

Syllabus
GIS 6127C Hyperspectral Remote Sensing (3 Credits)
Department of Geosciences
Florida Atlantic University
Spring 2016

Instructor: Dr. Caiyun Zhang

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Office hour: Tuesday, 10:00 AM– 12:00 PM (other times by appointment)

Teaching Assistant (TA): Ms. Molly Smith, msmit259@my.fau.edu, SE 486

TA Office hour: Monday, 10:00 AM-12:00 PM; Wednesday, 3:00 PM-5:00 PM, (other times by appointment)

This class is conducted fully on line.

PREREQUISITES

GIS 4037C or GIS 5033C Digital Image Analysis (on-line course)

Permission of the instructor is required for enrolling this course if you have not finished the prerequisites.

COURSE DESCRIPTION

This course introduces state-of-the-art techniques for collecting, processing, and interpreting hyperspectral data. The focus of this course is the thematic information extraction from airborne and spaceborne hyperspectral sensors. The course will cover the full hyperspectral remote sensing processing chain: data acquisition, data processing, and thematic mapping.

OBJECTIVES

By the end of this course, students will be able to:

- Describe the principle of hyperspectral remote sensing
- Recognize how to collect hyperspectral data
- Process hyperspectral data
- Extract thematic information from hyperspectral data
- Apply hyperspectral data in various fields
- Recognize the current research status of hyperspectral remote sensing
- Fulfill a project using hyperspectral data

COURSE ORGANIZATION

This course is designed as a series of on-line lectures followed by hands-on laboratory exercises. The lecture portion of the course will usually last 1-1.5 hour. Videos, lecture notes, lab instructions will be loaded in the Blackboard.

REFERENCE BOOKS

No textbooks are required for this course, but the following texts can be used as references:

Freek van der Meer and Steven de Jong, 2001. *Imaging Spectrometry: Basic Principles and Prospective Applications*. Springer Academic Publishers, ISBN 1-4020-0194-0.

Borengasser, M., W.S. Hungate, and R. Wadkins, 2004. *Hyperspectral Remote Sensing: Principles and Applications*. CRC Press, ISBN-10: 1566706548, ISBN-13: 978-1566706544

Kalacska, M., and G.A. Sanchez-Azofeifa, 2008. *Hyperspectral Remote Sensing of Tropical and Sub-Tropical Forests*. CRC Press, ISBN: 9781420053418

Thenkabail, P.S., J. G. Lyon, and A. Huete, 2011. *Hyperspectral Remote Sensing of Vegetation*. CRC Press, ISBN: 9781439845370

Jensen, J. R., 2016. *Introductory Digital Image Processing* (4th Edition), Prentice Hall, ISBN-13: 978-0134058160; ISBN-10: 013405816X

Jensen, J. R., 2006. *Remote Sensing of Environment: An Earth Resource Perspective* (2nd Edition) Prentice Hall, ISBN-10: 0131889508, ISBN-13: 978-0131889507

Eismann, M.T., 2012. *Hyperspectral Remote Sensing*, ISBN: 9780819487872

COURSE MATERIALS IN BLACKBOARD

All course materials are loaded in Blackboard, and lab required data files are located in G:\CourseMaterial\GIS 6127c Hyperspectral Remote Sensing. In the Blackboard, course materials are distributed in the following areas:

- **My Instructor:** the instructor’s information including office hour, office, phone, etc.
- **Syllabus and Schedule:** course syllabus, schedule, and grading, etc.
- **Learning Units:** lecture notes, videos, and all related references are uploaded and organized as units under this category; Lab instruction and assignments are also loaded here; Midterm and final project instruction and requirement are also loaded here.
- **Student Submissions:** Note that 50% of the course grade comes from successfully completing these labs in a timely manner; students need to submit their assignment in PDF format and keep the original work at G temp drive. Final project report should be submitted here too. Quizzes are also distributed here.
- **Textbook and tutorials:** free textbook and related tutorials are uploaded here.
- **Discussions:** Course related questions and discussion are posted here.

COMMUNICATION

All course related issues are communicated through the Discussion Board and Email function in the Blackboard. For the Discussion Board, General Questions and Answers (FAQ) will be posted by the Instructor. All other related questions can be posted in the Discussion Board such as questions, discussions, and ancillary information to complete labs, and helpful hints. It takes about 3 days to reply your questions. Note that all course communications, whether with fellow students or the instructor, should be respectful and relevant to the course. Think of the online course space as being similar to a conference room at your place of employment where you are communicating with co-workers and supervisors. If your posts and messages are not appropriate in that environment, they are not appropriate in the course space either.

