University of Maryland at College Park Department of Geographical Sciences

GEOG 372 – Fall 2017

Introduction to Remote Sensing

(3 Credits)

Lectures	Tuesday and Thursday 9:30am - 10:45am Room: LeFrak Hall 1158 Lecture schedule will be provided at the beginning of the class
Laboratory classes	Section 0101: Friday 9:00am - 11:00am Section 0102: Friday 11:00am - 1:00pm Room: LeFrak Hall 1136 Assigned times cannot be changed owing to limited space in the lab. The lab may also be used during open hours as needed. Check the lab policy here: http://geog.umd.edu/content/lab-conduct-policy
First class	Monday, August 29
Last class	Monday, December 7
Instructor	Dr. Peter Potapov potapov@umd.edu Office Hours: Room 1138 LeFrak Hall, Wed 11:00am-1:00pm, strictly by appointment
Teaching Assistant	Alison Thieme thieme@terpmail.umd.edu Matthew Cooper mattcoop@terpmail.umd.edu Lab hours only, otherwise strictly by appointment

General information about the course

This course is intended to provide an introduction to remote sensing of the environment, emphasizing the techniques that are used to monitor the Earth's land surfaces. It will include the interaction of electromagnetic radiation with the land surface and atmosphere and EMR measurement by passive optical and thermal instruments with brief outlines of LiDAR and RADAR. Particular attention will be given to satellite-borne sensors and digital image processing. The main theme will be how quantitative information from remotely sensed data of spatial and environmental relationships are acquired, processed and used. All topics will be related to examples of remote sensing applications. The lab sessions will provide hands-on analysis of remotely sensed digital data using professional image processing software.

This course is intended either as an overview for a general academic program or as preparation for further remote sensing technology courses. It is a gateway for majors in Geography and to 400 level classes in Geography. This course does not have any pre-requisites, but GEOG 201 and 306 are highly recommended.

Learning outcomes for the course

Upon a successful completion of the course, the students will be able to:

- Understand the general principles of electromagnetic energy interaction with the Earth's surface and atmosphere which enable and limit successful applications of remote sensing methods.
- Understand the basis of operations for active and passive air- and satellite-born instruments within the optical, thermal, and microwave range of the electromagnetic spectrum.
- Describe the major properties of remotely sensed imagery including resolution(s), instruments and platform-dependent distortions and data limitations.
- Perform qualitative and quantitative analysis of remotely sensed data, extract spectral information, and perform image classification using standard and emerging techniques.
- Acquire publicly available satellite imagery and competently handle simple image processing routines using commercial (PCI Geomatica) and open source (Quantum GIS) image analysis software.

Course materials

The main course communication will be carried out through the Canvas within the University of Maryland Enterprise Learning Management System (ELMS; https://elms.umd.edu). All students enrolled in the course have access to the system. In addition to communications, Canvas will be used by the instructor and the TAs to post assignments and grades and by the students to submit their reports.

The ELMS course site is at https://myelms.umd.edu/courses/1229461 where all announcements, lectures, reading materials, and grades will be posted. A series of on-line sources, free-of-charge electronic textbooks, and peer-reviewed articles will be provided to the students as required or supplementary readings.

Required textbook:

Emilio Chuvieco. Fundamentals of Satellite Remote Sensing: An Environmental Approach. CRC Press, Second Edition. ISBN 9781498728058 *(The e-book may be ordered or rented at www.crcpress.com)*

Recommended additional textbooks:

Campbell, J.B. and Wynne, R. H. 2011. Introduction to Remote Sensing. Guildford Press, New York. 5th Edition. ISBN 978-1-60918-176-5

Jensen J.R. 2006. Remote Sensing of the Environment: An Earth Resource Perspective. ISBN-13: 978-0131889507, ISBN-10: 0131889508

Lillesand T., Kiefer R.W., Chipman J. Remote Sensing and Image Interpretation. Wiley, 6th Edition. ISBN-10: 0470052457; ISBN-13: 978-0470052457

Jones H.G., Vaughan R.A. Remote Sensing of Vegetation: Principles, Techniques, and Applications. Oxford University Press. ISBN-10: 0199207798; ISBN-13: 978-0199207794

Weng Q. An Introduction to Contemporary Remote Sensing. McGraw-Hill Education. ISBN-10: 0071740112; ISBN-13: 978-0071740111

Course organization

Lectures

The purposes of the lectures are to provide a topic framework and to present particularly difficult concepts. Lectures will contain information complementary to the textbook, however, will not completely cover all required information. Topic exams will be based on information from the lectures and from the textbook. Attendance to lectures is very strongly encouraged.

