GGR 337 Environmental Remote Sensing

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Lectures

Monday 10 am -12 noon, UC161

Consultations

Instructor: 12:45-2:45 pm, Monday, Room 5058, 100 St. George St.
TA: 1:00-3:00 pm, Tuesday, Room 5027B, 100 St. George St.

Lab. Tutorials

Tuesday 5-7 pm and Wednesday 3-5 pm, GIS Lab, Room 620, Sydney Smith. There are five tutorials in total (two times each in the same week). Dates of these tutorials are given in the schedule below. Students should be available for one of the two time slots.

Prerequisite

GGR100/GGR107Y/GGR272 (The requirement is flexible and can be discussed with the instructor)

Outline

Environmental remote sensing has been an exciting subject as many satellite sensors have been launched in the past few decades and many are still forthcoming. The unprecedented abundance of earth observation data will allow us to address many pressing environmental issues. This course will cover the basics of using remote sensing data for environmental studies. In addition to learning the basic concepts, terminology, and theories of remote sensing science and applications, students will have the opportunity to acquire hands-on experience in digital image processing using ArcGIS. A series of laboratory assignments are designed with detailed instructions to lead the students through the key steps in processing satellite images and in extracting quantitative information about the Earth's surface.

Evaluation

5 Lab assignments_____ 45%
Mid-term exam _____ 15%
Final exam _____ 40%
Late lab reports will be penalized at 10% of the portion of the lab for each day of delay, i.e., a multiplying factor of 0.9 will be used for 1-day delay, and 0.8 for 2-day delay, etc.

Text Book

Lillesand, T. M., R. W. Kiefer, and J. W. Chipman, 2015. *Remote Sensing and Image Interpretation*. seventh edition. ISBN 978-1-118-34328-9

Other References (in order of importance)

Campbell, J. B. 2011. *Introduction to Remote Sensing*. Guilford Press, fifth edition, ISBN: 978-1-59385-319-8.

Verbyla, D. L., 1995. *Satellite Remote Sensing of Natural Resources*. Lewis Publishers, New York. ISBN:1-56670-107-4

Course Objectives

After successfully completing GGR337H1S, students will be able to:

- Understand fundamental principles of electromagnetic radiation as applied to remote sensing;
- Appropriately use basic concepts related to remote sensing observations;
- Acquire the basic knowledge on the characteristics of the main existing spaceborne and airborne remote sensing systems;
- Have the ability to conduct applications of remote sensing techniques to real-world environmental issues;
- Use an image processing tool to implement basic operations with remote sensing images and conduct quantitative analysis;

Note: If you are having difficulties in keeping up with class assignments or in understanding the material we are covering, please see me as soon as possible!

Lecture Schedule

Date	Subject	Reading	Labs. Due
Jan 09	Introduction to remote sensing principles, lab facility, computer accounts, etc. Electromagnetic radiation	JC: Chapter 1 LKC: Chapter 2.1-2.2	
Jan 16 **Jan 17/18**	Electromagnetic radiation and Radiation terminology **Tutorial** for Lab. 1, 5% (not a computer lab.)	LKC: Chapter1.1-1.43 JC: Chapter 2	
Jan 23	Spectral characteristics of ground targets	LKC: Chapter 1.4-1.5	
Jan 30	Satellite orbits and sensors	LKC: Chapters 4, 5 and 6 JC: Chapters 6 and 7	Lab. 1 report due
Feb 06 **Feb 07/08**	Digital data handling and geometric corrections **Tutorial** for Lab. 2, 10%	LKC: Chapters 1.7, 4.6-4.7 JC: Chapter 4	
Feb 13 **Feb 14/15**	Image enhancement techniques Radiation terminology (review) **Tutorial** for Lab. 3, 10%	LKC: Chapter 7.3-7.5 JC: Chapter 5	
Feb 20	Reading week		
Feb 27	Mid-term exam (15%, 50 min) Color display techniques	LKC: Chapters 2.4-2.5 and 7.6	Lab. 2 report due
Mar 06 **Mar 07/08**	Radiometric corrections **Tutorial** for Lab. 4, 10%	LKC: Chapters 1.4 and 7.2 (Radiometric Cor.)	
Mar 13	Multispectral transformations of image data and vegetation indices	LKC: 7.6 JC: Chapters 17	Lab. 3 report due
Mar 20 **Mar 21/22**	Clustering and unsupervised classification **Tutorial** for Lab. 5, 10%	LKC: 7.11 JC: Chapter 12	
Mar 27	Supervised classification techniques	LKC: 7.8 JC: Chapter 12	Lab. 4 report due
Apr 03	Remote sensing applications: Forestry, agriculture, climate change, urban environment, etc.	JC: Chapters 17, 19-21	
Apr 10	No teaching		Lab. 5 report due Term paper due for GGR1911

