Department of Electrical and Computer Engineering
CNT 6154   Advanced Applied Machine Learning

Instructor: Dr. Himanshu Upadhyay

Catalog Data: This course will focus on the application of traditional machine learning algorithms and popular framework to large data sets. Students will learn about supervised/unsupervised learning, classification / regression algorithms, clustering and ensemble methods, model building and prediction, model optimization & dimensionality reduction.

Office Hour: Friday 12:30 PM - 02:30 PM (by appointment)

Email: upadhyay@fiu.edu

Prerequisites: **None**
Corequisites: **None**

Textbooks: **Hands-On Machine Learning with Scikit-Learn, Keras and TensorFlow**

                       Concepts, Tools, and Techniques to Build Intelligent Systems

                       By Aurélien Géron Publisher**:** O'Reilly Media

                       ISBN-13: 978-1492032649

                       ISBN-10: 1492032646

Reference Book: **Machine Learning**

                       By Tom Mitchell Publisher: McGraw-Hill

                       ISBN-13: 978-0071154673

                       ISBN-10: 0071154671

Type: Elective for all Graduate students
Course Objectives:

                       This course will teach students model development and prediction with machine learning algorithms using open source and commercial libraries like Scikit-Learn and MicrosoftML. Students will learn about supervised and unsupervised learning and its application to large datasets. Students will learn about python packages and concepts used in large data analytics with focus on NumPy, Pandas, SciPy, MatPlotLib and Seaborn. Research work from engineering area, case studies and assignments will be

provided to assist students in establishing real-world scenarios for data storage, model building, prediction, analysis and visualization.

Course Learning Outcomes:
At the end of this course, the students will be able to:

- Understand advanced area of AI/ML/DL
- Perform pre-processing of large data sets
- Knowledge of advanced machine learning algorithms and applications
- Identify and apply advanced classification & regression algorithms with large data sets
- Develop clusters using large data sets and advanced techniques
- Understand error metrics, dimensionality reduction & feature engineering
- Perform optimization with hyper-parameter tuning
- Perform analysis with multiple algorithms and operationalize the models for prediction.
- Understand ensemble learning and optimization
- Apply ensemble algorithms to large datasets
- Understand advanced algorithms for unsupervised learning
- Display analytics results and reporting with data visualization tools
- Able to store and analyze results in the persistent data store
- Perform anomaly detection with sensor data
- Perform research & solve problems in various engineering disciplines

Topics Covered:

- Introduction to Artificial Intelligence, Machine Learning & Deep Learning
- Python data structures and packages- Pandas, NumPy and ScikitLearn
- Data visualization with MatPlotLib and Seaborn
- Supervised / Semi-Supervised & Unsupervised Learning
- Pre-processing techniques with large data sets
- Data analysis with classification algorithms
- Application of linear and non-linear regression algorithms
- Classification Error Metrics
- Advanced optimization with Regularization & Gradient Descent
- KNN, Logistic Regression, Naïve Bayes, Decision Trees and SVM/Kernels
- Neural Network
- Ensemble Learning
- Bagging, Random Forest, Boosting and Stacking
- Advanced Clustering applications with large data sets
- K-Mean and Hierarchical Agglomerative Clustering
- Dimensionality Reduction/PCA/Kernel PCA
- Manifold Learning / Multi-Dimensional Scaling
- Anomaly Detection with Sensor Data

Grading Scheme

Grading Scale: NOTE: There are *no makeup exams* offered	
Assignments	10%
Quiz 1	10%
Midterm	25%
Quiz2	10%
Final	25%
Project – Research Paper	20%

Grading Scale

A	100-95	B+	86-89	C+	74-77	D	60-69
A-	90-94	B	82-85	C	70-73	F	0-59
		B-	78-81				

University's Code of Academic Integrity

"Florida International University is a community dedicated to generating and imparting knowledge through excellent teaching and research, the rigorous and respectful exchange of ideas, and community service. All students should respect the right of others to have an equitable opportunity to learn and honestly to demonstrate the quality of their learning. Therefore, all students are expected to adhere to a standard of academic conduct, which demonstrates respect for themselves, their fellow students, and the educational mission of the University. All students are deemed by the University to understand that if they are found responsible for academic misconduct, they will be subject to the Academic Misconduct procedures and sanctions, as outlined in the Student Handbook."
More information can be found at http://academic.fiu.edu/academic_misconduct.html

Department Regulations Concerning Incomplete Grades
To qualify for an Incomplete, a student:
1. Must contact (e.g., phone, email, etc.) the instructor or secretary before or during missed portion of class
2. Must be passing the course prior to that part of the course that is not completed
3. Must make up the incomplete work through the instructor of the course
4. Must see the Instructor. All missed work must be finished before last two weeks of the following term.

University policies: on sexual harassment, and religious holidays, and information on services for students with disabilities
http://academic.fiu.edu/
http://drc.fiu.edu

Policies:

- **Academic Misconduct:** For work submitted, it is expected that each student will submit their own original work. Any evidence of duplication, cheating or plagiarism will result at least a failing grade for the course.
- **Unexcused Absences:** Two unexcused absences are permitted during the term. More than two will result in the loss of points from your final grade. (**1 point** per absence above two**, 3 points** per absence above 5).
- **Excused Absences:** Only emergency medical situations or extenuating circumstances are excused with proper documentation. After reviewing documentation you are **required to email** a description of the excuse and absence dates as a written record to apons@fiu.edu.
- **On Time:** As in the workplace, on time arrival and preparation are required. Two "lates" are equivalent to one absence. (Leaving class early is counted the same as tardy.)
- **Deadlines:** Assignments are due at the beginning of the class period on the date specified. Assignments submitted late (within 1 week) will receive **half credit.**
- **DO NOT** send assignments by email.
- Instructor reserves right to change course materials or dates as necessary.