Laboratory classes

The lab classes are an essential part of this course, so attendance at all lab classes is mandatory. Absences excused according to the Senate policy statement given in Official Notices (below). During the lab exercises the students will work individually to produce a lab report which will be graded by the TA. Each completed lab report is worth 9 points max, from which one point is given for attendance. Some Labs will include tasks for "extra" points. These tasks are optional, and the points earned will be added to the total score. All deliverables as described in each lab assignment should be submitted to Canvas/ELMS. Reports must be submitted within a week after the lab. Delayed reports will be downgraded by 50%. Reports will not be graded if submitted three weeks or more after the lab class.

Seminars

Seminars one and two will be in the form of problem solving tasks performed in research groups. Seminars 3 and 4 will be in the form of group assignment. Each group will have to collect information and prepare a presentation for a topic, and seminar time will be used for presentation and answering questions. Instructions and reading materials required for a seminar will be provided upfront during lectures. Personal computers, tablets and smartphones are allowed and endorsed during seminars. Seminar grades will be assigned based on group performance. Each seminar is worth 7 points max. Seminar attendance is mandatory, there will be no make-up seminars.

Exams

The course is divided into four topics. Following lectures on topic one, two, and three there will be a 60-minute test. Test attendance is mandatory; make-up exams will only be given for absences according to Campus policies. Test topics will focus on the material studied in the preceding lectures, textbook material, and required additional reading materials. Although the tests are non-cumulative, understanding of the principles acquired in earlier parts of the course will be necessary to answer test questions in the later parts of the course. All exams will be "closed book" and will be in form of problem questions and/or multiple choice tests. Some questions will involve calculations (calculators permitted). On test day, students are strongly advised to come to class at least 5 min early. Each exam is worth 15 points max.

Homework

Homework are provided as credit assignments. There will be four homework assignments, each announced during the lecture. The deadline for homework submission will be provided, and no report will be accepted after the deadline. Reports will be accepted via Canvas. Each of the homework report worth 7 points max.

Grade determination

The total grade in the course will be comprised of the grades for exams, labs, seminars, and homework. A student may earn a maximum of 200 points. The general guidelines for letter grades will be as follows: A+ >195; A 190-195; A- 183-190; B+ 176-183; B 169-176; B- 162-169; C+ 155-162; C 148-155; C- 141-148; D+ 134-141; D 127-134; D- 120-127; F <120. Minor adjustments may be introduced to the general scheme to allow for students grade distribution.

Provisional schedule of the course

Please, note that modifications may be introduced to the schedule as the semester progresses. Updated schedules will be made available to all students via Canvas as soon as possible.

