E419/E519 Remote Sensing of the Environment

School of Public and Environmental Affairs
Indiana University
Bloomington

Spring Semester
2003
REVISED

Lecture
4:00 - 5:15 p.m. Monday
PV 277

Laboratory
4:00 - 6:00 p.m. Wednesday
PV 151

J. C. Randolph
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SPEA 443

Office hours:
Monday 1:30 p.m. - 3:30 p.m.

By appointment only, please contact Ms. Rebecca Snedegar
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SCHEDULE

Date	Day	Topic/Activity	Reading/Assignment Due
13 January	M	Concepts and Foundations of RS	JENSEN, Ch 1
15 January	W	Lab 1: Introduction to Imagine	None
20 January	M	MLK Day	No Classes
22 January	W	Lab 2: Viewer Display and Cursor Operations	**Lab Exercise #1**
27 January	M	Coordinate Systems and Aerial Photography	JENSEN, Ch 1
29 January	W	Lab 3: Aerial Photography	**Lab Exercise #2**
3 February	M	Scanner Systems	JENSEN, Ch. 2
5 February	W	Lab 4: Comparison of Satellite Imagery	**Lab Exercise #3**
10 February	M	Satellite Platforms	JENSEN, Ch. 2
12 February	W	Lab 5: Image Annotation and Map Composition	**Lab Exercise #4**
17 February	M	Preprocessing	JENSEN, Ch. 6
19 February	W	Lab 6: Geometric Corrections	**Lab Exercise #5**
24 February	M	Spatial and Spectral Enhancement	JENSEN, Ch. 6
26 February	W	Lab 7: Spatial and Spectral Enhancement	**Lab Exercise #6**
3 March	M	Unsupervised Classification	JENSEN, Ch. 7
5 March	W	Lab 8: Unsupervised Classification	**Lab Exercise #7**
10 March	M	Supervised Classification	JENSEN, Ch. 7
12 March	W	Lab 9: Supervised Classification	**Lab Exercise #8**

Date	Day	Topic/Activity	Reading/Assignment Due
17 March	M	SPRING BREAK	No Classes

19 March	W	SPRING BREAK	No Classes
24 March	M	Classification Strategies	JENSEN, Ch. 8
26 March	W	Lab 10: Advanced Classification Techniques	**Lab Exercise #8**
31 March	M	Change Detection Analysis	JENSEN, Ch. 9
2 April	W	Lab 11: Change Detection and Spatial Modeler	**Lab Exercise #9**
7 April	M	Subpixel Classification	JENSEN, Ch. 9
9 April	W	Lab 12: Remote Sensing of Vegetation and Subpixel Classification	
14 April	M	Overviews of Remote Sensing Applications	JENSEN, Ch. 10
16 April	W	Start Final Lab Project	**Lab Exercise # 10**
21 April	M	Vector-based GIS and Raster / Vector Integration	JENSEN, Ch.
23 April	W	Optional Lab for Final Project	**Lab Exercise #11**
28 April	M	Future Directions in Remote Sensing Review Session	
30 April	W	Optional Laboratory for Final Project	**Lab Exercise #12**
2 May	F	Submit Final Lab Project	**Lab Exercise #13**

COURSE OBJECTIVES

This course provides an introduction to the use of remotely sensed data in environmental research. Remote sensing is the science of acquiring data using techniques that do not require actual

contact with the object or area being observed. Many different sensors are used to collect such information, the analytic and interpretative techniques vary widely, and new approaches are being developed at an astounding rate. This course will focus on the interpretation and applications of data from satellite imaging systems (primarily Landsat TM, with some images from Ikonos, AVHRR, SPOT, and MODIS).

The number of disciplines that use remotely sensed data continues to increase. Natural scientists such as geologists, geographers, climatologists, and ecologists, as well as social scientists such as anthropologists, economists, and political scientists, have adapted remote sensing techniques to their respective research. This course will briefly discuss many different uses of remotely sensed data, but will focus on applications in natural resources management.

Lecture classes will be used for discussion of fundamental topics and theory. Laboratory sessions are designed to provide hands-on experience in the processing and interpretation of remotely sensed information. The laboratory exercises will use ERDAS Imagine version 8.5 software. There are several image analysis software packages on the market now. ERDAS Imagine is the best performing, most capable image analysis software, but it is also the most complex and difficult.

PREREQUISITES

While introductory coursework in statistics and physics are not requirements, a basic understanding of the electromagnetic spectrum, and simple statistical distributions are necessary to understand many of the principles being presented. A review of these topics will be given during the first few weeks of class. These topics are of critical importance, and anyone who feels they may need additional background reading or other assistance should contact the instructor early in the semester.

