LEBANESE INTERNATIONAL UNIVERSITY

الجامعة اللبنانية الدولية

School of Arts and Sciences

Department of Computer Science and Information Technology

Fall 2025 - 2026

CSCI441 Machine Learning

Class Day	: _____	**Class Time:**	_____	**Room :**	_____
Instructor	: _____				
E-mail	: _____				
Office	: _____	**Office Hours:**	_____	**Extension No:**	_____

I. Course Description

This course introduces principles, algorithms, and applications of machine learning from the point of view of modeling and prediction. It includes formulation of learning problems and concepts of representation, performance metrics and tuning, over-fitting, and generalization. These concepts are exercised in supervised learning, unsupervised learning.

II. Course Objectives

CO-1: To explore all the major features of Python

CO-2: To train students how to explore data before using the Machine learning Models.

CO-3: To teach the students how to build Machine learning Models.

CO-4: To teach the capabilities to validate Machine learning Models.

III. Course Learning Outcomes

CLO-1: Get familiar with Python syntax

CLO-2: Analyzing and exploring data

CLO-3: The spectrum from unsupervised to supervised learning

CLO-4 Get familiar with Classification, Regression and Clustering Algorithm.

CLO-5 Performance metrics and tunning, Overfitting vs underfitting

CLO-6 Program machine learning algorithms in python using libraries such as

- Scikit-learn
- NumPy
- Matplotlib

- Pandas

IV. Mapping to program outcomes (*PLOs are listed at the end of the syllabus*)

Machine Learning	PLO -1	PLO -2	PLO -3	PLO -4	PLO -5	PLO -6	PLO -7	PLO -8	PLO -9
CLO-1				X					
CLO-2		X							
CLO-3	X								
CLO-4			X						
CLO-5			X						
CLO-6				X					

V. Topics Covered

1 Basic Python programming
2 Python libraries for Machine Learning
3 Data Exploratory Analysis
4 Supervised and Unsupervised Learning
5 Classification, Regression and Clustering Algorithm
6 Performance metrics for Machine Learning
7 Overfitting and Underfitting

VI. Prerequisite – Corequisite

CSCI378- Data Structures and Algorithms

VII. Course Material: Book or handouts

Title: *Introducing data science big data, machine learning, and more, using python tools*
Author: *Davy Cielen, Arno d. B. Meysman, Mohamed Ali*
Released 2016
Publisher(s): *Manning Publications*
ISBN*: 9781633430037*

Title: *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 3rd Edition*
Author: *Aurélien Géron*
Released October 2022
Publisher(s): *O'Reilly Media, Inc.*
ISBN*: 9781098125974*

VIII. Software Needed

Anaconda – Jupyter notebooks, VScode, Spyder, Pycharm

Google Colab

IX. Course Assessment

#	Activity	Percentage
2	Project	30
3	Midterm Exam	35
4	Final Exam	35

I. Detailed weekly Schedule

Week		Book Reference	Topic Details
Week 1 Sep 28 – Oct 4, 2025	**Lecture 1**	*Introducing data science big data, machine learning, and more, using python tools*	Syllabus reading and Course review. Quick Introduction to Python and Machine Learning
	Lecture 2	*Introducing data science big data, machine learning, and more, using python tools*	Get Familiar with Jupiter Notebook, Visual studio code and Colab website Introduction to Python syntax and expressions, variable assignment, and numbers
Week 2 Oct 5 – 11, 2025	**Lecture 1**	*Introducing data science big data, machine learning, and more, using python tools*	Python data types part1 Strings and Lists, Set and tuples (in brief)
	Lecture 2	*Introducing data science big data, machine learning, and more, using python tools*	Python data types part2 Dictionaries Booleans and Conditionals (in brief)
Week 3 Oct 12 – 18, 2025	**Lecture 1**	*Introducing data science big data, machine learning, and more, using python tools*	Loops and List Comprehensions Built-in functions and User defined (in brief) Using Python's built-in documentation
	Lecture 2	*Introducing data science big data, machine learning, and more, using python tools*	Import libraries, Math, time, random….