Date (9:30 - 10:45 AM)		Lectures, Seminars, and Exams Date
8/29/2017	Tue	Class Intro
8/31/2017	Thu	Basic concepts of Remote Sensing
9/5/2017	Tue	RS data and data providers
Topic 1 – Physical Basis of Remote Sensing		
9/7/2017	Thu	Topic 1 Lecture 1
9/12/2017	Tue	Topic 1 Lecture 2
9/14/2017	Thu	Topic 1 Lecture 3
9/19/2017	Tue	Topic 1 Lecture 4
9/21/2017	Thu	***Exam on Topic 1***
Topic 2 - Analysis of Remotely Sensed Data		
9/26/2017	Tue	Topic 2 Lecture 1
9/28/2017	Thu	Topic 2 Lecture 2
10/3/2017	Tue	***Seminar 1: Image interpretation***
10/5/2017	Thu	Topic 2 Lecture 3
10/10/2017	Tue	Topic 2 Lecture 4
10/12/2017	Thu	***Seminar 2: Spectral profiles***
10/17/2017	Tue	Topic 2 Lecture 5
10/19/2017	Thu	Topic 2 Lecture 6
10/24/2017	Tue	***Exam on Topic 2***
Topic 3 - Remote Sensing Instruments		
10/26/2017	Thu	Topic 3 Lecture 1
10/31/2017	Tue	Topic 3 Lecture 2
11/2/2017	Thu	Topic 3 Lecture 3
11/7/2017	Tue	***Seminar 3 Part 1: Group presentations***
11/9/2017	Thu	***Seminar 3 Part 2: Group presentations***
11/14/2017	Tue	***Exam on Topic 3***
Topic 4 – Remote Sensing Applications		
11/16/2017	Thu	Topic 4 Lecture 1
11/21/2017	Tue	Topic 4 Lecture 2
11/23/2017	Thu	*No classes*
11/28/2017	Tue	Topic 4 Lecture 3
11/30/2017	Thu	Topic 4 Lecture 4
12/5/2017	Tue	***Seminar 4 Part 1: Group presentations***
12/7/2017	Thu	***Seminar 4 Part 2: Group presentations***

Date	Laboratory classes Section 0101: 09AM-11AM; Section 0102: 11AM-1PM
9/1/2017	Lab Intro: Working with RS data
9/8/2017	Lab 1: Introduction to data visualization and analysis
9/15/2017	Lab 2: Field measurements using thermal and multispectral radiometers
9/22/2017	Lab 3: Satellite data from different sensors
9/29/2017	Lab 4: Landsat-8 data analysis and interpretation
10/6/2017	Lab 5: Thermal remote sensing
10/13/2017	Lab 6: Analyzing images in QGIS; estimating percent land cover using a sampling approach
10/20/2017	Lab 7: Spectral indices and spatial filters
10/27/2017	Lab 8: Supervised & unsupervised image classification
11/3/2017	Lab 9: Decision tree supervised classification & accuracy assessment
11/10/2017	Lab 10: Change detection
11/17/2017	Lab 11: Working with RS data catalogs

Report for each lab is due within a week after the class. Delayed reports will be downgraded by 50%. Reports submitted three weeks after the class or later will not be graded at all.

Homework dates

	Announcement date	Report submission deadline
Homework #1	31 Aug	21 Sep
Homework #2	26 Sep	10 Oct
Homework #3	26 Oct	14 Nov
Homework #4	26 Nov	7 Dec

Keys to Success

This course is challenging for many students due to the quantitative nature of remote sensing and aspects of computer processing using complex software tools. While extensive explanations will be provided, always ask if anything is not clear.

The following will contribute to your success in this class:

- **Attend all lectures** – each one aims to help you learn important components of the class. Each Topic builds on earlier ones and any significant gaps in your understanding will accumulate and may leave you unable to catch up.
- **Use the Study Guides** and other materials. This course is not primarily a lecture-style class; rather, you teach yourself and the lectures are the opportunity to interact with the Instructor to ask questions and be shown how to solve examples and get the big-picture.
- During lectures, **take notes**. After the lecture, go over your notes to clarify any parts of which you are unsure or that you were unable to adequately write down during the lecture. It is a good idea to cross-reference the lecture notes with the pages in the textbook that are relevant. The lecture content alone is not sufficient to succeed in this course.
- You could **form a study group** with several of your classmates or utilize the Canvas online discussion board to facilitate understanding of course content.
- **Ask questions**. Use Office Hours and email the Instructor or TA with questions.

