Data Science for the Social Sciences
Special Topics in Psychology
Psychology 5939

Course Details
Class number: 17982
Section: U05-O
Day of the Week: Fridays
Inclusive Dates: January 6, 2020 to April 24, 2020
Time: 9:30 am to 12:15 pm
Semester: Spring 2020
Classroom: Charles Perry 449
Modality: Face-to-face
Textbook: Lantz, B. (2019). Machine learning in R: Expert techniques for predictive modeling. Third edition. Birmingham, UK: Packt. ISBN-13: 978-1788295864

Instructor Details
Instructor: Dr. Adela C. Timmons
Department: Psychology
Office Hours: By appointment (I am happy to meet—just ask!)
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Course Description
Data science is a rapidly growing field of study that combines domain expertise, statistical knowledge, and programming skills (no prior computer programming knowledge is required for the class). Data science is becoming increasingly integrated with psychological science, medicine, and the related social sciences, with exciting and cutting-edge applications related to digital health and phenotyping; experimental therapeutics; smart and adaptive intervention; mobile devices, wearables, and affective forecasting; and precision medicine. An understanding of the fundamentals of data science is becoming increasingly important in social science. This course is designed to be hands-on and interactive. We will have short lectures that are interspersed with lab activities designed to provide in-class, real-time opportunities for practice and implementation. The course will be taught primarily as a "flipped classroom," where lectures will be kept to a minimum and class time will be spent on applied learning. Emphasis will be on practical applications relevant to psychology, health, and the social sciences broadly. As part of the course requirements, students will complete a data science project. Pursuing class projects with overlap to ongoing projects/interests is allowed and encouraged.

Course Objectives and Outcomes:
(1) Obtain foundational knowledge in the field of data science
(2) Become familiar with cutting-edge methods and gain experience implementing these techniques
(3) Complete a data science project to demonstrate skills mastered in the course

Class Policies
- **Syllabus changes:** The information on this syllabus, including the class schedule, is subject to change by the instructor. Any changes will be announced in class and emailed to the class. An

updated version of the syllabus will always be available under the Modules tab on Canvas. Students are responsible for staying informed of these changes.

- **Contacting the instructor**: The best way to contact me is via email at: atimmons@fiu.edu. I hold my office hours by appointment and am happy to set up a time to meet with you as needed.
- **Student conduct:** Florida International university is a community dedicated to generating and imparting knowledge through excellent teaching and research, the rigorous and respectful exchange of ideas, and community service. All students should respect the right of others to have an equitable opportunity to learn and to demonstrate the quality of their learning. Therefore, all students are expected to adhere to a standard of academic conduct, which demonstrates respect for themselves, their fellow students, and the educational mission of the university. All students are deemed by the university to understand that if they are found responsible for academic misconduct, they will be subject to the academic misconduct procedures and sanctions as outlined in the Student Handbook.
- **Services for students with disabilities:** In accordance with the Americans with Disabilities Act of 1990, FIU provides appropriate accommodations and support services to qualified applicants and students with disabilities. These include, but are not limited to, auxiliary aids/services, such as sign language interpreters, assistive-listening devices for hearing-impaired individuals, extended time for proctoring of exams, and registration assistance. Accommodations and types of support services vary and are specifically designed to meet the disability-related needs of each student based on current, verifiable medical documentation. Arrangements for auxiliary aids/services are available only through the FIU Disability Resource Center. Requests for accommodations **MUST** go through this office. Initiate requests at the start of the semester.
- **Late and incomplete assignments:** Assignments are due on the date stated in the syllabus. Please turn in your assignments online via Canvas. In the event of an emergency, I will accept the assignment for full credit **IF** you turn in appropriate documentation within 2 weeks of the due date. You may turn in late assignments for half credit up until 4/17. Assignments that do not adhere to page length requirements will receive additional deductions off the total score proportional to what is turned in.

