COURSE SYLLABUS

INFO 7374 – SPECIAL TOPICS: APPLIED MACHINE LEARNING FOR MEDICAL DEVICES

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COURSE 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.

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.

PRE-REQUISITE:

Data Science Engineering Methods and Tools - INFO 6105 – 08
Or
Data Science Engineering Methods and Tools - INFO 6105 - 09

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

PLAGIARISM POLICY

When there is evidence that a student has committed plagiarism, copied the work of others, allowed others to copy their work, cheated on an exam, altered class material or scores, or has inappropriate possession of exams, or sensitive material, the incident will be investigated. The consequences for academic dishonesty are severe and that will include a straight F in the course with the potential for dismissal.