GEOG472 Remote Sensing: Digital Processing and Analysis

Department of Geographical Sciences
University of Maryland
Fall 2014

Lectures: Weds. 2:30 - 4:30pm (1124 LeFrak Hall)
Labs: Session 1: 9:00-11:00 Thursday (1136 LeFrak Hall);
Session 2: 11:00-13:00 Thursday (1136 LeFrak Hall)

Instructor: Prof. Shunlin Liang
2181g LeFrak Hall
301-405-4556
sliang@umd.edu
http://www.glue.umd.edu/~sliang
Office hours: 12:30-2:30pm Weds. & by appointment

Co-Instructor: Dr. Dongdong Wang
ddwang@umd.edu

Lab Instructor: TBD`````

Prerequisites:

- Geography 372, *Introduction to Remote Sensing* or equivalent
- Geography 306 *Introduction to Quantitative Methods for Geography and Environmental Sciences* or equivalent

Required Textbook:

Mather, P.M. & M. Koch, (2010) *Computer Processing of Remotely Sensed Images: An Introduction*, John Wiley & Sons Ltd, 4th Edition, (460 pp.) ISBN: 978-0-470-74239-6

Reference Book:

Liang, S., X. Li, and J. Wang, (2012) *Advanced Remote Sensing: Terrestrial information extraction*, Academic Press, 1st Edition, (800 pp.) ISBN: 9780123859556.

Course Content and student learning outcomes:

The Lecture-laboratory class will build upon principles introduced in GEOG 372, and emphasize the advanced techniques for processing and analyzing remote sensing data. It is a highly technical course but will be taught in a non-quantitative way. Laboratory sessions will give students hands-on experience in the fundamentals of digital image processing and information extraction techniques. It will mainly include four parts:

Part 1: Introduction/Background (Weeks 1– 3)
Part 2: processing techniques (Weeks 4–7)
Part 3: Image classification and land use change detection (Weeks 8-10)
Part 4: Estimating land surface biogeophysical variables (Weeks 11-13)

Upon successful completion of the course:

- Students should be able to demonstrate good skills:
  - manipulating satellite data with different formats
  - geometric correction and image registration
  - image enhancement for visual interpretation

- various techniques for extracting surface information of category and numerical variables

- Students should be able to demonstrate an understanding of the advanced principles of remote sensing, including sensor calibration, atmospheric correction, classification, and inversion algorithms

- Students should be able to solve some technical issues in an application project using actual satellite data

- Students should be able to locate additional learning materials on-line

- Undergraduate students should be able to confidently enroll in a graduate-level remote sensing course with the background and skills necessary to actively engage in learning.

Requirements:

Course evaluation for students at all levels will take into account class and laboratory attendance and participation, execution and submission of the laboratories, examinations, and lecturing.

Exams -There will be a mid-term and final exam. The exams will focus on the concepts and terminology presented in this course, within the lectures, laboratories and textbook. The examinations will consist of both multiple choice and short essay questions.

Labs - Each laboratory assignment will be worth 10 points and will be due at the beginning of the next lab. Lab assignments build successively and therefore will not be accepted if more than one day late.

Group Project –each student will identify a specific project in which you hope to apply remotely sensed data. For this remote sensing application, each student will:

- Join one of the project groups not later than **Oct 1**.
- Within the context of this application, each student will acquire relevant digital remotely sensed data that they will subject to the image processing and analysis presented in this course.
- A ppt presentation of this work from each group will be made to the class **on December 10.**
- **On December 10** each group will submit an al-least 15 page (double-spaced, 12 pt font) report on their findings from this analysis. This paper will include suitable figures and appropriate citations to the research literature that each student has reviewed (>10 refereed journal articles) to support their analysis.

Grading: Class participation (10%), Mid-term (20%) Final (20%), Labs (25%) and final project (25%). The grade of the final project is based on the ppt presentation and the written report, and all members of a group will get the same grade.

