Boston University Metropolitan College

Machine Learning

MET CS767

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Office hours: by appointment

Course Description

Theories and methods for automating and representing knowledge with an emphasis on learning from input/output data.
The course covers a wide variety of approaches, including Supervised Learning, Neural Nets and Deep Learning, Reinforcement Learning, Bayesian Learning, and Genetic Algorithms. Each student focuses on two of these approaches and creates a term project.

Prerequisites

MET CS 521 and either MET CS 622, MET CS 673 or MET CS 682.
MET CS 677 is strongly recommended.
Or, instructor's consent.

Learning Objectives

Students will accomplish the following.

(1) Understand the goals and applications of Deep Learning
(2) Apply the principal deep learning technologies
(3) Implement more than one of these techniques in a significant manner

Text Book

- "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems 2nd Edition", by Aurélien Géron
  ISBN-13: 978-1492032649
  ISBN-10: 1492032646

Other Books

Strongly suggest selecting one more book as a complement, like.

- "Machine Learning, A Probabilistic Perspective, Kevin Murphy, 1012

Courseware
List course website (Blackboard), as well as any web links that will be necessary for the class.

COVID-19 Policies

Compliance: All students returning to campus will be required, through a digital agreement, to commit to a set of Health Commitments and Expectations including face coverings, testing, contact tracing, quarantine, and isolation. The agreement makes clear that compliance is a condition of being a member of our on-campus community.

You have a critical role to play in minimizing transmission of COVID-19 within the University community, so the University is requiring that you make your own health and safety commitments. Additionally, you are asked to always wear your face mask over your mouth and nose. If you do not comply with these rules you will be asked to leave the classroom. If you refuse to leave the class, the instructor will inform the class that they will not proceed with instruction until you leave the room. If you still refuse to leave the room, the instructor will dismiss the class and will contact the academic Dean's office for follow up.

Boston University is committed to offering the best learning environment for you, but to succeed, we need your help. We all must be responsible and respectful.

Class Policies

1) **Assignment Completion & Late Work** – all the assignment has to be submitted in person or by email, or on Blackboard site. No late work will be acceptable.
2) **Academic Conduct Code** – Cheating and plagiarism will not be tolerated in any Metropolitan College course. They will result in no credit for the assignment or examination and may lead to disciplinary actions. Please take the time to review the Student Academic Conduct Code:

   http://www.bu.edu/met/metropolitan_college_people/student/resources/conduct/code.html.

Grading Criteria

The course grade will be based on

- Active class participation (10%)
- Assignments and Quizzes (35%)
    - Each Assignment and quiz will have the same weight
- Term project(s) (20%)
    - Project proposal and progress reports
    - Design and implementation (12%)
    - Final presentation and final report (8%)
- Final exam (35%)
    - Final exam will be closed book and closed notes
    - Final exam will cover the entire course
    - You can bring one page of cheat sheet to the exam

Assignments are expected to be submitted by their respective due dates. Late submissions are not accepted.

Tentative Class Syllabus

Lectures, Readings, and Assignments subject to change, and will be announced in class as applicable within a reasonable time frame.

Class Syllabus

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The course will cover many machine learning subjects including

1. Introduction to Machine learning, including
    - System level view of a machine learning solution
    - Data traps
    - Fitness functions

2. Machine learning optimization, including
    a. Gradient descent
    b. Stochastic gradient descent
    c. Regularization

3. Introduction to neural networks, including
    a. Human brain
    b. History of neural network
    c. Simple neural networks model
    d. Activation functions

4. Neural networks
    a. Architecture
    b. Cost functions
    c. Back-propagation

5. Keras and Tensorflow

6. Training neural networks

7. Hyper-parameter fine tunning

8. Convolutional Neural Networks – CNN

9. Recurring Neural Networks – RNN

10. Natural Language Processing

11. Autoencoders

12. Generative Adversarial Networks (GAN)

13. Genetics Algorithm