Note: JC is the reference book of James Campbell, and LKC is the textbook of Lillesand, Kiefer and Chipman

Additional Readings

To be provided in class

Academic Integrity

It is your responsibility as a student at the University of Toronto to familiarize yourself with, and adhere to, both the Code of Student Conduct and the Code of Behaviour on Academic Matters.

This means, first and foremost, that you should read them carefully.

- The Code of Student Conduct is available from the U of T website: http://www.governingcouncil.utoronto.ca/policies/studentc.htm
- The Code of Behaviour on Academic Matters is available from the U of T website: http://www.governingcouncil.utoronto.ca/policies/behaveac.htm

See also the University's website on Academic integrity: www.utoronto.ca/academicintegrity.

Accessibility Services

The University of Toronto is committed to accessibility. If you require accommodations or have any accessibility concerns, please visit Accessibility Services at http://www.accessibility.utoronto.ca/ as soon as possible.

For more information please contact Accessibility Services at
Robarts Library
1st Floor (ground entrance off St . George St.)
130 St. George Street, Toronto, ON M5S 3H1
Voice: 416-978-8060
Fax: 416-978-8246
TTY: 416-978-1902
Email: accessibility.services@utoronto.ca
Web: www.accessibility.utoronto.ca

Policies

Assignments:

Assignments should be submitted either before or after the class or put it on the envelope on my office door (Room 5058, 100 St. George) prior to 5 PM on the due date**. *Please do not put your assignments in my mail box at Sydney Smith Hall.*** Late assignments will be subject to a late penalty of 10% per day (including weekends) of the total marks for the assignment. Assignments submitted five calendar days beyond the due date will be assigned a grade of zero. ***Electronic submissions will not be accepted***. All late assignments must be turned into the drop box located outside of the Geography main office (Sidney Smith Hall, Room 5047). You can only turn in a late assignment during business hours, normally between 9am and 5pm, Monday – Friday. They will be time stamped at 5pm on the day submitted.

Missed assignments and mid-term test:

There will be no re-writes or make-ups for missing the assignments and the mid-term test for University-accepted, verifiable reasons. Instead the total marks of the final exam will be increased by the marks of the missed assignments and test.

Informing Your Instructor and Submitting Appropriate Documentation:

Students must submit an original University-accepted documentation (e.g., signed U of T medical certificate) within **one week** of a missed assignment due date or test date. Failure to submit appropriate documentation will result in a grade of zero.

GGR1911
Remote Sensing, Graduate Course

This graduate course is offered to graduate students of diverse backgrounds, and therefore it does not require prior training in remote sensing. Similar to GGR337, the emphasis of this course is on the basic concepts and skills in using remote sensing data. However, graduate students are expected to learn additional skills in using remote sensing imagery for environmental research, as a way to encourage you to use remote sensing techniques for your graduate research.

All graduate students should attend the classes and finish the first four laboratory assignments in the same way as undergraduate students. The score percentages for the assignments are the same for both graduate and undergraduate students. Graduate students will also write the same mid-term and final exams. A term paper (less than 10 double-spaced pages, excluding figures and tables) on a chosen remote sensing topic will be required as a replacement for Lab. 5 in the undergraduate course. A list of topics for the term papers will be given before the reading week. The topic can also be self-chosen, and those related to your graduate research are encouraged. In the final exam, graduate students will be asked to answer one additional question worth about 3%.

Evaluation:

4 Lab assignments_____ 35%
Mid-term exam _____ 15%
Term paper _____ 20%
Final exam _____ 30%

Late lab. reports and term paper will be penalized at 10% of the portion of the lab for each day of delay, i.e., a multiplying factor of 0.9 will be used for 1-day delay, and 0.8 for 2-day delay, etc.