University of Maryland Geography Department
GEOG671 Advanced Remote Sensing
Remote Sensing Instruments and Observations
Monday 5:00 – 7:30 p.m.
LeFrak Hall 1171

Instructor:
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Office Hours: Tuesday 2 - 4 p.m. or by appointment

Recommended Text:

Schott, J.R. (1997) Remote Sensing: The Image Chain Approach, 1st ed. Oxford University Press, New York. (ISBN 0-19-508729-7)

Suggested Texts (selected examples):

Asrar, G., ed. (1989) Theory and Applications of Optical Remote Sensing. John Wiley & Sons, New York.

Colwell, R.N., ed. (1983) Manual of Remote Sensing, 2nd edn, pp 2310. America Society of Photogrammetry, Falls Church, Virginia.

Holz, R. K., Ed. (1973). The Surveillent Science: Remote Sensing of the Environment. Boston, Houghton Mifflen Company.

Jensen, J.R. (2004) Introductory Digital Image Processing: A Remote Sensing Perspective, 3rd ed. Prentice Hall, Upper Saddle River, New Jersey.

Kramer, H.J. (2002) Observation of the Earth and Its Environment: Survey of Missions and Sensors, 4th edn. Springer-Verlag.(1510 pp.) (ISBN 3-540-42388-5)

Landgrebe, D.A. (2003) Signal Theory Methods in Multispectral Remote Sensing John Wiley & Sons, Hoboken, N.J.

Lillesand, T.M., Kiefer, R.W., & Chipman, J.W. (2003) Remote Sensing and Image Interpretation, 5th edn. John Wiley & Sons, New York (784 pp.).

Mather, P.M. (2004) Computer Processing of Remotely-Sensed Images: An Introduction, 3rd edn. John Wiley & Sons, West Sussex, England.

Reeves, R.G., ed. (1975) Manual of Remote Sensing, 1st edn, pp 2123. American Society of Photogrammetry, Falls Church, Virginia.

Richards, J. & Jia, X. (2006) Remote Sensing Digital Image Analysis: An Introduction, 4th edn. Springer-Verlag.(439 pp.)

Schowengerdt, R.A. (1997) Remote Sensing: Models and Methods for Image Processing, 2nd edn. Academic Press, San Diego.

Slater, P.N. (1980) Remote Sensing: Optics and Optical Systems Addison Wesley, Reading, Mass.

Ustin, S. ed. (2003) Manual of Remote Sensing, Vol 4: Remote Sensing for Natural Resource Management and Environmental Monitoring, John Wiley & Sons, Inc., Hoboken, New Jersey and American Society of Photogrammetric Engineering and Remote Sensing.

Objective

This course will explore important, advanced topics in remote sensing that are not fully developed in our introductory courses. Specifically, we will examine the relation between remote sensing instrumentation, observations and the earth scientist's goals of acquiring measurements of Earth surface phenomena and conditions. Primary focus will be on solar reflective and terrestrial emissive spectral wavelengths. Factors considered include instrument capabilities and limitations, satellite observatories, data archives, digital data constraints, geo-registration, radiometric calibration. Special emphasis will be placed on technical handling of remotely sensed data and data products. In addition each student will select an application of interest which they will examine within the context of the course and report results to the class.

Approach

The intent is to balance between theory and practice in this advanced concepts course. Each week, the course focus will contain:
a) Literature reviews and discussions
b) Laboratory exercises that explore the concepts discussed.

Weekly Student Reports and Presentations

Each week, following an introductory commentary by the instructor selected individual participants make presentations that address topic under discussion that week. These presenters will also identify readings or simple exercises that other course participants will complete in preparation for discussions.

Presentations should cover:
a) Concepts researched,
b) Reference sources used
c) Supporting materials such as sample imagery and
d) Case study examples that demonstrate use of the subject.

In addition to a short in-class presentation, each group will be required to present a 1 page written summary of their findings to be distributed to the class members. Weekly reports will be assembled using the Wiki function of the Blackboard system (www.elms.umd.edu). The reports must present a coherent narrative describing the major findings from the literature review assignments and include proper citations.