Assignments and Evaluation

- **Readings/R Code:** Come to class having read the assigned readings due on that day. Readings will be from our course textbook, articles, and example R code. **Students should read and run all example R code prior to each class.** The lecture material for the day will generally relate to and reinforce the readings. All articles are available on Canvas under Modules.
- **Attendance**: Attending every class for the entire class duration is required. I will collect attendance each week (**if you leave early without permission, even if it's only 15 minutes early, you will be marked absent**). Class attendance will make up 13% of your grade (1% per class). If you need to miss class, you must provide documentation within 2 weeks of the missed class to receive an excused absence.
- **In-class participation:** Class participation will make up 14% of your grade**.** Participation grades will be entered after the last class period and will reflect general levels of participation over the course of the semester. Please ask questions, make comments, and participate. This is especially important during class presentations—which are meant to be workshop-like feedback sessions. This class is meant to be interactive and is more fun when everyone is engaged! At the beginning of the class, please put away class-irrelevant electronic devices, including cell phones. Using your phone during class will negatively impact your participation grade. If you are expecting an emergency call, inform the instructor at the beginning of the class, turn your phone

to vibrate and take your call outside. Although the class atmosphere will be casual and friendly, it is also important to respect each other. If your behavior disrupts class, you may be asked to leave.

- **Labs:** Labs will be completed in class and will be worth 1 point each. They will make up 12% of your grade. If you miss class, you are responsible for completing the lab within 1 week of the missed class. Upload the labs on Canvas up to 1 week after the due date for full credit. Lab assignments will generally be graded as pass/fail. You will receive a point as long as you attempt almost every question and appear to try to complete the lab earnestly. Labs assignments for each week will be posted under the Assignment tab on Canvas.
- **One-on-one check ins:** I will reserve class time some weeks for you to conduct one-on-one check ins with me to help brainstorm and guide you through your analyses. There will be 4 of these check ins over the course of the semester. Each one-on-one check in is worth 3% of your grade (12% total). If you need to miss class on a day when there is a check in scheduled, you will need to provide documentation of your absence within 2 weeks of the missed class date. When we are not meeting (i.e., I am with other students), you will use class time to make progress on your project. Check ins will generally be graded as pass/fail.
- **Mid-term write up:** You will complete the first half of your write up (introduction and methods) as your mid-term project. This should be approximately 8 pages long and should include all components on the rubric (see Canvas for rubric). It should follow standard APA formatting for a manuscript. This is worth 10% of your grade. Upload the final version on Canvas by 9:30 am on 2/21.
- **Final write up:** You will complete the final write up (including any revisions suggested to your introduction and methods plus your results and discussion) as your final project. This should be approximately 16 pages long and contain all components listed on the rubric, including **at least one data visualization** (see Canvas for rubric). It should follow standard APA formatting for a manuscript. This is worth 20% of your grade. Upload the final version on Canvas by 9:30 am on 4/17.
- **Final presentation:** You will give a final presentation of your project to the class. Your presentation should contain all components listed on the rubric, including **at least one data visualization** (see Canvas for rubric). This is an opportunity to practice public speaking and communicating scientific findings to others, which are critical academic skills! This is worth 20% of your grade. Upload the final version on Canvas by 9:30 am on 4/17.
- **Odds and ends:** All course assignments should be submitted on Canvas and are due by class time on the due date. Further details and specific grading guidelines (including rubrics, if applicable) for all assignments will be provided in class and under the Assignments tab on Canvas. Late assignments can be submitted for half credit up on Canvas up until 9:30 am 4/17.

DUE DATES AND POINT BREAKDOWNS			
Assignment	**Due Date(s)**	**Points**	**Percentage**
Attendance	All class dates	13	13%
Participation	All class dates	13	13%
Labs	Most class dates	12	12%
Project concept one-on-one check in	1/24/20	3	3%
Method one-on-one check in	2/7/20	3	3%
Mid-term write up	2/21/20	10	10%
Visualization one-on-one check in	3/6/20	3	3%
Preliminary results one-on-one check in	3/27/20	3	3%