COURSE EVALUATION

The final grade will come from quizzes, laboratory exercises, midterm exam, and the final research project.

Course Component	% of Final Grade
Quiz	10%
Midterm Exam	15%
Lab Exercises	50%
Final Project	25%

Points	Final Grade	Points	Final Grade
94 - 100	A	74 - 76	C
90 - 93	A-	70 - 73	C-
87 - 89	B+	67 - 69	D+
84 - 86	B	64 - 66	D
80 - 83	B-	60 - 63	D-
77 - 79	C+	59 or lower	F

Tentative Lecture Schedule and lab Assignments (Schedule is subject to change)

Week	Date	Lectures and labs
1	Jan. 11	Overview of the Course and Syllabus Introduction to Hyperspectral Remote Sensing <i>Lab 1 Introduction to ENVI 5</i>
2	Jan. 18	Hyperspectral Sensors and Data Collection <i>Lab 2 Introduction to ENVI Classic</i> <i>Lab 1 is due</i>
3	Jan. 25	Hyperspectral Image Display and Basic Analysis <i>Lab 3 Downloading, Displaying, and Analyzing Hyperspectral Imagery in ENVI</i> <i>Lab 2 is due</i>
4	Feb. 1	Pre-processing of Hyperspectral Data <i>Lab 4 Atmospheric Correction of Hyperspectral Imagery</i> <i>Lab 3 is due</i>
5	Feb. 8	Reducing High Dimensionality of Hyperspectral Imagery and Endmember Selection <i>Lab 5 MNF and Endmember Analysis in ENVI</i> <i>Lab 4 is due</i>
6	Feb. 15	Thematic Information Extraction from Hyperspectral Imagery <i>Lab 6 Hyperspectral Image Classification Using SAM & SFF</i> <i>Lab 5 is due</i>
7	Feb. 22	Unsupervised Hyperspectral Image Classification Using a Neuron-fuzzy System <i>Lab 7 Hyperspectral Imagery Classification Using an Unsupervised Neuron-fuzzy System</i> <i>Lab 6 is due</i>
8	Feb. 29	Hyperspectral Applications: Soil, Mineral & Rock, Urban Area and Water <i>Lab 8 Application of Hyperspectral Imagery in Geological Studies.</i> <i>Lab 7 is due</i>
9	Mar. 7	<i>Spring Break, no class</i>
10	Mar. 14	<i>Midterm: Bibliography on Hyperspectral Research Issues; Quiz is available</i>
11	Mar. 21	Vegetation Mapping in the Kissimmee River Floodplain and Coastal Everglades Using Hyperspectral Imagery <i>Lab 9 Vegetation Mapping</i> <i>Lab 8 is due; Midterm Bibliography is due; Quiz is due</i>
12	Mar. 28	<i>AAG Conference/Reading week</i>
13	Apr.4	Combining Object-based Texture Measures with a Neural Network for Vegetation Mapping in the Everglades from Hyperspectral Imagery <i>Lab 10 Target Detection using Hyperspectral Imagery</i> <i>Lab 9 is due</i>
14	Apr.11	Mapping Individual Tree Species in an Urban Forest Using Airborne LiDAR and Hyperspectral Imagery <i>Lab 10 is due</i> <i>No lab assignment</i>
15	Apr. 18	Benthic Habitat Mapping in the Florida Keys Using Hyperspectral Imagery <i>No lab assignment</i>
16	Apr.25	<i>Project week. Final Project is due on May 2 at 11:59 PM</i>