Week 4 Oct 19 – 25, 2025	**Lecture 1**	*Introducing data science big data, machine learning, and more, using python tools*	Introduction to numpy, pandas, matplotlip
	Lecture 2	*Introducing data science big data, machine learning, and more, using python tools*	Get Familiar with Your Data and Basic Data Exploration Introduction to Exploratory Data Analysis (EDA) and Data preprocessing,
Week 5 Oct 26 – Nov 1, 2025	**Lecture 1**	*Introducing data science big data, machine learning, and more, using python tools*	Intro to Kaggle and datasets Types of Machine learning, supervised and unsupervised, Classification, regression and clustering Algorithm
	Lecture 2	*Introducing data science big data, machine learning, and more, using python tools*	Your First Machine Learning Model, intro to Sklearn Get familiar with Machine Learning definitions (features, labels, target…)
Week 6 Nov 2 – 8, 2025	**Lecture 1**	*Introducing data science big data, machine learning, and more, using python tools*	Linear regression algorithm, what is a Linear regression algorithm? Advantages and disadvantages. Sample algorithm with python
	Lecture 2	*Introducing data science big data, machine learning, and more, using python tools*	Logistic regression vs linear regression
Week 7 Nov 9 – 15, 2025	**Lecture 1**	*Introducing data science big data, machine learning, and more, using python tools*	Naïve Bayes, how does it work? Bayes Theorem, Application of Naïve Bayes, Types of Naïve Bayes Sample algorithm with python
	Lecture 2	*Introducing data science big data, machine learning, and more, using python tools*	K-Nearest Neighbors, features similarity, K in KNN, KNN for classification and regression, Mean absolute Error and Best fit, Elbow curve, Advantages and disadvantages. Sample algorithm with python Project announcement

Week 8 Nov 16 – 22, 2025	**Lecture 1**	*Introducing data science big data, machine learning, and more, using python tools*	Decision tree, Decision Tree Terminology, Entropy and Variance, Information Gain, Random forest, how it works, why use it? steps and applications, Decision Tree VS Random Forest (mention bagging and boosting) Sample algorithms with python
	Lecture 2	*Introducing data science big data, machine learning, and more, using python tools*	Support vector Machines (Regression and classification) Basic concepts, soft margin, support vectors etc.
Week 9 Nov 23 – 29, 2025	**Lecture 1**	*Introducing data science big data, machine learning, and more, using python tools*	Intro to performance metrics, Accuracy, precision, recall, confusion matrix…..
	Lecture 2	*Introducing data science big data, machine learning, and more, using python tools*	Generalization in ML, Underfitting and overfitting, Importance of Feature Selection Sample algorithm with python Midterm
Week 10 Nov 30 – Dec 6, 2025	**Lecture 1**	*Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*	Feature Scaling, standardization, data normalization, data encoding
	Lecture 2	*Introducing data science big data, machine learning, and more, using python tools*	Clustering, Unsupervised algorithm k-Means, life example, steps, Clusters, mean distance centroid. Best K value, difference between K in KNN and in K-means Sample algorithm with python

Week 11 Dec 7 – 13, 2025	**Lecture 1**	*Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*	Demo session show different unsupervised learning tools DBScan vs Kmeans vs Agglomerative clustering Silhouette score **+** pickle (Saving models simple dump and load)
	Lecture 2	*Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*	Demo session on Dimensionality reduction, PCS and TSNE
Week 12 Dec 14 – 20, 2025	**Lecture 1**	*Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*	Intro to neural network + example in tensor flow
	Lecture 2	*Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*	**Project submission**
Week 13 Dec 21 – 27, 2025	**Lecture 1**	*Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*	**Project submission**
	Lecture 2		**christmas**
Week 14 Dec 28, 2025 – Jan 3, 2026	**Lecture 1**		**christmas**
	Lecture 2		**Project submission**
Week 15 Jan 4 – 10, 2026	**Lecture 1**		**Revision/ Project submission**
	Lecture 2		**Revision**

II. Class Rules & Discipline

Attendance Policy

The student is administratively withdrawn (AW) from the class if he/she is absent for more than one third of the classes (15 class sessions for courses offered 3 times a week, 10 for courses offered twice a week, and 5 for courses offered once a week). If the number of absences exceeds the limit after the withdrawal deadline, i.e. including all the period up-to the end of the semester, the student will not receive an AW grade, therefore, the final examination must be written, otherwise, an F grade will be granted. When absent, you are responsible for all material presented in class. Missed exams will only be excused by documented evidence as explained in the make-up examination policy below.

A "10%" has been allocated on the "Marking Profile" for attendance. A student who hasn't missed any lecture will get a full mark on the attendance grade. Every absence, a 20% will be deducted, that is, a student with 5 absences will get a ZERO on that grade.

Cheating

The University policy on cheating will be strictly applied. Students are required to adhere to the policy on academic irregularities contained in the university student handbook. Collaboration among students in solving assignments is not acceptable. It is okay to ask another student for advice when stuck on a problem, but if the instructor receives assignments that are substantially equivalent, all involved students will be punished with a grade of zero.

Classroom Manners

All students are expected to conduct themselves in a professional manner. Students should not: keep their cell phones on during the class, disrupt the class, do other course work in class, have side conversations with other students, be rude towards anyone. The first failure to respect these rules will result in a *warning* from the instructor. If a student chooses to disregard the *warning,* he/she will be dismissed from class.

Instructor late to the class

In case the instructor is late the students should wait for 15 minutes before leaving the class.