All of the satellite imagery laboratory exercises will use the cluster of workstations located in the STS facility at SPEA (PV151). A sound understanding of PC-platform computing, particularly in a GUI environment (WinNT, Win2000, Linux) is required.

TEXTBOOK

There are many excellent remote sensing textbooks available at this time, ranging from basic to complex. This course uses a textbook that is somewhat advanced, but should serve as a good reference for years to come. Due to the advanced nature of some sections of the text, and time constraints, certain sections in some chapters will not be emphasized.

Jensen, J.R. 1996. *Introductory Digital Image Processing: A Remote Sensing Perspective*. Prentice-Hall, New York.

BACKGROUND LITERATURE AND INFORMATION

Other good remote sensing, raster GIS, and aerial photography textbooks include the following:

Jensen, J.R. 2000. *Remote Sensing of the Environment: An earth resource perspective,* 1st edition Prentice Hall, New Jersey.
Campbell, J.B. 1996. *Introduction to Remote Sensing,* 2nd edition. The Guilford Press.
Avery, T.E. and G.L. Berlin. 1992. *Fundamentals of Remote Sensing and Airphoto Interpretation,* 5th edition. Macmillan, New York.
Lillesand, T.M. and R.W. Keifer. 1999. *Remote Sensing and Image Interpretation*. 4th edition. John Wiley and Sons, New York.
Ryerson, R.A. (ed.) *Manual of Remote Sensing*, 3rd edition (CD-ROM). American Society of Photogrammetry and Remote Sensing.
Sample, V.A. (ed.) 1994. *Remote Sensing and GIS in Ecosystem Management*. Island Press, Washington, D.C.
Schowengerdt, R. 1997. *Remote Sensing: Models and Methods for Image Processing*. Academic Press, New York.
Verbyla, D. 1995. *Satellite Remote Sensing of Natural Resources.* CRC-Lewis Publishers, Boca Raton, Florida.

Some vector-based GIS textbooks provide information about the use and interpretation of remotely sensed data.

DeMers, M. N. 1997. *Fundamentals of Geographic Information Systems.* John Wiley and Sons, New York
Environmental Systems Research Institute, Inc. 1995. *Understanding GIS: The ARC/INFO Method*. ESRI, Inc., Redlands, California.
Maguire, D.J., M.R. Goodchild, and D.W. Rhind (eds.) 1991. *Geographic Information Systems. Volume I: Principles; Volume II: Applications*. Longman Scientific and Technical, John Wiley and Sons, New York.
Star, J. and J. Estes. 1990. *Geographic Information Systems*. Prentice Hall, Englewood Cliffs, New Jersey.

Due to the nature of remote sensing technology, there is much information regarding satellite platforms, processing techniques, and data availability on various web sites. Some good starting points for remote sensing information are:

terra.nasa.gov
landsat.gsfc.nasa.gov
modis.gsfc.nasa.gov
edc.usgs.gov
www.spaceimaging.com
www.spot.com
www.gis.leica-geosystems.com
www.asprs.org

ASSIGNMENTS

The Laboratory Exercises are fairly complex and much of each exercise will need to be completed outside of laboratory periods. These exercises are an integral part of the learning procedure in this course and are timed to coincide with the appropriate lectures and reading materials. As such they comprise a significant proportion of your grade.

Twelve exercises are planned which go from basic introductory tasks through intermediate levels to some advanced remote sensing techniques. The grade for one exercise may be dropped.

You will have **one week** to complete most of the laboratory exercises. All laboratory exercises must be handed in at the **beginning** of the next laboratory period. Late lab exercises **will not** be accepted.

Instead of a mid-term exam, each student (or small group of students – not more than three) should select an application of remote sensing and give an in-class presentation.

Instead of a final exam, each student will complete a Final Laboratory project.

No form of academic dishonesty will be tolerated. This course requires individual integrity and professionalism from all involved. Should your integrity be suspect, you will be notified immediately and asked to explain your actions. If academic dishonesty is proven, you will receive a grade of zero for the exam or exercise, and the appropriate administrator will be informed of the misconduct.

EVALUATION

Evaluation will use a point system. Undergraduates enrolled in E419 and graduate students enrolled in E519 will be graded separately.

Activity	Points
Laboratory Exercises (11 @ 109 each)	1200 (60%)
Applications Presentation	300 (15%)
Final Project	500 (25%)
TOTAL	2000

Course letter grades will be assigned using the percentage of points earned divided by 2000 (e.g., 1700 / 2000 = 85 % = B).