COMP-7745-002 Machine Learning Fall Term 2023

Instructor: Salim Sazzed
Time and Location: TR 01:00 pm-02:25 pm, International Center 115
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Office Hours: By appointment (Room 131)
TA: Venkat Narsimha Reddy Velga (vvelga@memphis.edu), Hong Shi (hshi@memphis.edu), and Naresh Bolishetty (nblshtty@memphis.edu)
TA Office Hours: please email TA (CC me) to schedule a meeting.

If you have any questions, please send an email to the TAs and copy me. Whenever you deem it necessary to get answers from me, you may communicate with me directly via email/phone.

Learning Objectives
The goal of this course is to provide a comprehensive understanding of Machine Learning (ML) techniques and their practical application across different problem domains. We will delve into both the theoretical foundations and real-world, hands-on aspects of Machine Learning. By the conclusion of this course, students will have acquired the essential knowledge and skills needed to construct functional machine learning systems and effectively utilize machine learning techniques in their research endeavors.

Learning materials: Slides, Online Videos, Interactive Discussions, Textbooks, Online resources, etc.

Topics (subject to change)

**Classical Supervised/Unsupervised/Other techniques**

- Linear and logistic regression
- K-Nearest Neighbors (KNN) Algorithm
- Decision tree, Random Forest (RF), and XGBoost
- Support Vector Machine (SVM)
- Unsupervised Learning (Clustering): K-means, DBSCAN, etc.
- Dimensionality Reduction Techniques
- Semi supervised learning, Reinforcement Learning, Correlation Analysis, etc.
- Regulations and Ethics in ML

**Neural Network (NN)**

- Multilayer perceptron (MLP), Artificial Neural Networks (ANNs), and training and optimization methods
- Variants: Convolutional Neural Network (CNN), Recurrent Neural Networks (RNN), Long Short-Term Memory (LSTM), Generative Adversarial Networks (GANs), Autoencoders, Transformer.
Applications of Machine Learning / Deep Learning:

- Text Classification (e.g., sentiment analysis, abusive content detection)
- Object Recognition/Classification (e.g., biological/medical objects)

Course Textbook

No specific books are required. You are encouraged to explore online resources, such as tutorials, blogs and YouTube videos, to gain a better understanding.

Laptop:
Feel free to bring your laptop to class, as we will be utilizing online resources during the lectures.

Pre-Requisites

Linear Algebra, Probability Theory, Algorithm Analysis, Python.

Evaluation

Your final grade for this course will be determined by the following averaging procedure (subject to change):

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignments (2-3)</td>
<td>≈ 10%</td>
</tr>
<tr>
<td>Monthly Exams (3)</td>
<td>≈ 30%</td>
</tr>
<tr>
<td>Paper Presentation (1)</td>
<td>≈ 10%</td>
</tr>
<tr>
<td>Final Exams (1)</td>
<td>≈ 20%</td>
</tr>
<tr>
<td>Project (1)</td>
<td>≈ 30%</td>
</tr>
<tr>
<td>Bonus credit</td>
<td>≈ 10%</td>
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</tbody>
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Grading
Grading: A+ ≥ 95%, A ≥ 92%, A− ≥ 87%, B+ ≥ 82%, B ≥ 77%, B− ≥ 72%, C ≥ 65%

Note: A modified curve may be used for determining the grades at the discretion of the instructor.

Policies

1. Exams are closed book and closed notes.
2. No late homework will be accepted unless well-documented reasons are presented.
3. All homeworks must be individual work. Plagiarizing assignments or code sharing is not permitted.
4. Although class attendance does not contribute to your marks, it's important to make an effort to attend all the classes. There is a strong correlation between regular attendance...
and obtaining a good grade. Students are responsible for any material and content covered in missed lectures.

5. No early or late exams will be given unless under extreme situations.

6. Any grading errors in assignments should be notified within a week to the TA.

7. By taking this course, you agree that any assignment turned in may undergo a review process and that the assignment may be included as a source document in Turnitin.com's restricted access database solely for the purpose of detecting plagiarism in such documents. Any assignment not submitted according to the procedures given by the instructor may be penalized or may not be accepted at all.

8. If plagiarism or cheating occurs, the student will receive a failing grade on the assignment and (at the instructor's discretion) a failing grade in the course. The course instructor may also decide to forward the incident to the University Judicial Affairs Office for further disciplinary action. For further information on U of M code of student conduct and academic discipline procedures, please refer to https://www.memphis.edu/osa/students/academic-misconduct.php

References:

- Pattern Classification, David G. Stork, Peter E. Hart, and Richard O. Duda, Wiley, 2000
- Pattern Recognition and Machine Learning, Chris Bishop, Springer-Verlag, 2006
- Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani and Jerome Friedman, Springer, 2009
- Machine Learning: A Probabilistic Perspective, Kevin Murphy, MIT press

Acknowledgment: The syllabus has been modified from the course (COMP/EECE 7745 Machine Learning Summer 2023), offered by Md Zahangir Alom.