Students with Learning Disabilities:

I will make every effort to accommodate students who are registered with the Disability Support Service (DSS) Office and who provide me with a University of Maryland DSS Accommodation form which has been updated for the Fall 2014 semester. Only written DSS documentation of the accommodation will be considered. This form must be presented to me no later than September 30, 2014. I am not able to accommodate students who are not registered with DSS or who provide

me with documentation which has not been reviewed and approved by UM's DSS Office after September 30, 2014

Honor Code

The University has a nationally recognized Honor Code administered by the Student Honor Council (www.umd.edu/honorpledge). **Unless you are specifically advised to the contrary, the Pledge statement should be handwritten and signed on the front cover of all papers, projects, or other academic assignments submitted for evaluation in this course.** Students who fail to write and sign the Pledge will be asked to confer with the instructor.

Medical Excuses

In my class, you (student) or a guardian must email me or call me PRIOR to class to inform me that you will not be in attendance due to illness or injury thus will miss the class participation/homework/exam/paper deadline. On the very next class session that you are in attendance, you must present me with a self-signed note for missing one single lecture/laboratory. This note must include the date of illness and a statement that the information you have provided is true. You must also state that if your absence is found to be false, you understand that you will be referred to the Office of Student Conduct. The statement must be signed and dated. Do understand that only one self-signed note for one absence will be allowed. For non-consecutive absences or a major assignment/exam, I will require a Health Center or medical doctor's health excuse. If you do not inform me or if you do not present me with timely documentation, 0 points will be given to you for exam/lab/paper. Note: In the case that you are unable to get a written medical excuse, you may ask your provider for a copy of your medical notes for the specific visit(s) in question.

Religious observance

By September 11, 2014, students must provide me, in writing, a request for a makeup exam for an exam date on this syllabus that you are unable to make due to a specific religious observance (specify) on a specific date. Please refer to the Online Catalog Policy on Religious Observance. Please remember that accommodations are NOT made for travel to and from the religious observance.

Course Evaluation

I take your course evaluation very seriously. I revise my syllabus, course assignments and exam questions based on the feedback I receive on the course evaluation. I am not only interested in the scores that you give this class but I am also very interested in the specific comments you have about this course. I want to encourage each student in this class to evaluate not only my class but all of your classes. One important campus-wide evaluation is the online evaluation at the end of the semester. Students can go directly to the website (www.courseevalum.umd.edu) to complete their evaluations.

Date	Topic
1(Sept. 3)	Introduction: A Systematic View of Remote Sensing (Ch1-Mather, Ch1-Liang) Lab1: *Introduction to ENVI*
2(Sept. 10)	Earth Observation Missions and Instrumentation (Ch2-Mather, Section1.2-Liang) Lab2: *Methods for managing data using the software ENVI*
3(Sept. 17)	Understanding Surface Signatures (Section 1.3.2-Mather, Section1.6-Liang) Lab3: *Analyzing and understanding spectral data*

4(Sept. 24)	Radiometric Calibration and Preprocessing (Section 4.6 & Ch5 – Mather, Ch3-Liang) Lab4: *radiometric calibration* & *Image enhancement*
5(Oct 1)	Geometric Correction (Section 4.3-Mather; Ch2-Liang) Lab5: *Geometric correction*
6(Oct. 8)	Image registration & temporal processing (Section 4.3.4-Mather, S2.4 & Ch4-Liang) Lab6: *image registration*
7(Oct. 15)	Feature Extraction Techniques (Ch6-Mather) Lab7: *Principal component analysis and vegetation index*
Oct. 22	**Mid-term Exam**
8(Oct. 29)	Image Classification Techniques (Ch8-Mather) Lab8: *Clustering analysis*
9(Nov. 5)	Land Use/Cover Mapping (Ch24-Liang, supporting materials) Lab9: *Supervised classification*
10(Nov. 12)	Change Detection (Ch24-Liang, supporting materials) Lab10: *Change detection*
11(Nov. 19)	Atmospheric Effects in Optical Imagery and Correction (Section4.4-Mather; Ch5-Liang) Lab11: *Atmospheric correction*
12(Nov. 26)	Estimation of Surface Biophysical Variables (Ch11-Ch16-Liang) No Lab: Thanksgiving holiday
13(Dec. 3)	Estimation of Surface Geophysical Variables (Ch6-Ch9-Liang) Lab12: *Estimation of LAI*
14(Dec. 10)	Project presentations Lab13: *Estimation of surface albedo*
Dec. ??,	**Final Exam**