Abuse of Computing Privileges

The Office of Information Technology maintains policies posted in the computer labs regarding proper behavior in the labs. Failure to adhere to these policies may result in loss of computer privileges, and possible legal action.

Make-Up Examination Policy

As per university council decision, a student is eligible for a mid-term or final examination make-up if and only if he/she had the following incidents:

a. Sickness; **proved by hospitalization report**; that is; a discharge summary is necessary.

b. Death in the family **proved by a death certificate** and personal identification.

c. Accidents **proved by an expert report**.

A student that misses an exam should submit a petition within one week from the examination date. Late petitions will be rejected unless it is an extreme case (Hospitalization as an example).

In case a petition is accepted, the student submits a MAKE-UP exam. The grade of the missing exam will be equal to a percentage % of the Final Exam's grade. The percentage % will be set by the administration once the petition is approved.

Cheating policy: Any cheating will be rewarded with a zero, all students involved in cheating will get a zero (even if the cheating is in one question). The activity would not be repeated.

Missing Assignments and Projects Policy

- A -10 per day penalty will be applied to late projects (weekends count as two days).
- A ZERO will be applied for late assignments on the next day.

Curriculum, Yearly Plan, and Advising

If a student majoring in Computer Science or Information Technology is planning to graduate in three years then he/she should follow the corresponding major yearly plan. A copy of the yearly plan and the curriculum (which contains the prerequisites and co-requisites of courses) can be picked up from the office of the school of Arts and Science. When not sure about anything please contact your advisor prior to or during the registration period.

Probation Policy

If a student who has attempted 19 credits has a GPA or a major GPA below 2.0 then the student is considered under probation.

E-mails

Students should use their university e-mails in communicating with the instructors. Important announcements, syllabi, assignments, and solutions will be sent to your university e-mail accounts.

University Peer Review Policy

All classes will be visited by instructors either from the same or different departments. This policy helps instructors figure out ways to improve student educational experiences in class and eventually their performance.

Snapshots

Students are not allowed to take snapshots of the whiteboard in classrooms using their mobile-phones.

Equivalent Lettering Grades

Percent (%)	QPTS	Letter Grade (G)	Percent (%)	QPTS	Letter Grade (G)
<60	0	F	67	1.7	
60	1	D	68	1.8	
61	1.1		69	1.9	
62	1.2		70	2	C
63	1.3		71	2.1	
64	1.4		72	2.2	
65	1.5	D+	73	2.3	
66	1.6		74	2.4	
75	2.5	C+	83	3.3	
76	2.6		84	3.4	
77	2.7		85	3.5	B+
78	2.8		86	3.6	
79	2.9		87	3.7	
80	3	B	88	3.8	
81	3.1		89	3.9	
82	3.2		>=90	4	A

Grade	Description	QPTS
A	Excellent	4.00
B+	Very Good	3.50
B	Good	3.00
C+	Above Average	2.50
C	Average	2.00
D+	Fair	1.50
D	Poor	1.00
F	Fail	0.00

IP	Course in Progress
I	Incomplete work
W	Student has withdrawn from the course
AW	Administrative withdrawal from the course
R	Course has been repeated
S	Satisfactory work
U	Unsatisfactory work
%G	Final Grade
QPTS	Quality Points

Computer Science Outcomes
Graduates of the Computer Science Program will have the ability to:

	Program Outcomes
category -1 Underlying Conceptual Basis for Informatics	**PLO -1** Describe and explain the essential facts, concepts, theories and mathematical methods relevant to computing, computing equipment, computer communication and informatics applications as appropriate to their program of study
	PLO-1 for CSIT=> Gain basic skills in mathematics and outline the characteristics of relevant state-of-the-art hardware and software and their practical application
category -2 Analysis	**PLO -2** Select and use relevant analytic, modelling and simulation methods
	PLO-3 Choose appropriate solution patterns, algorithms and data structures
category -3 Design and Implementation	**PLO -4** Describe the software development process and apply relevant practical and programming skills to the creation of computer programs, and/or other informatics artefacts
	PLO-4 for CSIT=>Specify and design computing/network hardware/software which meet specified requirements
category -4 Economic, legal, social, ethical and environmental context	**PLO -5** Explain the importance of information privacy and security issues in relation to the design, development, maintenance, monitoring and use of informatics-based systems
category -5 Informatics practice	**PLO -6** Describe and explain management techniques appropriate to the design, implementation, testing, deployment and maintenance of informatics systems, including project management, configuration management, change management, etc., and including relevant automated techniques
	PLO -6 *for CSIT=> Demonstrate an awareness of project management and business practices, such as risk and change management, and understand their limitations;*
category -6 Other Professional Skills and Competences	**PLO -7** Communicate effectively both verbally and using a variety of communications media
	PLO -8 Plan self-learning and improve personal performance as a foundation for lifelong learning and ongoing professional development
	PLO -9 Participate effectively in informatics group-working