COMP/EECE 7/8745
Machine Learning
Fall 2022

Instructor: Md Zahangir Alom
Time and Location: T, Th, 6:00-7:25, Dann Hall 351
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Office Hours: Please send me an email to set up an appointment.
TA: TBA
TA Office Hours: TBA

Learning Objectives
The aim of this course is to study, analyze and apply fundamental techniques in Machine Learning. Both theoretical and empirical aspects of Machine learning will be emphasized. At the end of this course, students should have the necessary background to build practical machine learning systems and also be able to apply machine learning in their own research.

Topics

Concept of Learning
Data acquisition and preparation
Model validation and evaluation
Supervised Learning
- Linear regression
- Support Vector Machine (SVM)
- Kernelization tricks
- Principal Component Analysis (PCA)
- Decision tree
- Random Forest (RF)
- XGBoost
Neural Network (NN)
- NN fundamentals, MLP, and model optimization
- Autoencoder (AE)
- Extreme Learning Machine (ELM)
- Deep Belief Network (DBN))
- RNN
Graph Learning
Semi supervised and incremental learning
Unsupervised Learning
- K-means + KNN
- SOM
- tSNE, UMAP, and MDE
Reinforcement Learning
Learning with less and imbalance data
Explainable ML (XML)
Statistical analysis for ML approaches
Regulations and Ethics in ML

Course Text
a) Machine Learning, Tom Mitchell, McGraw Hill, 1997
b) Neural Networks: A systematic Introduction, Raul Rojas. Springer-Verlag, 1996.
c) Deep Learning by Ian Goodfellow, Yoshua Bengio, and Aaron Courville (available at http://www.deeplearningbook.org/).

Pre-Requisites
   Discrete Mathematics, Probability Theory, Algorithm Analysis and Data Structure

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

Assignments	$\approx 50\ \%$
Examinations	$\approx 20\ \%$
Progress Reports	$\approx 10\ \%$
Term project	$\approx 20\ \%$

   For 8000-level Ph.D. students: Research paper presentation (10%)
   • Select a paper from one of the following conferences (preferably published within the last 3 years): NIPS, ICML, KDD, CVPR, ICLR, and AAAI
   • Send me the paper that you wish to present by October 15. I will break ties if there are any and try to make sure we have a good overall schedule
   • Presentations in the last two weeks of class. Schedule will be announced later.
   • Note: If you want to present your own work related to machine learning by tying it to your research, it is highly encouraged. However, it should be current, i.e., you should perform the research during this semester and not previous work. In this case, by October 15th, please send me a proposal of your intended research.

Grading
 Grading: A+ ≥ 95%, A ≥ 90%, A− ≥ 85%, B+ ≥ 80%, B ≥ 75%, B− ≥ 65%, C ≥ 50%
Note: A modified curve may be used for determining the grades at the discretion of the instructor.

Policies
   1. Both midterm and final exams are closed book and closed notes
   2. No late homeworks 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. Regular class attendance is mandatory. There is a strong correlation between regular attendance and obtaining a good grade. Instructor reserves the right to lower grades for lack of attendance. Students are responsible for any material and contents of 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

http://www.people.memphis.edu/~jaffairs/">http://www.people.memphis.edu/~jaffairs/

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