

IE 496: Independent Studies

Eduardo Lopez Tasks for Jan 20–Feb 17

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1 Introduction

This project aims to provide you with an understanding of the role computation can play in data science and engineering. This understanding shall be aided by specific examples in field of transportation engineering. Specifically, the project will enable you to

1. code basic computational machine learning models
2. analyze the output of such models to make inferences
3. understand some fundamental steps involved in computational research
4. excel in subjects with programming components

The project is designed assuming that you have little or no programming experience. At the end of the semester, you should feel confident of your ability to write computer programs that allow you to accomplish the above goals. We will use the Python programming language.

1.1 Task structure

Tasks will be split in time periods of roughly 4 weeks each. Each task will involve some combination of:

- A reading assignment
- A programming assignment
- A presentation assignment, based on the reading and programming tasks: this will be due after roughly 2 weeks

1.2 References

Instructions for downloading all relevant material will be provided along with the weekly tasks. Contact the instructor if you have trouble accessing any of the material.

2 Tasks for Weeks 1–4

Complete the tasks in this order. If you are finished with these tasks, let the instructor know so we can chart out next steps.

1. [\[Reading\]](#) Read Chapter 1 of the book [1]
 - (a) Understand the concepts of ‘algorithm’, ‘flowchart’ and ‘programming language’
 - (b) Understand the consequences of programming errors
2. [\[Reading\]](#) Read the introduction to Chapter 2 of the book [1]
3. [\[Programming\]](#) Follow the instructions in Section 2.1 of [1] to install Python on your computer
4. [\[Programming\]](#) Play with Python:
 - (a) Complete all sections of ‘Learn the Basics’ until ‘Loops’ in this website: <https://www.learnpython.org/>
 - (b) This material is also covered in the remainder of Chapter 2 of the textbook, but the above website allows you to run code within your web browser
5. [\[Reading\]](#) Read this page about travel forecasting: Big Picture
6. [\[Reading\]](#) Read this page about travel forecasting: Travel Behavior
7. [\[Reading\]](#) Read Chapter 1 of this PDF: NHTS-2017 Dataset
8. [\[Programming\]](#) Load the NHTS-2017 dataset in Python
 - (a) Download the CSV survey data from this link: <https://nhts.ornl.gov/downloads>
 - (b) Follow instructions in Section 23.1 of the textbook [1] to load the file: ‘vehpub.csv’
 - (c) Complete both sections of ‘Data Science Tutorials’ in this website: <https://www.learnpython.org/>
9. [\[Reading\]](#) Read this page about regression analysis: Regression Analysis
10. [\[Presentation \(Due in 2 weeks\)\]](#) Make a roughly 10-minute powerpoint presentation summarizing the following:
 - (a) What is the basic premise of travel forecasting?
 - (b) What are some common assumptions in travel behavior modeling?
 - (c) What are some applications of the NHTS Survey dataset?
 - (d) The basic idea of regression analysis and multiple regression
 - (e) Among all the data columns in the dataset for individual vehicles (‘vehpub.csv’), what sets of variables would it make sense to do regression analysis?

2.1 Programming Tips

1. If you don't understand something, google it. A very useful internet forum for all programming-related concepts (including Python) is <https://stackoverflow.com/>
2. You can also ask questions on Slack - you will hear from the instructor or one of the grad students
3. Check the Style guide for Python
4. The ultimate resource for any programming language is its official documentation

2.2 Presentation Tips

1. Use as many pictures/graphs/plots as possible – humans are visual learners and concepts are best communicated graphically
2. Convey only ONE message per slide

References

- [1] John V. Guttag. *Introduction to Computation and Programming Using Python, third edition: With Application to Computational Modeling*. MIT Press, London, England, 2021.