Official Notices

- Attendance: *You are strongly advised to attend all lectures since this will provide a basic understanding of the subject matter of the course. The course grade is dependent upon successful completion of 4 Exams and 11 Lab Reports. The Campus Senate policy http://www.umd.edu/catalog/0405/chapter4.pdf) requires students who are absent due to illness/injury to furnish documentary support to the instructor (see below). In this class the policy applies to the lab classes only. You are required to contact the Instructor by email, where possible, prior to lab sessions for which they are unable to attend owing to an illness or an injury. No later than on return to class, you must provide written and, where appropriate (determined by the Instructor) signed documentation verifying that your illness/injury is such that you cannot attend the Lab session. You will not be allowed to turn in missed assignments or make up quizzes and lab classes if you have not provided this documentation. If you do not present documentation of illness or emergency, zero points will be given. In addition, if it is found that you have falsified the documentation provided, you will be referred to the University's Student Conduct Office.*
- *Religious Observance: By the 2nd week of the course, students must provide the Instructor, in writing, any request for absence from lab classes due to a named religious observance on a specified date. Please refer to the Online Undergraduate Catalog Policy on Religious Observance.*
- *Disabilities: If you have a documented disability and wish to discuss academic accommodations, please contact the Instructor as early as possible. Every effort will be made 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 2016 Fall semester. This form must be presented to me no later than the 2nd week of the course. 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.*
- *CourseEvalUM. Your participation in the evaluation of courses through CourseEvalUM is a responsibility you hold as a student member of our academic community. Your feedback is confidential and important to the improvement of teaching and learning at the University as well as to Faculty tenure and promotion procedures. The date from which CourseEvalUM is open for you to complete your evaluations will be announced by the University. Please go directly to the website (www.courseevalum.umd.edu) to complete your evaluations by the published date*

From the University Registration, Academic Requirements, and Regulations, Sect Attendance (http://www.umd.edu/catalog/0405/chapter4.pdf.)

- *The university expects each student to take full responsibility for his or her academic work and academic progress. The student, to progress satisfactorily, must meet all of the requirements of each course for which he or she is registered. Students are expected to attend classes regularly, for consistent attendance offers the most effective opportunity open to all students to gain command of the concepts and materials of their courses of study. Except as provided below, absences will not be used in the computation of grades, and the recording of student absences will not be required of the faculty.*
- *It is the policy of the university to excuse the absences of students that result from the following causes: illness of the student, or illness of a dependent as defined by Board of Regents policy on family and medical leave; religious observance (where the nature of the observance prevents the student from being present during the class period); participation in university activities at the request of university authorities; and compelling circumstance beyond the student's control.*

Students claiming excused absence must apply in writing and furnish documentary support for their assertion that absence resulted from one of these causes.

- *In some courses, attendance and in-class participation are ongoing requirements and an integral part of the work of the course. In other courses, occasional in-class assessments may occur, sometimes without advance notice. It is the responsibility of the instructor to inform each class at the beginning of the semester of the nature of in-class participation expected and the effect of absences on the evaluation of the student's work in the course.*
- *Absences in courses where in-class participation is a significant part of the work of the course shall be handled by the instructor in the course in accordance with the general policy of his or her* academic *unit".*
- *Policy on phones: Outgoing calls are not permitted during lectures. Phones must be set to silent mode. More than one occurrence of phones making an audible sound will result in the owner being asked to leave the lecture room.*
- *Policy on computers and smart phones: Students may use computers to take notes, but other uses are not permitted. Class materials on the Web should be downloaded before the class. Anyone found using their computer for purposes other than note-taking will be asked to leave.*
- *Academic Integrity Expectations: The University of Maryland, College Park has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity or the Student Honor Council, please visit: http://www.studenthonorcouncil.umd.edu/whatis.html By registering for this course you indicate your acceptance of these provisions for academic integrity.*
- *Students are expected to treat each other with respect. Disruptive behavior of any kind will not be tolerated. Students who are unable to show civility with one another, or instructor will be subject to being referred to the Office of Student Conduct or to Campus Police. You are expected to adhere to the Code of Student Conduct.*
- *The lectures delivered in this class and the course materials are protected by federal copyright law as the Instructor's original works. You are permitted to use course materials for your use. You may not record, reproduce, or distribute my lectures/notes for any commercial purpose without written consent. Persons who sell or distribute copies or modified copies of course materials, possess commercial copies of notes (i.e., Terpnotes), or assist another person or entity in selling or distributing those materials may be considered in violation of the University Code of Student Conduct, part 9(k).*