SUPPORTIVE RESOURCES

- **Campus Supports**
 - **FAU eLearning Resources**
 - Center for Learning and Student Success (CLASS) (<http://www.fau.edu/class/>): CLASS at FAU offers a dedicated eLearning Advisor, Eduardo Santiago (email: esantia5@fau.edu), who is available to help you with any fundamental issues related to eLearning, technology with online courses, and with your effort to achieve success in the online environment (www.fau.edu/esuccess)
 - FAU Library (www.fau.edu/library): The library at FAU is an essential resource for the students. The library provides a number of online resources to assist you with your assignments in the course. On the home page is the SearchWise search engine with flexible functionality to assist you in finding resources. Also on the home page, you will find links to LibGuides, one of which is for Geography. You can also access the libraries online collections by using the off campus EZproxy system.
 - **FAU's [Online Computing Support Center](#)**: The center allows you to search the Knowledge Base for answers to common questions. Submit your own help ticket by clicking on "Submit a ticket". If the Blackboard server is not available at night or on the weekend, please contact the FAU Help Desk at 561-297-3999.
- **Department Supports**
 - **Department of Geosciences Help Desk**: this help desk provides support for the Geosciences remote applications as well as the Department's network drives (e.g., student G: drive). Submit your own help request via e-mail to GeoHelpDesk@fau.edu.
 - **Department of Geosciences Resources** for this course: There are two computer teaching labs (SE 457 and SE 483 at Boca Raton campus) available exclusively for students taking Geosciences courses requiring the use of these labs. Labs are departmentally supported and not open to the general university student body. Systems are available on a first come first serve basis when a scheduled class does not occupy the room. For more department resources, you can visit website <http://www.geosciences.fau.edu/computer.html>
 - **G:\SemesterTempDrive**: For this course, students will use this drive to finish their labs and related homework. This is a temporary storage space for the general student body to keep course work for one semester (120 days). Permissions are set to prevent access by other students. However, department faculty and graduate students have read access to these directories. There is a 4GB disk space limit. Any files older than 120 days are automatically deleted.
 - **Department Software support**: Geosciences' students may access most of our department software applications from off campus using our Citrix hosted cloud application. Systems are found at <http://geoportal.fau.edu>.

POLICIES

Lab Policy: Most labs will become available Mondays at 5 PM and will be closed on Mondays at 11:59 PM. Be sure to check the syllabus each week as some labs dates are

scheduled to accommodate for larger assignments. Please make all efforts to complete and submit labs assignments via BlackBoard Assignments by 11:59 PM on the due date. If this time is passed, Blackboard (BB) will accept your assignment; however, it will be considered late and a late penalty will apply of a 10% reduction in grade per day. Labs are only accepted via Blackboard Assignments. After ten days, the lab is worth zero points. "F" Grade if original work files are not saved in the G drive folder to support lab. You will get 10% deduction of points for omission or wrong path location. All work must be your original work, not a copy of group or team project you did with someone else.

Technical Policy: Thousands of students have successfully used our online system for distance learning. However, should a student experience technical difficulties if remotely accessing the course from home or other locations outside the Geosciences Lab, it is up to each student to solve their own technical issues such as internet access. Note that all the labs are only tested under Windows Operation System. Labs may not work under other operation systems.

Incomplete Grades Policy: Incomplete are awarded only under extreme circumstances at the discretion of the instructor. The University policy is that candidates for an Incomplete Grade must have extreme circumstances that hinder the completion of the course AND must be passing the course at the time of the occurrence of the extreme circumstance.

Make-up Policy: Even though there is some flexibility in the learning pace in online courses, graded labs and exams will be time dependent and the deadlines must be observed. Late assignments will be accepted, and make-up labs and exams will only be given for a verifiable excuse with documentation. Lack of documentation will result in a zero. Make-up labs and exams will be scheduled at the instructor's discretion and may not be of the same format. Reasonable accommodation will be made for religious observances, scholastic, athletic, or other FAU approved events and prior arrangements must be made with the instructor before the conflict occurs.

General Policy at FAU: Each student is expected to follow and conform to the rules and regulations identified in the Florida Atlantic University 2013 -2014 graduate Catalog.

Disability Policy at FAU: *In compliance with the Americans with Disabilities Act (ADA), students who, due to a disability, require special accommodation to properly execute course work must register with the Office for Students with Disabilities (OSD) -- in Boca Raton, SU 133 (561-297-3880); in Davie, LA 240 (954-236-1222); in Jupiter, SR 110 (561-799-8010) -- and follow all OSD procedures.*

Academic Integrity Policy at FAU: *Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty is considered a serious breach of these ethical standards, because it interferes with the University mission to provide a high quality education in which no student enjoys an unfair advantage over any other. Academic dishonesty is also destructive of the University community, which is grounded in a system of mutual trust and places high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. For more information, see the Code of Academic Integrity in the University Regulations:*

<http://www.fau.edu/ctl/4.001> *Code of Academic Integrity.pdf*