CPSC 311: Introduction to Machine Learning with Python

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Office: Trexler 365B
Office Hours (in-person/zoom) : MWTF 12:00-01:00 PM, or by appointment
Zoom: https://roanoke-edu.zoom.us/j/82886911429
Class: MWF 02:20-03:20 AM, Trexler 363

Course Description

We will learn how to develop machine learning applications in Python. The class will cover data collection, data cleaning, classification, regression, clustering, and natural language processing.

Optional Materials

- Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow by Aurelien Geron

Prerequisites

CPSC 170, or permission of the instructor. Familiarity with Unix is assumed.

Course Objectives

Successful students will be able to:

1. prepare data for machine learning,
2. load data into pandas data frames,
3. clean data in a pandas data frame,
4. prepare data for machine learning,
5. apply machine learning algorithms to the data.

Course Structure

In case of scheduling conflicts, make-up tests will be available by **pre-arrangement only**. Make-ups will also be available in case of documented medical emergencies.

Besides the exams, there will be homework assignments, short weekly programming projects, and a co-curricular requirement.

This course expects you to spend at least 12 hours of work each week inside and outside of class.

Homework: On all assignments, your name must be written clearly as it **appears on Inquire**. Your homework must be neat and legible, you will **lose points** for submitting rough work.

Co-curricular Requirement: The Mathematics, Computer Science and Physics department offers a series of discussions that appeal to a broad range of interests related to these fields of study. These co-curricular sessions will engage the community to think about ongoing research, novel applications and other issues that face these disciplines. Each student is required to attend **at least two** of these sessions, and turn in a short paper describing the contents of the session, and your critical reflections about the topic and content. **These papers are due in class (or via email) within a week of the session**. A paper submitted beyond a week from the event being discussed in the paper will NOT be accepted. The MCSP Conversation Series website has the schedule of talks in the series.

Grading Policy

The final grade will be computed based on the grades in the quizzes, tests, the final exam, home works and programming projects according to the following weights:

- **2%**: Co-curricular **50%**: Homework
- **24%**: Midterm **24%**: Final exam

The final course grade will be calculated as follows:

- $\geq$ **92%**: A **[90-92)%**: A- **[86-90)%**: B+ **[83-86)%**: B **[80-83)%**: B-
- **[76-80)%**: C+ **[73-76)%**: C **[70-73)%**: C- **[66-70)%**: D+ **[63-66)%**: D
- **[60-63)%**: D- **< 60%**: F

Course Policies

During Class

Please do not multitask during class. I encourage you to take hand written notes.

Attendance Policy

Regular attendance in class is highly recommended. Regardless of attendance, students are responsible for all material covered or assigned in class.

Expected Number of Hours of Work per Week

You are expected to spend at least 12 hours of work each week inside and outside of class.

Office Hours (MWTF 12:00-01:00 PM)

My office hours are in-person by default. I can also meet on Zoom with the link provided in the title of the syllabus.

Policies on Incomplete Grades and Late Assignments

Late assignments will be accepted for no penalty if a valid excuse is communicated to the instructor before the deadline. Otherwise, **you will receive no credit**.

Academic Integrity and Honesty

Students are expected to adhere to the Academic Integrity policies of Roanoke College. All work submitted for a grade is to be strictly the work of the student unless otherwise specified by the instructor. The policies as outlined in the Academic Integrity handbook will be enforced in the course.

Graded programs are subject to the Roanoke College Academic Integrity policies. Copying a program or a portion of a program (even a single line) or reading another person's program to obtain ideas for solving a problem is plagiarism. Other examples of integrity violation include writing code for someone else, using code written by someone else, telling someone else how to solve a problem or having someone tell you how to solve a problem. These cases apply to any work that is handed in for a grade under the instructor's assumption that the work is your own. Unless specified otherwise by the instructor, discussion among students should be limited to general discussion of concepts and language details, not specific aspects of a solution to the assigned problem.

AI Policy

Students are encouraged to leverage AI tools, such as code assistants and language models, as supplementary resources for learning. However, their use must adhere to the following guidelines:

1. **Understanding Over Reliance**: AI tools should be used to aid in understanding concepts, not as a substitute for learning. Students are expected to fully grasp any code or solutions generated by AI tools. Submitting AI-generated content without understanding it is considered academic dishonesty. Students must be prepared to defend their submissions. Failure to demonstrate understanding or defend submitted work will result in **no grade** for that assignment.

