Course Description:
Through algorithmic investigation, brainstorming, and case analysis, students develop the skills and strategies that are necessary for effective leaning from data, including Big Data emerging from science and engineering. The course format will be a combination of lecture presentation and hand-on programming sessions. Supplementary information for the course is available at http://blackboard.wayne.edu. Log on with your Access ID for class notes, lecture slides, class announcements, the course syllabus, and other information for the course.

Credit Hours:
Lectures (3.0)

Prerequisite:
CSC 3110 or Graduate Standing

Co-requisites:
None

Text(s) Book:
Course contents:
This course covers some of the most important modeling and prediction techniques, along with relevant applications. Topics include linear regression, classification, resampling methods, shrinkage approaches, tree-based methods, deep learning, nonparametric density estimation, clustering, and more.

Laboratory (lab location)
N/A

Course Learning Objectives:
The course learning objectives are skills and abilities students should have acquired by the end of the course.

Upon successful completion of this class, the student will be able to:

<table>
<thead>
<tr>
<th>#</th>
<th>CSC 5825 Course learning Objectives</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>To understand the basic and essential concepts in machine learning.</td>
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<tr>
<td>2</td>
<td>To design and implement machine learning techniques for solving real-world problems.</td>
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<tr>
<td>3</td>
<td>To apply those techniques for data analysis.</td>
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<tr>
<td>4</td>
<td>To be aware of the cutting edge areas relevant to machine learning</td>
</tr>
</tbody>
</table>

Assessment:

- Five Homework’s 50%
- Midterm Exam 20%
- Term Project 20%
- Attendance and Participation 10%
- Bonus: TBD

Grading Scale:

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Grade</th>
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<tbody>
<tr>
<td>90-100%</td>
<td>A</td>
</tr>
<tr>
<td>85-89%</td>
<td>A-</td>
</tr>
<tr>
<td>80-84%</td>
<td>B+</td>
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<tr>
<td>75-79%</td>
<td>B</td>
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<tr>
<td>70-74%</td>
<td>B-</td>
</tr>
<tr>
<td>65-69%</td>
<td>C+</td>
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<tr>
<td>60-64%</td>
<td>C</td>
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<tr>
<td>55-59%</td>
<td>C-</td>
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<tr>
<td>54 or Below</td>
<td>F</td>
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</tbody>
</table>

Grading Policies:
You will receive the grade that you earn through your performance on the homeworks and projects. If you are not satisfied with grades you received for either homeworks or term projects, you may formally request re-grading (in writing) the entire project or homework (but NOT the individual problem(s)). I’ll be glad to honor your request but there is no guarantee of a better outcome.

Homeworks Submission Policy:

Dongxiao Zhu
CSC 5825
Homeworks must be submitted electronically through Blackboard website on/before the due date/time. Homework assignments are usually due in class at the beginning of lecture on the due date given. Homework must be typed with LaTeX, PDF or Word. Late homework’s will be accepted with penalty, i.e., 20% penalty if late for 24 hours or less, 40% penalty if late for 48 hours or less and so on. You will receive no credit if late for 120 hours or more.

Programming language: CS students must use Python to homeworks and project. Non-CS students may use the programming language of their choice.

Homework assignments will be given roughly every two weeks. Students can expect most homework assignments to be time-consuming. Students are encouraged to work together on the problem sets. Note that this says work together -- copying homework solutions from another student or from online resources will be considered as cheating. Collaboration during exams (even take-home exams) or unacceptable collaboration or plagiarism on homeworks will also be considered cheating. A student caught cheating will receive a grade of "F" for the course and face charges with University Judicial Officer. For more on what constitutes “acceptable collaboration” in this course and academic misconduct in general, see the collaboration policy document in Blackboard under “Course Documents”, the University’s Student Code of Conduct (http://www.doso.wayne.edu/assets/codeofconduct.pdf), and Academic Dishonesty section in this syllabus (below).

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.

Student Disabilities Services:

- 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 Adaman 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:
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). 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.

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

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 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 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.

<table>
<thead>
<tr>
<th>Date</th>
<th>Topics</th>
<th>Homeworks</th>
<th>Due</th>
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<tbody>
<tr>
<td>Aug 30</td>
<td>Introduction</td>
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<td></td>
<td>Go Over Syllabus and Course</td>
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<tr>
<td>Sept 4</td>
<td>Holliday (no class)</td>
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<tr>
<td>Sept 6</td>
<td>Supervised learning</td>
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<tr>
<td>Sept 11</td>
<td>Supervised learning</td>
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<tr>
<td>Sept 13</td>
<td>Bayesian decision theory</td>
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<tr>
<td>Sept 18</td>
<td>Bayesian decision theory</td>
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<tr>
<td>Sept 20</td>
<td>Parametric methods</td>
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<td>Sept 25</td>
<td>Parametric methods</td>
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<tr>
<td>Sept 27</td>
<td>Nonparametric methods</td>
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<td>Oct 2</td>
<td>Nonparametric methods</td>
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<td>Oct 4</td>
<td>Multivariate methods</td>
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<td>Oct 9</td>
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<td>Oct 11</td>
<td>Dimensionality reduction</td>
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<td>Oct 16</td>
<td>Dimensionality reduction</td>
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<td>Date</td>
<td>Topic</td>
<td>Assignment</td>
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<tr>
<td>Oct 18</td>
<td>Clustering</td>
<td>Hwk III</td>
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<td>Oct 23</td>
<td>Clustering</td>
<td>Hwk IV</td>
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<td>Oct 25</td>
<td>Decision trees</td>
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<tr>
<td>Oct 30</td>
<td>Decision trees</td>
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<tr>
<td>Nov 1</td>
<td>Linear discrimination</td>
<td>Project</td>
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<td>Nov 6</td>
<td>Linear discrimination</td>
<td>Hwk V</td>
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<tr>
<td>Nov 8</td>
<td>Multilayer perceptrons</td>
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<td>Nov 13</td>
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<td>Nov 15</td>
<td>Support vector machines</td>
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<td>Nov 20</td>
<td>Review for midterm exam</td>
<td>Hwk V</td>
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<td>Nov 22</td>
<td>Thanksgiving</td>
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<td>Nov 27</td>
<td>In-class midterm exam</td>
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<td>Nov 29</td>
<td>Deep learning – unsupervised feature learning</td>
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<td>Dec 4</td>
<td>Deep learning – convolutional neural network</td>
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<tr>
<td>Dec 6</td>
<td>Deep learning – recurrent neural network</td>
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<tr>
<td>Dec 11</td>
<td>Selected topics</td>
<td>Project</td>
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