Specific topics and reading assignments will be distributed in the class weekly. Reading assignments will include 3-5 published articles as well as sections of the text book.

Applications Case Study

Individual students will present an evaluation of published case studies. Potential case study topics will be discussed throughout the course and student will be encouraged to select a case study topic early on. The goal is to evaluate the role understanding of observation geography

and radiometry, particularly data pre-processing, play in the outcome the published studies. Hands-on examination and comparison of outcomes using the approach presented by the authors of the published work and another possible approach are strongly encouraged.

Laboratory Work
An important part of this class will be analysis examples using the imagery made available for this class. The software package ENVI will be the primary analytical tool that will be employed. Laboratory assignments will be completed individually and in groups. The outcome of the assignment and a short written summary of the findings should be submitted to the Blackboard weekly.

Evaluation

Grading
Course grading will consider all components of class work: weekly presentations (20%), weekly reports (20%), labs (30%), case study presentation (15%), and case study report (15%).

Applications Report
Each participant will prepare a written report on the application case studies selected for assessment in this course. This paper must be submitted for evaluation no later than December 8, 2008. This report will address the importance of understanding sensor system characteristics in the selected studies, specifically how data calibration (or lack thereof) impacts the reported outcome of these studies. Each report should be based on review of 8 -10 articles published in the refereed research literature. These articles will be cited in the report and presented in a properly formatted (Annuals of the Association of American Geographers) citation list at the end of the report. From this list, 1 article will be selected for in-depth assessment. A narrative discussion of this article, including cross-comparisons, will be presented. The total length of this paper, 12 point font, double-spaced, will be no more that 15 pages, excluding the citation list. Tables and figures that support the discussion are encouraged. This report will contribute approximately 15% of the final grade for the course.

Disabilities
If you have a documented disability and wish to discuss academic accommodations, please contact the Instructor as soon as possible. I will make every effort to accommodate students who are registered with the Disability Support Services (DSS) Office and who provide me with a University of Maryland DSS Accommodation form which has been updated for the Fall 2008 semester. This form must be presented to me no later than October 1, 2008. I am not able to accommodate students who are not registered with DSS or who do not provide me with documentation which has been reviewed by DSS after October 1, 2008."

Honor Code
The University of Maryland has a student-administered Honor Code that applies to all course evaluation activities conducted in this course. Please visit the Web site www.umd.edu/honorpledge for further details.

Class Schedule

Date	Topic	Lab
9/8/2008	Class Overview, Goals and Approaches, Introductions	Lab set-up, Intro to ENVI
Radiometry		
9/15/2008	Radiometric concepts	ENVI exercise: Landsat co-registration
9/22/2008	Instrument design and resolutions	ENVI exercise: Landsat mosaics
Satellite Data Sets and Systems		
9/29/2008	Landsat, Ikonos	Landsat: DN to at sensor reflectance
10/6/2008	MODIS, AVHRR	MODIS: reading quality bits
10/13/2008	ASTER, MISR, International systems	Ikonos: DN to at sensor reflectance
Comparison of measurements, Scale		
10/20/2008	Comparing data sets: ground, satellite	Assessing comparability of ground and RS data
10/27/2008	Geo-registration and Aggregation	Geo-registration and aggregation: Ikonos & Landsat, Landsat & MODIS
Spectral Vegetation Indices		
11/3/2008	Biophysical principles of VIs	Scatter plot comparisons of reflectance vs NDVI measurements from Landsat/Ikonos/MODIS
11/10/2008	Standard Vis: overview	Comparison of selected VI for (DN, Rad, Refl) using Landsat
Case Studies I		
11/17/2008	Case studies proposal review	Case studies development
Thermal IR		
11/24/2008	Principles of Thermal IR	Case studies development
12/1/2008	Thermal IR capabilities for Landsat, MODIS, Aster, AVHRR	Converting Landsat DN to Radiant temperatures
Case Studies II		
12/8/2008	Case studies presentation (part1)	
12/15/2008	Case studies presentation (part2)	