

CSC/DSP 310: Programming for Data Science

Syllabus – Spring 2023

Time: CSC/DSP 310 Section 1 MWF 10-10:50, Location: Ranger Hall room 403

Webpage: BrightSpace and <https://lutzhamel.github.io/CSC310>

Prerequisites: CSC201 or CSC211

Instructor:

Prof. Lutz Hamel

email: lutzhamel@uri.edu

office: Tyler Hall Rm 251

office hours: (see BrightSpace)

Course Description

Data science exists at the intersection of computer science, statistics, and machine learning. That means writing programs to access and manipulate data so that it becomes available for analysis using statistical and machine learning techniques is at the core of data science. Data scientists use their data and analytical ability to find and interpret rich data sources; manage large amounts of data despite hardware, software, and bandwidth constraints; merge data sources; ensure consistency of datasets; create visualizations to aid in understanding data; build mathematical models using the data; and present and communicate the data insights/findings.

This course provides a survey of data science. Topics include data driven programming in Python; data sets, file formats and meta-data; descriptive statistics, data visualization, and foundations of predictive data modeling and machine learning; accessing web data and databases; distributed data management. You will work on weekly substantial programming problems such as accessing data in database and visualize it or build machine learning models of a given data set. For the midterm and the final exam you will undertake either an individual or team based programming project which you will define and implement.

Goals

The primary aim of CSC 310 is to introduce you to programming in the context of data science and statistical thinking by providing a survey of the major technologies and techniques that are currently being employed.

The objectives of CSC 310 are

- To provide an introduction to data sets, file formats, and meta-data.
- To provide an introduction to database systems such as MySQL.
- To provide a basic overview of data manipulation, statistical data summary techniques, and visualization.
- To provide an introduction to data modeling techniques, in particular computational techniques usually referred as “machine learning”.

Learning Outcomes

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

- Describe what data science is with a detailed view
- Access and visualize data
- Build and evaluate models of data
- Solve problems in data science using standard tools and techniques

Required Texts

Python Data Science Handbook, Jake VanderPlas, O'Reilly, 2017. (available free online)

Software

We will be using the freely available Google Colab environment.

Laptops

You will need to bring a working, fully charged laptop to class for in class lab exercises.

Grading

Labs, Homework	40%
Midterm Project	20%
Final Project	20%
Attendance	20%

Class attendance is mandatory. You will be given one unexcused absence per semester otherwise an unexcused absence will count against your attendance grade.

Grading Key

Symbol*	Start %*
F	0
D	60
D+	67
C-	70
C	73
C+	77
B-	80
B	83
B+	87
A-	90
A	93

Policies

- Check BrightSpace!
- **Email Policy:** Emails sent to me on **Monday through Friday between 8am and 5pm** will usually be answered within an hour or two. For emails sent to me outside of these time you can expect an answer on the next business day.
- Class **attendance** is mandatory and will be checked.
- Class **promptness, participation, and adequate preparation** for each class are expected. If you are absent, it is your responsibility to find out what you missed (e.g. handouts, announcements, assignments, new material, etc.)
- **Late assignments** will not be accepted.
- All work is to be the result of your own individual efforts unless explicitly stated otherwise. **Plagiarism, unauthorized cooperation, or any other form of cheating will be reported to the Dean.** See the appropriate sections (8.27) of the University Manual.
- Any student with a documented disability is welcome to contact me as early in the semester as possible so that we may arrange reasonable accommodations. As part of this process, please be in touch with Disability Services for Students Office at 302 Memorial Union, Phone 401-874-2098.

Tentative Schedule

Week 1 & 2

- What is Data Science?
- Data Literacy
- Google Colab Notebooks

Week 3

- A Quick Crash Course to get You started
 - Data Sources
 - The CSV File
 - Basic Descriptive Statistics
 - Visualizing Data
 - Model Building/Machine Learning

Week 4 & 5

- More on working with Numeric Data
 - Pandas Data Frames
 - Data Cleaning/Transforming
- Data Visualization with PyPlot and other Python Modules

Week 6 & 7

- Models of Data
 - Statistical Models
 - Machine Learning
- Evaluating Models
 - Model Selection
 - Model Comparisons
- Model Deployment

Week 8

- Natural Language/Text Processing (NLP)
 - Bag of Words
 - n-Grams

Week 9

- Databases
 - MySQL

Week 10

- Deep Learning
 - Convolutional networks for image processing
 - Deep neural networks for NLP

Tentative Lab Schedule

1. Colab Notebooks
2. Data Set Basics - the CSV File: loading, manipulating and summary statistics
3. Machine Learning: Decision Trees
4. Model Evaluation I
5. Working with Python Data Frames
6. Data Visualization

7. Model Evaluation II: Cross-Validation, Confusion Matrices, and Confidence Intervals
8. Additional ML Models: KNN and ANN
9. NLP: “Fake News Detection”