Final write up	4/17/20	14	14%
Final presentation	4/17/20	14	14%

TOPICS			
Week	**Date**	**Technical Topic**	**Social Science Applications**
1	1/10/20	Introduction to data science	
2	1/17/20	Big data and data mining	Overview and ethics
3	1/24/20*	Data visualization	Heat maps, animations, bubble plots
4	1/31/20*	Time series analysis part 1	Google search trends, EMA, forecasting
5	2/7/20	Time series analysis part 2	Google search trends, EMA, forecasting
6	2/14/20	Introduction to machine learning	Precision medicine
7	2/21/20*	Nearest neighbor and Naïve Bayes	Experimental therapeutics
8	2/28/20	Spring break - no class! ☺	
9	3/6/20	Decision trees and rules	Smartphones and wearables
10	3/13/20*	Regression	Digital phenotyping
11	3/20/20	Class work time: catch up, project work time, and individual meetings	
12	3/27/20*	Deep learning and black box methods	Smart and adaptive intervention
13	4/3/20	Association rules and clustering	
14	4/10/20	Improving model performance	
15	4/17/20	Class presentations	

*End early for CCF talk

READINGS/R CODE		
Week	**Date**	**Reading**
1	1/10/20	Introduction to Data Science; Lantz p. 24-40; read and run Week 1 Example R Code
2	1/17/20	Introduction to Big Data, Ethics of Data Science; Lantz p. 41-64; read and run Week 2 Example R Code
3	1/24/20	Data Visualization Beginner's Guide; Why Scientists Need Data Visualization; read and run Week 3 Example R Code
4	1/31/20	Jebb, Tay, Wang, & Huang, 2015 (p. 1-13; **stop** at harmonic models and **skip** interrupted time series); read and run Week 4 Example R Code
5	2/7/20	Jebb, Tay, Wang, & Huang, 2015 (p. 14-22; **plus** interrupted time series); Bridge 2019; read and run Week 5 Example R Code
6	2/14/20	Lantz Ch. 1 (**except** p. 24-28) & 10; read and run Week 6 Example R Code
7	2/21/20	Lantz Ch. 3 & 4 (for Ch. 4: p. 89-90 up to basic concepts; p. 96-97 from Naïve Bayes algorithm to classification with Naïve Bayes; 102-104; 114-122 from data preparation to end); read and run Week 7 Example R Code
8	2/28/20	No class! ☺
9	3/6/20	Lantz Ch. 5; Timmons et al., 2017; read and run Week 9 Example R Code
10	3/13/20	Lantz Ch. 6; read and run Week 10 Example R Code
11	3/20/20	Class work time: catch up, project work time, and individual meetings
12	3/27/20	Lantz Ch. 7 (**except** p. 244-249); Gonul et al., 2019; read and run Week 12 Example R Code
13	4/3/20	Lantz Ch. 8 & 9; read and run Week 13 Example R Code
14	4/10/20	Lantz Ch. 11; read and run Week 14 Example R Code

15	4/17/20	No reading

ASSIGNMENTS				
Week	**Date**	**Lab**	**One-on-One Check Ins**	**Assignment(s)**
1	1/10/20	Introduction to R		
2	1/17/20	More R		
3	1/24/20	Data visualization	Project concept	
4	1/31/20	Time series part 1		
5	2/7/20	Time series part 2	Method	
6	2/14/20	Performance		
7	2/21/20	Classification		Mid-term write up
8	2/28/20	Spring break - no class! ☺		
9	3/6/20	Trees and rules		
10	3/13/20	Regression	Visualization	
11	3/20/20	Class work time: catch up, project work time, and individual meetings		
12	3/27/20	Deep/black box		
13	4/3/20	Unsupervised	Preliminary results	
14	4/10/20	Performance		
15	4/17/20			Final presentation and write up

GRADE BREAKDOWN	
A	93.00% - 100.00%
A-	90.00% - 92.99%
B+	87.00% - 89.99%
B	83.00% - 86.99%
B-	80.00% - 82.99%
C+	77.00% - 79.99%
C	70.00% - 76.99%
D	67.00% - 60.00%
F	59.99% or less