# **Course Syllabus**

DS 637: Python and Mathematics for Machine Learning Spring 2025

Instructor: Daming(David) Li, email: dli@njit.edu

#### **Course Description and format:**

This course aims to equip students with foundational knowledge and practical skills in Python programming and mathematics as they relate to machine learning. By combining theory and practice, students will gain a solid understanding of the basics of numerical computing with Python, linear algebra, calculus, probability, optimization, as well as graph theory and analysis that becomes the most active ML research frontier, and be prepared for more advanced studies in machine learning. This course could be a valuable first step for anyone interested in pursuing a career or further studies in machine learning.

#### **Textbooks (helpful but not required):**

• Mathematics for Machine Learning 1st Edition by Marc Peter Deisenroth

**Collaboration and Honor Code:** Students may discuss problems together but must write up their own solutions. When writing up the solutions, students should write the names of people, if any, with whom they discussed the assignment. Note in particular that copying homework or programming assignments, in full or in part is forbidden. Students found cheating or plagiarizing will be immediately referred to the Dean of Students and the NJIT Committee on Professional Conduct and subject to Disciplinary Probation, a permanent marking on the record, possible dismissal, and an "F" grade in the course. All submitted assignments will be checked for similarities, and plagiarism and guilty students identified.

## Grading:

The requirements of this course will consist of participating in lectures, homework, in class computing lab assignments, two exams and a project. The grading breakdown is the following:

- Homework, computing lab exercise (10%)
- Quiz (20%)
- Term Project (20%)
- Midterm (20%)
- Exam (30%)

## Homework (10 %)

- Only use Python in homework
- Try to do it independently, discussions allowed, but copying is forbidden.

- 25% penalization per late day;
- Not accepted more than 3 days late

## Lab exercise

- Have a lab session every week
- Focus on Python computing exercises
- We will solve some simple problems
- Post your answers by replying on canvas
- Some answers may be selected for discussion by the end of lab session.
- Some problems may become part of homework

## Quiz (20%)

- Focus on course materials.
- 4 Quizzes
- Every other week
- Only Python is allowed

## Two Term Projects (20%)

- Use Python for your projects
- Use Jupyter
- Submit code and report to summarize what you have done and results you obtained.
- Prepare for presentation and demo.
- 1~3 students a group.
- More details to be announced on canvas
- Cheating/Copying is strictly prohibited.

## Two Exams (50%)

- One midterm and one Final (20%+30%)
- In-class
- Final is cumulative
- Only Python

## **Tentative course topics (Subject to changes according to progress)**

- 1. Introduction: Numerical Computing with Python
- 2. Linear Algebra and Systems of Linear Equations
- 3. Analytic Geometry
- 4. Symbolic Algebra, Eigenvalues and Eigenvectors
- 5. Matrix Decompositions
- 6. Interpolation (Quiz 2 for W4,5)

- 7. <u>Taylor Series and Root Finding</u>
- 8. <u>Midterm Exam for all above</u>
- 9. Numerical Differentiation
- 10. Numerical Integration
- 11. Vector Calculus (Quiz 3 for W9,10)
- 12. Probability and Distribution
- 13. Continuous Optimization (Quiz 4 for W11,12)
- 14. Graph Theory and Analysis
- 15. Final Exam