2. **Attribution**: Any work that involves AI assistance must be properly attributed. If an AI tool is used to generate or refine code, or to help with problem-solving, students must indicate this in their submission. For example, include a comment in the code or a note in the assignment specifying the tool used and how it was applied.

3. **Original Work**: Assignments, including programming projects, problem sets, and written work, must reflect the student's own effort and understanding. AI tools may be used for brainstorming and debugging, but the final submission should be the student's original work. Copying solutions directly from AI tools without modification is prohibited.

4. **Instructor's Discretion**: The instructor reserves the right to specify when AI tools are not permitted, such as for particular assignments or projects. These instances will be clearly communicated in advance.

Failure to adhere to this AI policy will be considered a violation of academic integrity and may result in disciplinary action.

Subject Tutoring

Subject Tutoring at Roanoke College provides free peer tutoring for current students in over 100 courses! Students can schedule tutoring appointments through the Navigate Student app (first-time users should select Roanoke College, login with their RC username & password, and create a profile). Walk-ins are also welcome! We are located on the ground floor of Fintel Library (Room 05). Subject Tutoring is open from 4 to 9 p.m. Sunday-Thursday each Fall & Spring semester. You can contact us via email at subject_tutoring@roanoke.edu or by phone at 540-375-2590 or 540-375-2247.

Writing Center

Roanoke College's Writing Center can assist current students with any writing or presentation project, at any stage of the creative process. Are you having trouble starting a project? Do you have questions about your thesis, argument, organization, citations, grammar, or any part of your paper? Perhaps your assignment is essentially ready to turn in, but you would like someone to look over it with you? The Writing Center can help! Students can schedule appointments through the Navigate Student app (first-time users should select Roanoke College, login with their RC username & password, and create a profile). Walk-ins are also welcome! We are located on the lower level of Fintel Library (Room 15). The Dr. Sandee McGlaun Writing Center is open from 4 to 9 p.m. Sunday through Thursday during the Fall and Spring semesters. You can also contact us via email at writingcenter@roanoke.edu or by phone at 540-375-4949 or 540-375-2247.

Accessible Education Services

Accessible Education Services (AES) is located in the Goode-Pasfield Center for Learning and Teaching in Fintel Library. AES provides reasonable accommodations to students with documented disabilities. To register for services, students must self-identify to AES, complete the registration process, and provide current documentation of a disability along with recommendations from the qualified specialist. Please contact Dustin Persinger, Assistant Director of Academic Services for Accessible Education, at 540-375-2247 or by e-mail at aes@roanoke.edu to schedule an appointment. If you have registered with AES in the past and would like to receive academic accommodations for this semester, please contact Dustin Persinger at your earliest convenience to schedule an appointment and/or obtain your accommodation letter for the current semester. This course expects you to spend at least 12 hours of work each week inside and outside of class.

Subject Tutoring

Subject Tutoring, located on the lower level of Fintel Library (Room 5), is open 4 pm – 9 pm, Sunday – Thursday. We are a Level II Internationally Certified Training Center through the College Reading and Learning Association (CRLA). Subject Tutors are friendly, highly-trained Roanoke College students who offer free, one-on-one tutorials in a variety of general education and major courses such as: Business, Economics, Mathematics, INQ 240, Modern Languages, Lab Sciences, INQ 250, and Social Sciences (see all available subjects at www.roanoke.edu/tutoring). Tutoring sessions are available in-person or online in 30 or 60-minute appointments (please specify if you prefer to meet with a tutor online or in-person when you make your appointment). All in-person appointments will maintain at least 6 feet of physical distance, desks will be cleaned between appointments, and masks must be worn in all indoor, public spaces. In the event that all classes go online this semester, Subject Tutoring will remain available online, too. Schedule an appointment at www.roanoke.edu/tutoring or contact us at 540-375-2590 or subject_tutoring@roanoke.edu. We hope to see you soon!

Topics

1. Introduction to Machine Learning
2. Data frames
3. Classification
4. Regression
5. Ensemble Learning
6. Dimensionality Reduction
7. Unsupervised Learning
8. Artificial Neural Networks
9. Natural Language Processing
10. Sentiment Analysis

Important Dates

- Midterm: 2:20-3:20, Friday, February 28th
- Final: 2:00-5:00 PM, Thursday, April 24th