University of Puerto Rico
Mayagüez Campus
College of Engineering
Department of Computer Science and Engineering
Program in Software Engineering
Program in Computer Science and Engineering

COURSE SYLLABUS

COURSE TITLE:	Machine Learning Algorithms
ALPHA-NUMERIC CODIFICATION:	CIIC 5150
NUMBER OF CREDITS-CONTACT HOURS:	Three (3) credits / 45 hours
PREREQUISITES, COREQUISITES AND OTHER REQUIREMENTS:	Prerequisites – ((CIIC 4020 or equivalent) and ININ 4010) or authorization by the Department Director

COURSE DESCRIPTION:

Spanish: Desarrollo de algoritmos y programados de aprendizaje automático usando métodos de aprendizaje supervisado y no supervisado siguiendo diferentes estrategias como modelos de grafos y su generalización: árboles de decisión, modelos de núcleos, redes neuronales y principios de aprendizaje profundo, métodos de agrupamiento y el caso de detección de anomalías. Uso de librerías en un lenguaje de programación de alto-nivel utilizando un modelo computacional de grafos dirigidos en Sistema de Computación Distribuida y de unidades de procesamiento gráfico ("GPU"). Visualización gráfica de los datos y resultados utilizando herramientas de manipulación de datos y sus respectivas fuentes de datos. Revisión de publicaciones científicas relevantes al área de aprendizaje automático tanto en la industria como la academia. Este curso se podrá ofrecer en alguna de las siguientes modalidades: presencial.

English: Development of machine learning algorithms and programs using supervised and unsupervised learning methods following different strategies such as graph-based models and their generalization: decision trees, kernel methods, neural networks and deep learning concepts, clustering and anomaly detection. Use of software libraries and frameworks using computational models of directed graphs in distributed systems and graphical processing units ("GPU"). Graphical visualization of data and results using data manipulation tools and their respective data sources. Discussion of recent research publications in machine learning and their application in industry and academia. This course may be offered in any of the following modalities: face-to-face.

COURSE OBJECTIVES:

Students will acquire knowledge of the fundamental principles of machine learning algorithms and their implementation in high-level programming language frameworks. Students will also use and adapt machine learning methods to solve practical problems and produce a software artifact ready for production use.

Text Books:
- P. Dangeti, Statistics for Machine Learning: Techniques for Exploring Supervised, Unsupervised, and Reinforcement Learning Models with Python and R. Packt Publishing, 2017, ISBN 9781788295758.
- A. Muller and S. Guido, Introduction to Machine Learning with Python: A Guide for Data Scientists. O'Reilly Media, 2016, ISBN 1449369413.

Course time frame and thematic outline:

Theme	TIME DISTRIBUTION
	Face-to-Face
I. Introduction to machine learning and programming environments for algorithm development	1 hour
II. Machine learning software libraries and frameworks	1 hour
III. Introduction to regression models: Linear regression and Logistic regression	4 hours
IV. Probability and Statistics algorithms programming	2 hours
V. Linear Algebra algorithms programming	2 hours
VI. Supervised learning algorithms	5 hours
VII. Review of graph theory and related algorithms	1 hour
VIII. Graph based algorithms: generative models and Decision Trees	4 hours
IX. Kernel based algorithms	4 hours
X. Neural Network and Deep Learning Models	5 hours
XI. Contextual Information and Feature Identification	3 hours
XII. Clustering and the EM algorithm	3 hours
XIII. Anomaly Detection algorithms	2 hours
XIV. Algorithms for Reinforcement learning	3 hours
XV. Project Oral Presentations	2 hours
XVI. Exams	3 hours
Total contact hours	**45 hours**

INSTRUCTIONAL STRATEGIES:

Face-to-Face

- Conferences
- Individual tasks
- Assessment activities
- Practice activities
- Oral presentations

MINIMUM OR REQUIRED RESOURCES AVAILABLE:

RESOURCE	FACE-TO-FACE
Institutional learning management platform account (Ex. Moodle)	Institution
Institutional email account	Institution
Computer with high-speed internet access.	Institution/Student
Programs or applications: free, open-source machine learning frameworks (e.g., TensorFlow, PyTorch)	Institution/Student

EVALUATION STRATEGIES:

FACE to FACE		
	Quantity	Percent
☒ Exams	2-3	25%-35%
☒ Final Exam	1	20%-25%
☒ Short Quizzes	0-6	0%-10%
☐ Oral Reports		
☐ Monographies		
☐ Portfolio		
☒ Projects	1	30%-40%
☐ Journals		
☒ Other, specify: Homework	0-10	0%-10%
TOTAL:		100%

REASONABLE ACCOMMODATIONS:

The University of Puerto Rico at Mayagüez (RUM) recognizes that each student has an inherited right to request reasonable accommodation according to Law 51: Law for Integral Educational Services for People with Disabilities. Every student has the right to receive reasonable accommodation if he/she presents the necessary evidence to be evaluated by the Office of Services to Students with Disabilities (OSEI-RUM), and the related information can be found at the following link: https://www.uprm.edu/cms/index.php/page/85. If your case is approved by OSEI-RUM, you will receive reasonable accommodation in your courses and evaluation, and you must contact each professor for course registered. For additional information contact OSEI-RUM at Sánchez Hidalgo 410 or via telephone 787-832-4040 extension 3107.

ACADEMIC INTEGRITY:

The University of Puerto Rico promotes the highest standards of academic and scientific integrity. Article 6.2 of the UPR Student General Bylaws (Board of Trustees Certification 13, 2009-2010) states that academic dishonesty includes, but is not limited to: fraudulent actions; obtaining grades or academic degrees by false or fraudulent simulations; copying the whole or part of the academic work of another person; plagiarizing totally or partially the work of another person; copying all or part of another person's answers to the questions of an oral or written exam by taking or having someone else take the exam on his/her behalf; as well as enabling and facilitating another person to perform the aforementioned behavior. Any of these behaviors will be subject to disciplinary action in accordance with the disciplinary procedure established by the UPR Student General Bylaws.─.

To ensure the integrity and security of user data, all hybrid, distance and online courses must be offered through the institutional learning management platform, which uses secure connection and authentication protocols. The system authenticates the identity of the user (student and professor) using the username and password assigned by the institution. The users are responsible for keeping their password safe, protected, and not to share it with other people.

POLICY AGAINST DISCRIMINATION BASED ON SEX, SEXUAL ORIENTATION, AND GENDER IDENTITY:

«The University of Puerto Rico prohibits discrimination based on sex, sexual orientation, and gender identity in any of its forms, including that of sexual harassment. According to the Institutional Policy Against Sexual Harassment at the University of Puerto Rico, Certification 130 (2014-2015) from the Board of Governors, any student subjected to acts constituting sexual harassment, may turn to the Office of the Student Ombudsperson, the Office of the Dean of Students, or the Coordinator of the Office of Compliance with Title IX for an orientation or formal complaint».

GRADING SYSTEM

☒ Quantifiable (letters, A, B, C, D, F) ☐ Not Quantifiable

CONTINGENCY PLAN IN CASE OF AN EMERGENCY

In case of an emergency or class interruption the professor will use the institutional learning management platform (e.g., Moodle) and the institutional email to communicate with students, and coordinate the continuation of the class when the conditions permit it.

BIBLIOGRAPHY

1. P. Dangeti, Statistics for Machine Learning: Techniques for Exploring Supervised, Unsupervised, and Reinforcement Learning Models with Python and R. Packt Publishing, 2017, ISBN 9781788295758.
2. A. Muller and S. Guido, Introduction to Machine Learning with Python: A Guide for Data Scientists. O'Reilly Media, 2016, ISBN 1449369413.
3. A. Géron, Hands-On Machine Learning with Scikit-Learn and TensorFlow, O'Reilly Media, 2nd Edition, 2019, ISBN 1492032646.
4. R. S. Sutton, A. G. Barto, Reinforcement Learning: An Introduction, 2nd Edition, Bradford Books, 2018, ISBN 0262039249.
5. T. M. Mitchell, Machine Learning, McGraw-Hill, 1997, ISBN 0070428077 . **Classic Book**
6. E. Alpaydin, Introduction to Machine Learning, 4th Edition. Massachusetts: MIT Press., 2020, ISBN 0262043793.
7. C. Bishop, Pattern Recognition and Machine Learning, Springer, 2006, ISBN 0387310738. **Classic Book**

Electronic references:
- None