

GTECH 32200 Advanced Image Processing/71300: Digital Image Processing

Course Mode of Instruction: P

Fall 2017

Wednesdays 5:35 pm-9:25 pm, HN 1090B-1

Contact Information:

Instructor: Dr. Atsushi Tomita
Email: atomita@gradcenter.cuny.edu
Office: HN1032
Department Information: HN1006, Phone: 212-772-5265

Pre-requisites:

GTECH 20300 and 32100 for undergraduate students and GTECH 71200 for graduate students.

Required Textbook:

Introductory Digital Image Processing: A Remote Sensing Perspective (4th Edition), John R. Jensen, 2015 Pearson Education, ISBN-13: 978-0134058160

Suggested readings:

Introduction to Remote Sensing, 5th Edition, James B. Campbell and Randolph H. Wynne, 2011 The Guilford Press, ISBN-13: 978-1609181765 and ISBN-10: 160918176X.

Remote Sensing of the Environment –An Earth resource perspective (2nd Edition), John R. Jensen, 2006 Prentice Hall, ISBN: 0131889508.

Image Analysis, Classification and Change Detection in Remote Sensing: With Algorithms for ENVI/IDL and Python (3rd Edition), Morton J. Canty, 2014 CRC Press, Taylor & Francis Group, ISBN-13: 978-1466570375.

You are not required to purchase the suggested readings. However, certain portions of these books might be referred to in lectures or used in the labs as supplementary materials.

Course Description:

The objective of this course is to acquire advanced knowledge of and skills relating to satellite and air-borne remote sensing to enable you to pursue your own research topics. Remote sensing has great potential for the investigation of global environmental processes, in which human activities are also involved. The recent advancement of digital environment/infrastructure and data availability has set the appropriate stage not just for specialists but also for a wide range of researchers and members of the public. However, to conduct research successfully, you need to have: sound understandings of physical principles; hands-on experience with real world data; proper judgment of methods, or the capability to design and develop new methodologies, if necessary. In this course, you will deepen your knowledge and experience through lectures, lab exercises, and your own projects, making full use of current technological developments and publicly-accessible resources.

This is an advanced remote sensing course and requires successful completion of GTECH 32100, Remote Sensing of the Environment, for undergraduates and GTECH 71200, Remote Sensing of the Environment, for MS, MGeol, and GIS Certificate students. The class consists of two parts: lecture and lab. In the lab, you will use image processing software and tools that are available on the computers in our classroom, primarily the image processing software ENVI, and a comprehensive data analysis tool, IDL. The lecture portion of the

course will involve quizzes and your presentations. Some supplementary materials for the lecture could be posted on Bb as needed.

Learning Outcomes:

At the end of this course, you

- will have knowledge and skills to start pursuing your own research using satellite/air-borne data.
- will have deeper understanding of the global environment through case studies and laboratory work.

Grading:

Quizzes	15 %
Short Presentation	5 %
Lab Exercises	40 %
Final Project	40 %

For final grades, Hunter College grading policy will be used as explained at <http://catalog.hunter.cuny.edu/content.php?catoid=29&navoid=5993> for graduate students and <http://catalog.hunter.cuny.edu/content.php?catoid=28&navoid=5862> for undergraduate students.

The grade IN (incomplete) will only be given for this course in extreme circumstances such as bereavement in the family and your own hospitalization. You must notice me within 48 hours of the final exam and make arrangements with me to complete a Contract to Resolve an Incomplete Grade.

Quizzes:

A short quiz is given at the beginning of almost every class. It will consist of short questions to check the understanding of your learning. Missed quizzes cannot be made up.

Short Presentation:

Choose a topic on remote sensing and do a short presentation once during the semester. You need to clear the topic with the instructor to avoid the duplication of the topics.

Lab exercises:

The laboratory portion of the course focuses on physics, data sets, and methods of remote sensing through case studies.

Final Project:

Students pick their own topics. There will be mid-term and final presentations accompanied by the final report. There is no restriction on the theme or method. However, full use of the theme or method from other classes or your own research is not allowed. Be sure to include original elements which you will learn through this course. Only development of tools or just verification of data or method is also not allowed. Tackle concrete problems and make a real effort to find solution(s) using remote sensing techniques.

Your final report should be 10-15 page long (double space, 12-point font) and include a complete bibliography at the end of the report. List at least five references from academic journals. You can also list a wider range of information sources such as newspaper articles and other publications as needed. Use proper citation style (e.g. APA, MLA, Chicago, IEEE, etc.; You can check them out online at <http://pitt.libguides.com/citationhelp>).

Essential Policy Information:

- *Attendance/lateness policy:* Expect to attend the full class period, 5:35 pm - 9:25 pm.
- *Late work/missed exams/Incompletes:* The final submission date of the lab and the final project will be

at the beginning of class on December 20th, the date of the final project presentation. I will deduct 10% from your final grade for late submission of the final project, and I will not accept any late submissions after 48 hours of the final report due date.

