3.5	2.5	1	0
<u>Background reference</u> : demonstrate an effort to consult work of other researchers in defining and implementing the project	2	1.5	1	0.5	0
<u>Overall</u> : demonstrate a rigorous approach and systematic work. Presentation, report and digital backup were submitted in a timely manner	4	3.5	2.5	1	0
	40	33.5	23.5	9.5	0

Grading criteria for lecture and lab participation (20 points)

	Excellent	V. Good	Average	Poor	V. poor
Systematic/timely work on project	5	4	2	1	0
Attendance in lectures and labs	5	4	2	1	0
Revision of what has been taught	3	2.5	2	1	0
Participation in class discussions	3	2.5	2	1	0
Lab exercises	4	3	2	1	0
	20	16	10	5	0

Grading criteria for quiz (15 points)

Closed book
15 questions; 1 point each

Grading criteria for GEOS 422 Test 2 / home work (25 points)

	Excellent	V. Good	Average	Poor	V. poor
Home work 1: image interpretation: (Criterion: student was able to use all elements of visual interpretation to make a meaningful interpretation)	4	3.5	2.5	1	0
Homework 2. satellite and sensors (excel spreadsheet + presentation)	8	7	5	2	0
Homework 3: image interpretation (Criterion: student was able to demonstrate the understanding of spectral signatures and multipectral data interpretation)	4	3.5	2.5	1	0
Test 2: take home test (Criterion: student was able to demonstrate the overall understanding of what has been taught in this course)	9	7	5	2	0
	25	21	15	6	0

Grading Index

85-100 = A

75-84 = B

65-74 = C

50-64 = D

Below 50 = Fail

Tips - Tricks - Do's - Don'ts

Submission check list

- Final report (two printed copies)
- Powerpoint presentation
- A digital back up of your input data, processing results, final report and powerpoint presentation (very important!).

Report

- The cover page of the report should have the exact title of your work, your name, name and title of the course (GEOS 422: Geoscience Applications of Remote Sensing), name of the Department/s with which you are affiliated, names of the staff/faculty associate with your work, month and year of submission. Preferably, insert the appropriate logos the University and Department/s.
- The report should contain a table of contents, list of figures, acknowledgements, abstract, main contents and figures, references cited.
- All maps and remote sensing images presented should have a north arrow, scale and coordinates.
- Below is a suggested break-up of the contents of your report. You may choose to include more sub sections than what are given below. You may also choose to ignore one or the other of these sections if there is a considerable overlap in content. E.g. you may prefer not to make a separate section on advantages/contributions of your study, if you think the same points are already included in the section on conclusions. The sections in the report could include:
 - introduction/problem definition
 - objectives
 - study area
 - data input
 - method (preferably with a flow chart)
 - processing results
 - interpretation and discussion of results
 - advantages of the study/ what the study contributes
 - limitations of the study
 - recommendations/ future directions
 - conclusions
- The pages should be all numbered
- Text font size should be 12
- Do not make excessive use of acronyms and abbreviations. Use an acronym only if it will appear in the text at least three times. In such a case, define the acronym when it appears the first time in the report.
- Avoid using slang and 'casual' language
- All figures should be numbered and should have a caption which is self explanatory. This means that the reader should not feel the need to turn around pages to read and understand what the image intends to depict.

- Your reports and powerpoint presentations must be submitted latest by 10.00 p.m. on Wednesday, December 13, 2006. Your digital back-up needs to be submitted by noon on Thursday, December 14, 2006. The digital back up is VERY IMPORTANT.

Powerpoint presentation and delivering your presentation

- Each student will get 12 minutes for presenting. At the end of 10 minutes they will be prompted. A 12 minute presentation means that you should have about 12 slides ready.
- Rehearse and time your talk a day in advance of your presentation in front of a friend, mock audience, or just a mirror.
- Speak slowly, loudly and clearly, so that even the person sitting at the end of the room can hear you clearly without having to strain his/her ears.
- Make eye contact with your audience. Try looking at everyone present in the room and not just the person sitting in the first row or at one particular spot. **DO NOT READ YOUR SLIDES.** The audience can already read for themselves. They expect you to just elaborate on what is written there and convey your message in simple terms.
- Do not clutter a lot of text in your slides. Your text font size on a slide should ideally be about 32 and definitely not less than 28.
- Use either a light font color on a dark background or vice-versa. Avoid using colors such as red text on a blue background – which certainly makes it difficult to read.
- Avoid using too many fancy text animation effects in your presentation (one or two animation effects, here or there for fun is okay). These special effects tend to take too much time, without adding any value to the content. Effects such as fading in, fading out and letters appearing one at a time should definitely be avoided.
- Be confident about your work and what you are presenting. You probably know more about your study area and the image processing work you have carried out, than many sitting in the audience. Do not forget to smile once in a while – it reflects your own enthusiasm about your work.
- It is a good idea to be prepared to answer some ‘anticipated questions’. After your last concluding slide, you may keep some ‘additional slides’ ready in your presentation, which you could use to clarify some audience questions.
- There will be laser pointer available for you. However, laser pointer tends to shake a lot (more so if you are a bit nervous), giving the impression that you are very nervous. You may just prefer to use a wooden pointer, your mouse pointer, or simply walking up to the screen and pointing out things when there is a need to explain.
- Come to your presentation with a small note book and a pen. Should someone in the audience give constructive suggestion then thank him/her and note these points down in your note book. If you are faced with a question you have no clue of, do not feel shy to acknowledge that you do not know the answer. You must note down such a question, and try to find out an answer later.
- I will bring my laptop. I would like to put all the presentations in one directory on my hard disk, so that we do not waste time in changing laptops or changing CD's.

Digital Backup

- Your digital back up is very important for your own records and also for our records. You will be awarded your final grade after you have submitted your digital back up.
- Structure your data in separate folders before making your back up. Include a small text file clarifying where the files are located and what the files and folders contain. Use file names that are self explanatory and not names such as AB1, temp2, try5, final7 etc. As an example you can arrange your files in these folders:
 - Readme.txt
 - Original data
 - Landsat data
 - DEM data
 - Maps and other data
 - Original data in img/envi format
 - Landsat data
 - DEM data
 - Maps and other data
 - Processing results
 - FCCs
 - Classified images
 - Other results
 - Report
 - Powerpoint presentation
- Should you have a CD burner on your system, you can take blank CD's from me or from Bill Witte for making your digital back-ups. If you have problems in burning the CD yourself, you can put all your data in a structured manner in the geology computer lab, on the Nugget server space allotted to you and request Bill Witte to help you burn this information on CDs.
- Label your CD's with your name, and name of your study area. Keep a copy for yourself and submit one copy to me.