QTM 531: COMPUTING II
SPRING 2024

Instructor: Dr. Alejandro Sánchez Becerra

Email: alejandro.sanchez.becerra@emory.edu

Office: Psychology and Interdisciplinary Sciences (PAIS), 571

COURSE OBJECTIVES

This class is the second sequence of the two computing courses connecting to QTM 530 Computing I. Assuming that students know how to explore and manipulate data, and do the basic programming, this course will focus on gaining building blocks for programming related to data analysis and machine learning. In addition, the class will introduce practical concepts relevant for reproducible research with big data. By the end of the course, students are expected to (1) fluently reshape data into the most convenient form for analysis, (2) know how to implement methods related to data analysis, (3) know how to implement algorithms in machine learning, (4) know how to implement statistical methods and machine learning algorithms using cloud, (5) know how to make a research reproducible by understanding from the development and source control to the deployment. Students would primarily write code in Jupyter/IPython notebooks. Most of the computing exercises will be based on Python.

PREREQUISITES
• QTM 530 Computing I

LECTURES
The class will be entirely based off of lectures provided by the instructor for each class and stored in the following Github repository:

https://github.com/alejandrosanchezbecerra/qtm531spring2024

REQUIRED TEXTBOOK
• [IML] Introduction to Machine Learning with Python, by Andreas C. Müller and Sarah Guido, O'Reilly
• [PD] Python for Data Analysis, by Wes McKinney, O'Reilly
• [IPBS] Introduction to Python Programming for Business and Social Science Applications, by Frederick Kaefer and Paul Kaefer

OPTIONAL MATERIAL
[FPP] Foundations of Python Programming --------
https://runestone.academy/runestone/books/published/fopp/index.html
[PE] Python for Everybody, by Charles R. Severance,
http://do1.dr-chuck.com/pythonlearn/EN_us/pythonlearn.pdf

[GLM] statsmodels.org – GLM notebook ---------- FUNCTION REFERENCE
https://www.statsmodels.org/stable/examples/notebooks/generated/glm.html
[HDS] How to think like a Data Scientist,
(https://runestone.academy/runestone/books/published/httlads/index.html
[BB] Bash for Beginners [BB], by Machtelt Garrels,
https://www.tldp.org/LDP/Bash-Beginners-Guide/Bash-Beginners-Guide.pdf
[IL] Introduction to Linux [IL], by Machtelt Garrels,
https://www.tldp.org/LDP/intro-linux/html/
[ACP] AWS Cloud Practitioner Essentials [ACP], 2nd Ed,
https://www.aws.training/Details/Curriculum?id=27076&scr=path-cp

CLASS REQUIREMENTS

Grades will be based on

• homework assignments (45%)

• mid-semester project (20%)

• final project (30%)

• class participation and in-class exercises (5%)

HOMEWORK

The homework assignment consists of 7 computer-based problem sets. Any assignment submitted after the due date/time will be considered for half points. To accommodate unexpected circumstances, your lowest homework grade will be automatically dropped at the end of the semester. Working together on the homework assignments is encouraged, but you must write your own answers. It is highly recommended that you make your solo effort on all the problems before consulting others.

HONOR CODE

All students enrolled at Emory are expected to abide by the Emory College Honor Code. Any type of academic misconduct is not allowed which includes 1) receiving or giving information about the content or conduct of an examination knowing that the release of such information is not allowed and 2) plagiarizing, whether intentionally or unintentionally, in any assignment. For the activities that are considered to be academically dishonest, refer to the Honor Code:

http://catalog.college.emory.edu/academic/policies-regulations/honor-code.html.

DISABILITY ACCOMMODATIONS

If you are seeking classroom accommodations or academic adjustments under the Americans with Disabilities Act, you are required to register with Office of Accessibility Services (OAS), http://accessibility.emory.edu/. Once registration is finalized, students must request accommodation

needs to be communicated or facilitated. Students are expected to give two weeks' notice of the need for accommodations for any class activities including the exams. For more information, please see http://accessibility.emory.edu/students/new-to-oas/registering.html. Please make sure to contact me with the relevant letter at the beginning of the semester.

COURSE SCHEDULE

Week	Date	Topic
Module 1: Programming Essentials in Python		
Week 1	17-Jan	Introduction to version control
Week 2	22-Jan	Pandas, Mathematical Operations, and Lists.
	24-Jan	Boolean Types, Ifelse, Data Subsetting
Week 3	29-Jan	Recoding, and aggregating variables
	31-Jan	Merging, Codebooks, and Chaining
Module 2: Process Automation		
Week 4	5-Feb	Scraping 1: HTML, JSON, Dictionaries
	7-Feb	Scraping 2: Retrieving and Processing
	8-Feb	Assignment 1 due (10 p.m.)
Week 5	12-Feb	Flow Control / Loops
	14-Feb	Parallelization: Multiprocessing and Multithreading
Week 6	19-Feb	Time Series, Pivoting, and Panel Data
	20-Feb	Assignment 2 due (10 p.m.)
	21-Feb	Regular Expressions and Text Wrangling
Module 3: Model Deployment		
Week 7	26-Feb	Data analysis with OLS estimator
	28-Feb	Data analysis with randomized experiment
	29-Feb	Assignment 3 due (10 p.m.)
Week 8	4-Mar	Logit model
	6-Mar	Poisson model
	7-Mar	Midsemester Project Due
Week 9	11-Mar	Spring Break (no classes, no office hours)
	13-Mar	Spring Break (no classes, no office hours)
Week 10	18-Mar	Example 1: Decision Tree
	19-Mar	Assignment 4 due (10 p.m.)
	20-Mar	Classification
Week 11	25-Mar	Model Evaluation

	27-Mar	Example 2: Neural Networks
	20-Mar	Assignment 5 due (10 p.m.)
Week 12	1-Apr	Example 3: K-Means clustering Part I
	2-Apr	Assignment 6 due (10 p.m.)
	3-Apr	Visualizing model outputs
Module 4: Databases, Development and Production		
Week 13	8-Apr	Basic Query Language
	9-Apr	Assignment 7 due (10 p.m.)
	10-Apr	Relational SQL
Week 14	15-Apr	Managing virtual environments: Conda, Dockers and containers
	17-Apr	Scripting and Operating System
Week 15	22-Apr	Source Code and APIs
	24-Apr	Deployment
	25-Apr	Assignment 7 due (10 p.m.)
Week 16	29-Apr	Parallel Computing and GNU Computing
	1-May	Final Project Due