Northeastern University
College of Engineering

INFO 7374 Special Topics: Applied Machine Learning For Medical Devices

Course Information
Course Title: Applied Machine Learning for Medical Devices
Course Number: INFO 7374
Term and Year: Spring 2022
Credit Hour: 4
Course Format: On-Ground

Instructor Information
Full Name: Taral Oza
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Course Prerequisites
N/A

Course Description /Objectives
This course aims to use modern machine learning and deep learning techniques towards analyzing images and signals from real patients' data. The applied nature of this course focuses on leveraging latest toolchains and software libraries to find solutions for clinical problems that affect millions of lives. The course is based on use-cases for machine learning and encourages students to come up with creative and novel solutions for given problem. This course teaches using combination of tools such as R, Python, Jupyter Notebook, TensorFlow, etc. and applies them to given problem as suitable.

Standard Learning Outcomes

Learning outcomes common to all College of Engineering Graduate programs:

1. *An ability to identify, formulate, and solve complex engineering problems.*
2. *An ability to explain and apply engineering design principles, as appropriate to the program's educational objectives.*
3. *An ability to produce solutions that meet specified end-user needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.*

The Information Systems Program accepts students of different engineering backgrounds with minimum programming skills and produces first class Information Systems engineers that operate at the intersection of real-world complexity, software development, and IT management. Graduating students will be able to construct end-to-end advanced software applications that meet business needs.

Specific Learning Outcomes for the Information Systems program:

1. *Create a strong technical foundation through diverse, high-level courses*

2. *Built crucial interpersonal skills needed to succeed in any industry*
3. *Foster a deep level of applied learning through project based case studies*

APPROACH:

Students will select practical healthcare problem based on given patient data set. They will learn theory and get guidance towards applying it towards available dataset. Students will use machine learning concepts and techniques to build model, build training dataset and test dataset, test accuracy of their model using test dataset. During this exercise, students will create their own objective with help from instructor and implement machine learning based solution to achieve that.

TOOLS:

Python, R, RStudio, TensorFlow, Visual Studio Code, etc.

TOPICS:

- Recap: Fundamentals of Machine Learning
    - What?
    - Why?
    - Types: Supervised/Unsupervised/Semisupervised
    - Learnings
    - Classification
    - Deep Learning
    - Neural Networks
    - Artificial Neural Networks
    - Recurrent Neural Networks
    - Applications in the Industry
    - Signal Processing
    - Image Processing
    - Pattern Recognition
    - Speech Recognition
    - Architectures of Deep Networks
- TensorFlow based implementation
    - Overview
    - Matrices
    - Operations and Functions
    - Data Source
    - Layers
    - Loss Functions
    - Back Propagation
    - Batch and Stochastic Training
    - Linear Regression
    - Nearest Neighbor Methods
    - Neural Networks
    - Natural Language Processing
    - Convolutional Neural Network (CNN)
    - Recurrent Neural Network (RNN)

    - Single layer and Multi-layer perceptions
    - Distributed training with Keras
    - Time Series Forecasting
    - Optimizations
- Image Processing using Machine Learning
- Signal Processing using Machine Learning
- Case Studies in Healthcare
- Research Report
    - Apply machine learning to real patient data provided to you

GRADING

Coursework will be weighted as follows:

- Research Report: 70%
- Class Participation: 10%
- Quizzes: 20%

CLASS POLICIES:

- Punctuality, attendance and class participation are essential for success. If a student must miss a class for a valid reason, he/she should make arrangements ahead of time to complete the assignment and turn it in on time.
- All quizzes are open notes, open computer. Quizzes include questions requiring the student to have a good understanding of the software and concepts taught in class.
- Make-ups will only be given under extenuating and unavoidable circumstances. The student is responsible for informing the instructor prior to missing a class or an exam.
- Students should feel free to exchange ideas with each other. However, some effort through internet research is expected to solve various technical issues during class exercises.

TEXT BOOKS:

None

End-of-Course Evaluation Surveys

Your feedback regarding your educational experience in this class is very important to the College of Professional Studies. Your comments will make a difference in the future planning and presentation of our curriculum.

At the end of this course, please take the time to complete the evaluation survey at **https://neu.evaluationkit.com**. Your survey responses are **completely anonymous and confidential**. For courses 6 weeks in length or shorter, surveys will be open one week prior to the end of the courses; for courses greater than 6 weeks in length, surveys will be open for two weeks. An email will be sent to your HuskyMail account notifying you when surveys are available.

Academic Integrity

A commitment to the principles of academic integrity is essential to the mission of Northeastern University. The promotion of independent and original scholarship ensures that students derive the most from their educational experience and their pursuit of knowledge. Academic dishonesty violates the most fundamental values of an intellectual community and undermines the achievements of the entire University.

As members of the academic community, students must become familiar with their rights and responsibilities. In each course, they are responsible for knowing the requirements and restrictions regarding research and writing, examinations of whatever kind, collaborative work, the use of study aids, the appropriateness of assistance, and other issues. Students are responsible for learning the conventions of documentation and acknowledgment of sources in their fields. Northeastern University expects students to complete all examinations, tests, papers, creative projects, and assignments of any kind according to the highest ethical standards, as set forth either explicitly or implicitly in this Code or by the direction of instructors.

Go to http://www.northeastern.edu/osccr/academic-integrity-policy/ to access the full academic integrity policy.

Student Accommodations

Northeastern University and the Disability Resource Center (DRC) are committed to providing disability services that enable students who qualify under Section 504 of the Rehabilitation Act and the Americans with Disabilities Act Amendments Act (ADAAA) to participate fully in the activities of the university. To receive accommodations through the DRC, students must provide appropriate documentation that demonstrates a current substantially limiting disability.

For more information, visit http://www.northeastern.edu/drc/getting-started-with-the-drc/.

Library Services

The Northeastern University Library is at the hub of campus intellectual life. Resources include over 900,000 print volumes, 206,500 e-books, and 70,225 electronic journals.

For more information and for Education specific resources, visit http://subjectguides.lib.neu.edu/edresearch.

24/7 Blackboard Technical Help

For immediate technical support for Blackboard, call 617-373-4357 or emailhelp@northeastern.edu

Within Blackboard, open a support case via the red support button on the right side of the screen, click Create Case

myNortheastern, e-mail, and basic technical support
Visit the Information Technology Services (ITS) Support Portal
Email: help@northeastern.edu
ITS Customer Service Desk: 617-373-4357

Diversity and Inclusion

Northeastern University is committed to equal opportunity, affirmative action, diversity and social justice while building a climate of inclusion on and beyond campus. In the classroom, member of the University community

work to cultivate an inclusive environment that denounces discrimination through innovation, collaboration and an awareness of global perspectives on social justice.

Please visit http://www.northeastern.edu/oidi/ for complete information on Diversity and Inclusion

TITLE IX

Title IX of the Education Amendments of 1972 protects individuals from sex or gender-based discrimination, including discrimination based on gender-identity, in educational programs and activities that receive federal financial assistance.

Northeastern's Title IX Policy prohibits Prohibited Offenses, which are defined as sexual harassment, sexual assault, relationship or domestic violence, and stalking. The Title IX Policy applies to the entire community, including male, female, transgender students, faculty and staff.

In case of an emergency, please call 911.

Please visit www.northeastern.edu/titleix for a complete list of reporting options and resources both on- and off-campus.