Data-Driven Problem Solving in ME

ME 364 - Spring 2022

3 Credits

Instructor Info

Masoud Masoumi

Office Hrs:
Before the class by appointment

Office: TBA

Office Number: TBA

masoud.masoumi@cooper.edu

Course Info

Wednesdays

12-2:50pm

Classroom: 802 & 803 Lecture

Overview

This course focuses on the implementation of data analysis in engineering, providing insights, identifying possible problems in engineering systems, and providing solutions to identified problems. The course will discuss how to: 1) visualize and classify information; 2) identify problems in engineering systems using data analysis and machine learning tools; 3) predict characteristics of engineering systems; 4) provide data-driven solutions for engineering problems using data mining; and 5) design products and structures informed by data trends. A broad range of applications within mechanical engineering will be discussed.

Material

No textbook is required for this course. All the required materials will be provided. However, the following texts are two main references covered in this course:
- The Data Science Design Manual by *Steven S. Skiena* (ISBN: 978-3319554433) [Website: www.data-manual.com]
- Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython by *Wes McKinney*, 2^{nd} Edition (ISBN: 978-1491957660) [Website: www.github.com/wesm/pydata-book]

Grading Scheme

25%	Homework Assignments
15%	Reading Assignments
30%	Midterm Project
30%	Final Project

A	Grade $\geq$ 93%
A$^-$	90% $\leq$ Grade $<$ 93%
B$^+$	87% $\leq$ Grade $<$ 90%
B	83% $\leq$ Grade $<$ 87%
B$^-$	80% $\leq$ Grade $<$ 83%
C$^+$	77% $\leq$ Grade $<$ 80%
C	73% $\leq$ Grade $<$ 77%
C$^-$	70% $\leq$ Grade $<$ 73%
D$^+$	65% $\leq$ Grade $<$ 70%
D	60% $\leq$ Grade $<$ 65%
F	Grade $<$ 60%

Reading Assignments

Using data to solve problems is a general and relatively new approach as opposed to the traditional and historical way of solving problems. To familiarize you with pros and cons as well as different aspects of data-driven problem solving and data analysis, I will provide you with four reading assignments. You need to read the provided excerpt and then write a summary about what you have learned from it.

Academic Integrity

Students are expected to be independently familiar with academic standard and regulations and to recognize that their work in the course is to be their own original work that truthfully represents the time and effort applied. Violations of the academic standard and regulations are most serious and will be handled in a manner that fully represents the extent of the standard and that befits the seriousness of its violation. See the standard here. https://cooper.edu/engineering/curriculum/academic-standards-regulations for more information.

Diversity and Inclusivity

I consider this classroom to be a place where you will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, gender identities, national origins, religious affiliations, sexual orientations, ability, and other visible and non-visible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class.

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Class Schedule

The course will tentatively follow this schedule :

Week	Topic	Date
Week 1	Course Introduction	
	Python Programming	Jan 19^{th}
Week 2	Python Programming	Jan 26^{th}
Week 3[R1]	Numpy: Working with Arrays and Matrices	Feb 2^{nd}
Week 4	MODIFIED SCHEDULE - FRIDAY classes meet	Feb 9^{th}
Week 5	Pandas: Working with DataFrames	Feb 16^{th}
Week 6[R2]	Data Visualization - Part I	Feb 23^{rd}
Week 7	Data Visualization - Part II	Mar 2^{nd}
Week 8	Exploratory Data Analysis	
	Midterm Project Assignment	Mar 9^{th}
	Spring Recess - No Class	Mar 16^{th}
Week 9	Types of Learning & Linear Regression	Mar 23^{rd}
Week 10[R3]	Non-Linear Regression	Mar 30^{th}
Week 11	Classification: K-Nearest Neighbors	Apr 6^{th}
Week 12[R4]	Classification: Logistic Regression & SVM	Apr 13^{th}
Week 13	Classification: Decision Tree & Random Forest	Apr 20^{th}
Week 14	Clustering: K-Means & DBSCAN	Apr 27^{th}
Week 15[R5]	Web Scraping and APIs	May 4^{th}
Week 16	Final Project Submission and Presentation	TBA

[R1-R5] Reading assignments 1-5 due dates