- **Credit/No Credit (CR/NC)** as a final grade is available only to undergraduate students who have completed all of the requirements of the course. This includes all lab assignments, quizzes, and the final project. The Credit/No Credit form must be submitted to me no later than 10 minutes prior to the beginning of the class meeting on December 20th. Credit/No Credit forms will not be accepted after 5:35 PM on that date.
- I do not give Incomplete (**INC**) as a final course grade except under the most extraordinary and documented situations. Requests for IN must be made within 48 hours of the final project presentation and undergraduate students must meet with me and complete a Contract to Resolve an Incomplete Grade. With the request and, for undergraduates the Contract to Resolve an Incomplete Grade, I will average your and record the grade you earned over the course of the semester.

Hunter College Statement on Academic Integrity

Hunter College regards acts of academic dishonesty (e.g., plagiarism, cheating on examinations, obtaining unfair advantage, and falsification of records and official documents) as serious offenses against the values of intellectual honesty. The College is committed to enforcing CUNY Policy on Academic Integrity and will pursue cases of academic dishonesty according to the Hunter College Academic Integrity Procedures.

ADA Policy

In compliance with the American Disability Act of 1990 (ADA) and with Section 504 of the Rehabilitation Act of 1973, Hunter College is committed to ensuring educational parity and accommodations for all students with documented disabilities and/or medical conditions. It is recommended that all students with documented disabilities (Emotional, Medical, Physical, and/or Learning) consult the Office of AccessABILITY, located in Room E1214B, to secure necessary academic accommodations. For further information and assistance, please call: (212) 772- 4857 or (212) 650-3230.

Hunter College Policy on Sexual Misconduct

In compliance with the CUNY policy on Sexual Misconduct, Hunter College reaffirms the prohibition of any sexual misconduct, which includes sexual violence, sexual harassment, and gender-based harassment retaliation against students, employees, or visitors, as well as certain intimate relationships. Students who have experienced any form of sexual violence on or off campus (including CUNY-sponsored trips and events) are entitled to the rights outlined in the Bill of Rights for Hunter College.

- a. Sexual Violence: Students are strongly encouraged to immediately report the incident by calling 911, contacting NYPD Special Victims Division Hotline (646-772-4444).
- b. All Other Forms of Sexual Misconduct: Students are also encouraged to contact the College's Title IX Campus Coordinator, Dean John Rose (jtrose@hunter.cuny.edu or 212-650-3262) or Colleen Barry (Colleen.barry@hunter.cuny.edu or 212-772-4534) and seek complimentary services through the Counseling and Wellness Services Office, Hunter East 1123.

CUNY Policy on Sexual Misconduct Link: <http://www.cuny.edu/about/administration/offices/la/Policy-on-Sexual-Misconduct-12-1-14-with-links.pdf>

Syllabus Change Policy:

The contents of this syllabus are subject to change with advance notice.

Tentative Course Schedule

Session	Date	Topic(s)	Readings	Lab
---------	------	----------	----------	-----

1	8/30	Course overview, Information Domain	Ch. 1, 2 and 3, appendix	Review of ENVI and introduction to IDL
2	9/6	Optical remote sensing and image data processing	Ch. 6 and 7	Optical sensor image processing
3	9/13	Imaging spectroscopy and spectral mixture analysis	Ch. 5 and 11	Spatial resolutions and spectral mixture analysis
	9/20	No Classes Scheduled		
4	9/27	Imaging spectroscopy and spectral mixture analysis	Ch. 5 and 11	Spatial resolutions and spectral mixture analysis
5	10/4	Image transformation and vegetation Indices	Ch. 8	Image transformation and vegetation indices
6	10/11	Image transformation and vegetation Indices	Ch. 8	Image transformation and vegetation indices
7	10/18	Pattern recognition: spectral domain, parametric and nonparametric image classifications	Ch. 9 and 10	Parametric and nonparametric image classifications
8	10/25	Pattern recognition: spatio-spectral domain, image segmentations and geographic object-based image analysis and classification (GEOBIA)	Ch. 9	Image segmentations and geographic object-based image analysis and classification (GEOBIA)
9	11/1	Progress reports		
10	11/8	LIDAR	<i>IRS</i> Ch. 8 and <i>RSE</i> Ch. 10	LIDAR
11	11/15	LIDAR	<i>IRS</i> Ch. 8 and <i>RSE</i> Ch. 10	LIDAR
12	11/22	RADAR	<i>IRS</i> Ch. 7 and <i>RSE</i> Ch. 9	RADAR
13	11/19	RADAR	<i>IRS</i> Ch. 7 and <i>RSE</i> Ch. 9	RADAR/final project
14	12/6	Temporal Domain: Change Detection	Ch. 12	Change Detection/final projects
15	12/20	Project presentations Final paper due at beginning of class session		

**IRS: Introduction to Remote Sensing; RSE: Remote Sensing of the Environment*
-- These supplementary materials are tentative and could be replaced by others

****Notes on Schedule**

September 14: Last day to drop the class without a grade of "W".

November 10: Last day to drop the class with the grade of "W".