Syllabus

GIS 4306C LiDAR Remote Sensing (3 credits)

Department of Geosciences

Florida Atlantic University

Instructor: Dr. Caiyun Zhang
Office: SE 400
Phone: (561) 297-2648
Email: czhang3@fau.edu
Webpage: http://home.fau.edu/czhang3/web/
Office hour:
Teaching Assistant (TA):
TA office hour:
Prerequisite: GIS 3015 C Introduction to Mapping and GIS.

This class is conducted fully on line.

COURSE DESCRIPTION

This course introduces principles of LiDAR, LiDAR sensors and platforms, LiDAR data view, processing, and analysis, and LiDAR applications. Students will master basic skills of LiDAR needed to leverage the commercial LiDAR sources and information products in a broad range of applications, including topographic mapping, vegetation characterization, and 3-D modeling of urban infrastructure. Students will learn several software packages (ArcGIS LAS Dataset; FUSION/LDV; PointVue LE; LAStools) for LiDAR data displaying, processing, and analyzing.

OBJECTIVES

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

- Understand the principles of LiDAR systems.
- Describe the basic principles of geo-referencing and processing of LiDAR data.
- Describe quantitative and qualitative methods and industry standards for quality assurance and accuracy assessment of LiDAR-derived data products.
- Assess the strengths and weaknesses of various LiDAR platforms and instruments for a broad range of application scenarios.
- Apply acquired knowledge and critical thinking skills to solve a real-world problem with appropriate LiDAR data processing and analysis methods.
- Use LiDAR software packages

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 usually lasts 1-1.5 hour. Videos, lecture notes, lab instructions are loaded in the Blackboard. Relevant lab data are loaded at "G:\CourseMaterial\GIS 6032C LiDAR Remote Sensing".

BIBLIOGRAPHY (REFERENCE TEXTBOOKS)

- Popescu, S. C. 2012. *LiDAR: Remote Sensing of Terrestrial Environments.* 1st edition, CRC Press. ISBN 978-1420047639.

- Shan, J., and C. Toth. 2008. *Topographic Laser Ranging and Scanning, Principles and Processing.* Boca Raton, FL. Taylor & Francis Group. ISBN 9781420051421. (Free digital one is available at G drive).
- Maune, D. F. 2007. *Digital Elevation Model Technologies and Applications: The DEM Users Manual*. 2nd edition. Bethesda, MD. American Society for Photogrammetry and Remote Sensing. ISBN 1-57083-082-7.
- National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center, 2008. *LiDAR 101: An Introduction LiDAR Technology, Data, and Applications*. Charleston, SC: NOAA Coastal Services Center. (Free digital one is available and uploaded in the Blackboard).
- Campbell, J. B. 2007. *Introduction to Remote Sensing*. 4th edition. The Guilford Press. ISBN 978-1606230749.
- Congalton, R., and K. Green. 2009. *Assessing the Accuracy of Remotely Sensed Data*. 2nd edition. CRC Press. ISBN 978-1-4200-5512-2.
- Jensen, J.R. 2007. *Remote Sensing of the Environment: An Earth Resource Perspective.* 2nd edition. Prentice Hall. ISBN 978-0131889507.
- Wolf, P., and B. Dewitt. 2000. *Elements of Photogrammetry*. 3rd edition. Boston. McGraw-Hill. ISBN 0-07-292454-3.

COURSE MATERIALS IN BLACKBOARD

All course materials are loaded in Blackboard, and lab required data files are located in "G:\CourseMaterial\GIS 6032 C LiDAR Remote Sensing". In the Blackboard, course related information is organized 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.
- **Leaning 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.
- **Textbooks**: Free textbooks and relevant materials 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.

TENTATIVE LECTURE SCHEDULE AND LAB ASSIGNMENTS

Week	Date	Scheduled Lectures, Labs, and Assessment
1	Aug. 18	Overview of the Course (Shan and Toth's book) Introduction to LiDAR Remote Sensing (Chapter 1) *Lab 01 LiDAR Data Download and Display (PointVue LE)*
2	Aug. 25	LiDAR System Design and Platforms (Chapters 2-5) *No lab this week*
3	Sep.1	Georeferencing, Calibration, and Preprocessing (Chapters 4 & 6) *No lab this week*
4	Sep.8	LiDAR Data Format, Accuracy, and Management (Chapters 5, 9 & 10) *Lab 02 Introduction to FUSION/LDV*
5	Sep.15	LiDAR Data Analysis in ArcGIS 10.1 (Training in ESRI) *Lab 03 Introduction of LAS Dataset (LiDAR Solution in ArcGIS)*
6	Sep.22	LiDAR Data Filtering and DTM/DEM Generation (Chapter 11) *Lab 04 LiDAR Data Filtering and DTM Generation in FUSION/LDV*
7	Sep.29	*Midterm and Quiz*
8	Oct.6	LiDAR Application: Vegetation Analysis I (Chapter 12) *Lab 05 Tree Information Extraction in FUSION*
9	Oct.13	LiDAR Application: Vegetation Analysis II (Chapter 13) *Lab 06 Forest Vegetation Analysis in ArcGIS*
10	Oct.20	LiDAR Application: Vegetation Analysis III Urban Forest Inventory Using Airborne LiDAR and Hyperspectral Imagery (Instructor's PhD dissertation research) *Lab 07 LiDAR Feature Extraction with ArcGIS Spatial Analyst*
11	Oct.27	LiDAR Application: Urban Feature Extraction (Chapters 14-18) *Lab 08 2D and 3D Models for Urban Area*
12	Nov.3	LiDAR Application: Wetlands Combining LiDAR and Digital Aerial photography, or Hyperspectral Imagery for Vegetation Mapping in the Florida Everglades (Instructor's research in the Everglades) *Lab 09 Depressional Wetland Delineation from LiDAR*
13	Nov.10	LiDAR Application: Sea Level Rise Sea Level Rise Vulnerability Mapping Using LiDAR DEMs (Ms. Hannah Cooper, a Ph.D. student in Geosciences) *Lab 10 Mapping Coastal Inundation Using LiDAR DEMs*
14	Nov.17	Reading week, working on final project
15	Nov.24	SEDAAG Conference and Thanksgiving Recess
16	Dec. 8	Final Exam
Note: Schedule is subject to change.		

COURSE EVALUATION

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

Course Component	% of Final Grade
Quiz	20%
Midterm Exam	15%
Lab Exercises	50%
Final Exam	15%

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

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, Edwardo 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 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