

Digital Image Processing (NR 346)
Spring, 2008

Instructor: Dr. Leslie A. Morrissey

Lecture: [Thursday 3:30-5:30 p.m.](#) Aiken room 222 (Geospatial Technologies Lab)

Remote sensing from aircraft and satellite platforms has revolutionized mapping and monitoring of the Earth's surface. With the recent availability of high resolution satellite imagery combined with advances in digital image processing, remote sensing have proven essential for environmental applications. Detailed digital images recorded in multiple wavelengths provide more and better information than ever before, fundamentally changing our thinking about the planet on which we live, aiding landscape planning, and better utilization of resources and understanding the consequences of our actions. Remote sensing applications span many scales from town planning at the local level all the way up to monitoring global environmental change.

I. Goal: The principal goal of this course is for *each* student to gain an understanding of the principles and concepts of remote sensing, become familiar with the use and application of digital analysis of satellite data, provide a broad exposure to remote sensing applications, become proficient in the use of ERDAS Imagine image processing software.

II. Course Organization: A one hour lecture of remote sensing topics will be followed by a lab each week. Lecture topics will introduce the student to the many related but complex subjects of digital image processing. Laboratory exercises using ERDAS Imagine 8.7 will provide hands-on experience supporting the lecture material. All labs will be conducted by the student without a formally scheduled lab period.

IV. Course Materials: There will be no formal textbook for this course. Most readings will be available on the course web site at: www.uvm.edu/envnr/nr346/. In addition, the ERDAS Tour Guide and Field Guide are available by mapping a drive to [\\zoofiles\gisdata\imagery](#). The following Web site has additional required reading and information on each of the lecture topics: **RSCC** <http://www.cas.sc.edu/geog/Rslab/Rsccl/index.html>

Additional Recommended Reading Resources (on Reserve at Bailey Howe Library)

- Lillesand, T. M. and R. W. Kiefer, 2000, *Remote Sensing and Image Interpretation*, Fourth Edition, John Wiley and Sons, ISBN 0-471-57783-9, 750 pp.
- **Jensen, J. R., 2005. *Introductory Digital Image Processing: A Remote Sensing Perspective*. Second Edition, Prentice-Hall, ISBN 0-13-205840-5, 316 pp.**

V. Grading: Grades will be based on completion of literature review, satellite data search, participation (which reflects preparation), a project of the student's choice (with instructor's consent), and two exams. Short presentations on each student's project will be given at the end of the semester along with a report describing the objective, analyses, and results.

VI. Logistics: This course will be given every other spring (even years) and is limited to graduate students (or with permission of the instructor).

VII. Office Hours: by appointment

Aiken Center, room 325, Phone: 656-2695 email: lmorriss@uvm.edu

Assignments – all assignments are due one week following their listing on the schedule

1. Literature review of the application of remote sensing to an environmental issue. (10 pts)
 - a. Read and review at least five journal articles on a topic of your choice
 - b. Specify purpose of study, **data types** (e.g. satellite), and **processing techniques used**
 - c. 5 pages maximum.
2. Proposal - define a remote sensing project for the semester (15 pts)
 - a. Objective, candidate RS data, **planned technical analyses** you will test (1-2 pages)
 - b. Free Landsat data, ASTER data, and limited SPOT, QuickBird/IKONOS is available, as is VHR DOQ and LIDAR for most of Chittenden County.
 - c. Can include an investigation of particular digital image processing technique or an aspect of your thesis or project research
3. Conduct an online search for satellite data (your choice) (5 pts)
 - a. IKONOS or Quickbird, SPOT, ASTER, and Landsat (or other?)
 - b. Study area of your choice
 - c. Give image info (scene ID, data, etc.)
 - d. 1 page (use table\ to summarize scene information)
4. Short presentation of semester project (30 pts)
 - a. Objective, analyses performed, *lessons learned*, future directions
 - b. 20 minutes each, give copy of ppt to instructor

Note: Each exam is worth 20 pts. (for a total of 40 points)

Potential Project Topics (check out previous projects on course web page)

- Your choice in consultation with instructor
 - Thesis research topic - data may be the limiting factor
- Forest type mapping (fire, harvest, damage)
- Fragmentation of habitat (development)
- Mapping of impervious surfaces – storm water applications
- Land use and land cover mapping
- Lake water quality (turbidity, algal blooms, sediment patterns, currents, temps)
- Vegetative productivity (health and vigor)
- Landscape change (change detection of time series of historic aerial photos)
- Focus on a specific digital image processing technique (e.g. change detection, object oriented classn)

Schedule

Date	Topic	ERDAS Tour Guide Labs	ERDAS Field Guide Readings*	Morrissey Labs
Jan. 17	Terrestrial RS Applications	1-62, 63-78	I 1 – 28, I 106-111	1
Jan. 24	Spectral, Spatial, Radiometric Resolution(s)	3		2
<i>Note: those interested in GIS functions</i>		<i>105-134, 697-718</i>	<i>I 35-47, I 145-179</i>	
Jan. 31	Energy Interactions	7	I 145-178, I 35-47	3
	<i>Topic for project due 2/19</i>			
Feb. 7	Spectral Signatures	13`	II 119-126	
Feb. 14	Current and Future Satellite Systems	8	I 49-72	
	<i>Literature Review due ~2/26</i>			
Feb. 21	Preprocessing and Geometric Correction	183-202, 149-172,	I 219-253	4
	<i>Satellite data search due 3/4</i>			
Feb 28	Image Enhancement & Change Detection	257-286	II 15 - 57	5
March 6	Image Classification (Per Pixel)	135-142, 479-552	II 99-137	6, 7
<i>Spring Break March 10-44</i>				
March 20	Object Oriented and Expert Classifiers	593-630	II 138-148	Trial software tutorial**
March 27	Remote Sensing Data Options/Lessons Learned	Elective***		
April 3	<i>Guest speaker</i>			
April 10	<i>Open lab</i>			
April 17	<i>Open lab</i>			
April 24	<i>Project presentations</i>			
<i>Final Exam Friday, May 2 @ 3:30 p.m.</i>				

* "I" denote Volume I and "II" denotes Volume II for Field Guide

** download trial software (Definiens, Feature Analyst, Fusion, etc.) to your personal PC

*** elective labs – you should check through additional lab materials in Fundamentals of Imagine and Advancing with Imagine (which can be found on the Lab web page)