Course Description

Big Data are omnipresent in contemporary scientific, engineering, government, social and business applications. It contains a huge amount of information that cannot be analyzed by traditional data analytic tools. Consequently, data science has emerged as a new and exciting discipline that explores novel techniques and theories, rooted in many fields such as mathematics, statistics, computer science, and information theory, for extracting knowledge from Big Data.

This course will cover foundational aspects of data science including matrix theory, probability theory, optimization, and machine learning. Case studies will include decision trees, distributed optimization, regression etc. This course is designed to prepare students with the theoretical foundations and practical skills in analyzing data at scale.

Objectives and Learning Outcomes

The main objective of the course is to help students learn fundamental knowledge in data science and gain experience in data analytics. At the end of the course, the student

- is able to define and explain concepts/models relevant to data science
- is able to apply fundamental ideas for data analysis,
- is able to leverage algorithmic insights in order to design novel data science algorithms,
- has developed a solid background on foundations of data science algorithms,
- is able to understand and use terminology related to data science,
- is able to read material from published research in the area of foundations of data science.

Prerequisites

CSC 2110 or equivalent; some basic knowledge of probability theory and linear algebra; programming experience (the course will be taught with Python)
Required Textbooks:

*Machine Learning in Python: Essential Techniques for Predictive Analysis*, by M. Bowles

*Building Machine Learning Systems with Python*, 2nd ed. By Luis P. Coelho and Willi Richert

*A Gentle Introduction to Optimization*, by B. Guenin, J. Konemann, and L. Tuncel

**Grading and Late Policy**

The grading scale: A: 100 – 90, B: 80 – 89, C: 70 – 79, D: 60-69; F: 0-59.

The course grading includes: 50% Programming Assignments (2 ~ 4), 45% Final Project (including presentation and final writing report), 5% Class participation.

*Programming assignments* (50%): We will assign two to four programming problems over the course of the semester. The assignments must be typed in MS Word or LaTeX without exceptions (i.e., handwritten homework will receive a zero credit). They must be submitted in class at the due date. Late homework will NOT be accepted without prior permission from the course instructor.

*Final project* (45%): Over the course of the semester, you will work on a programming project that is relevant to Data Science. At the end of the semester, you are required to deliver a project presentation and also submit a 4 ~ 6 pages project report (again, typed)

*Class participation* (5%) : Attendance and participation in discussions are critical to your success in this course. Over the course of the semester, we will have up to six quizzes. These quizzes will not be announced ahead of time and will not be graded. I use them to assess the topics to emphasize and also your participation.

**Student Disabilities Services** (edited statement from the SDS web site)

If you have a documented disability that requires accommodations, you will need to register with Student Disability Services for coordination of your academic accommodations. The Student Disability Services (SDS) office is located in the Adamany Undergraduate Library. The SDS telephone number is 313-577-1851 or 313-202-4216 (Videophone use only). Once your accommodation is in place, someone can meet with you privately to discuss your special needs. Student Disability Services' mission is to assist the university in creating an accessible community where students with disabilities have an equal opportunity to fully participate in their educational experience at Wayne State University.

Students who are registered with Student Disability Services and who are eligible for alternate testing accommodations such as extended test time and/or a distraction-reduced
environment should present the required test permit to the professor at least one week in advance of the exam. Federal law requires that a student registered with SDS is entitled to the reasonable accommodations specified in the student’s accommodation letter, which might include allowing the student to take the final exam on a day different than the rest of the class.

**Academic Dishonesty -- Plagiarism and Cheating** (edited statement from the DOSO’s web site)

Academic misbehavior means any activity that tends to compromise the academic integrity of the institution or subvert the education process. All forms of academic misbehavior are prohibited at Wayne State University, as outlined in the Student Code of Conduct ([http://www.doso.wayne.edu/student-conduct-services.html](http://www.doso.wayne.edu/student-conduct-services.html)). Students who commit or assist in committing dishonest acts are subject to downgrading (to a failing grade for the test, paper, or other course-related activity in question, or for the entire course) and/or additional sanctions as described in the Student Code of Conduct.

**Cheating:** Intentionally using or attempting to use, or intentionally providing or attempting to provide, unauthorized materials, information or assistance in any academic exercise. Examples include: (a) copying from another student’s test paper; (b) allowing another student to copy from a test paper; (c) using unauthorized material such as a "cheat sheet" during an exam.

**Fabrication:** Intentional and unauthorized falsification of any information or citation. Examples include: (a) citation of information not taken from the source indicated; (b) listing sources in a bibliography not used in a research paper.

**Plagiarism:** To take and use another’s words or ideas as one’s own. Examples include: (a) failure to use appropriate referencing when using the words or ideas of other persons; (b) altering the language, paraphrasing, omitting, rearranging, or forming new combinations of words in an attempt to make the thoughts of another appear as your own.

**Other forms of academic misbehavior** include, but are not limited to: (a) unauthorized use of resources, or any attempt to limit another student’s access to educational resources, or any attempt to alter equipment so as to lead to an incorrect answer for subsequent users; (b) enlisting the assistance of a substitute in the taking of examinations; (c) violating course rules as defined in the course syllabus or other written information provided to the student; (d) selling, buying or stealing all or part of an un-administered test or answers to the test; (e) changing or altering a grade on a test or other academic grade records.

**Dates To Know**

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<thead>
<tr>
<th>Event</th>
<th>Dates</th>
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<tbody>
<tr>
<td>Classes Begin</td>
<td>Wednesday, September 2</td>
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<tr>
<td>Holiday</td>
<td>Monday, September 7</td>
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<tr>
<td>Holiday</td>
<td>Wednesday, November 25 – Sunday, November 29</td>
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<tr>
<td>Classes End</td>
<td>Monday, December 14</td>
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<tr>
<td>Final Exams</td>
<td>Wednesday, December 16 – Tuesday, December 22</td>
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Tentative Schedule

Here is a tentative schedule for the material to be covered in this course, which is subject to change by the instructor (depending on the students’ background and other considerations).

**Sept. 4, 11:** Course overview, Introduction to Python

**Sept. 18:** Practice: Python Programming

**Sept. 25/Oct. 2:** *A Gentle Introduction to Optimization*

**Oct. 9/16/23/30:** *Machine Learning in Python*

Students will decide course projects

**Nov. 6,13,20:** *Building Machine Learning Systems with Python*

**Dec. 4, 11:** Final project presentation/submission

Religious Holidays:
Because of the extraordinary variety of religious affiliations of the University student body and staff, the Academic Calendar makes no provisions for religious holidays. However, it is University policy to respect the faith and religious obligations of the individual. Students with classes or examinations that conflict with their religious observances are expected to notify their instructors well in advance so that mutually agreeable alternatives may be worked out.

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**Course Drops and Withdrawals:**
In the first two weeks of the (full) term, students can drop this class and receive 100% tuition and course fee cancellation. After the end of the second week there is no tuition or fee cancellation. Students who wish to withdraw from the class can initiate a withdrawal request on Pipeline. You will receive a transcript notation of WP (passing), WF (failing), or WN (no graded work) at the time of withdrawal. No withdrawals can be initiated after the end of the tenth week. Students enrolled in the 10th week and beyond will receive a grade. Because withdrawing from courses may have negative academic and financial consequences, students considering course withdrawal should make sure they fully understand all the consequences before taking this step. More information on this can be found at: [http://reg.wayne.edu/pdf-policies/students.pdf](http://reg.wayne.edu/pdf-policies/students.pdf)

**Student services:**
- The Academic Success Center (1600 Undergraduate Library) assists students with content in select courses and in strengthening study skills. Visit [www.success.wayne.edu](http://www.success.wayne.edu) for schedules and information on study skills workshops, tutoring and supplemental instruction (primarily in 1000 and 2000 level courses).
- The Writing Center is located on the 2nd floor of the Undergraduate Library and provides individual tutoring consultations free of charge. Visit [http://clasweb.clas.wayne.edu/writing](http://clasweb.clas.wayne.edu/writing) to obtain information on tutors, appointments, and the type of help they can provide.

**Class recordings:**
Students need prior written permission from the instructor before recording any portion of this class. If permission is granted, the audio and/or video recording is to be used only for the student’s personal instructional use. Such recordings are not intended for a wider public audience, such as postings to the internet or sharing with others. Students registered with Student Disabilities Services (SDS) who wish to record class materials must present their
specific accommodation to the instructor, who will subsequently comply with the request unless there is some specific reason why s/he cannot, such as discussion of confidential or protected information.