جمهورية مصر العربية
وزارة التعليم العالي والبحث العلمي
Ministry of Higher Education and Scientific Research

SH. A.
أكاديمية الشروق

المعهد العالى للحاسبات وتكنولوجيا المعلومات
مدينة الشروق ـ القاهرة
شعبة علوم الحاسب

Course specification

Course Code: CS 462

Course Title: Machine Learning

Academic Year: /

Course specification
(CS462 Machine Learning)

Course Outline	
Faculty:	*HICIT- (**Higher Institute for Computers & Information Technology**-El Shorouk Academy)*
Programme(s) on which the course is given:	Undergraduate program in Computer Science
Major or minor element of programme:	Compulsory
Department offering the program	Department of Computer Science
Department offering the course:	Department of Computer Science
Level	Fourth Level
Date of specification approval	DD/MM/2022

Basic Information				
Code:	CS 462	***Title:***	machine learning	
Prerequisites:	BS 210 Statistics & Probabilities			
Weekly Hours:				
Lecture: 2	**Exercise:**		**Practical : 2**	**Total:** 3 credit hours

Professional Information

Course Aims:

The objective of CS 323 is to survey the fundamentals of machine learning; The class will briefly cover topics in regression, classification, mixture models, neural networks, deep learning, ensemble methods and reinforcement learning.

After completing this course students must be able to:

- Understand the concepts of regression.
- Understand the classification.
- Understand mixture models.
- Understand neural network.
- Understand basic concepts of deep learning.
- Understand ensemble methods and reinforcement learning.

Program ILOs Covered by Course			
Knowledge and understanding	**Intellectual Skills**	**Professional and practical skills**	**General and Transferable skills**
A1, A4,A7	B1, B3,B5	C1,C16	D1,D9

Intended learning outcomes of course (ILOs)

a. Knowledge and Under-Standing:

a1 - Understand what is learning and why it is essential to the design of intelligent machines.
a2 - Know how to fit models to data.
a3 - Understand numerical computation, statistics and optimization in the context of learning.
a4 - Have a good understanding of the problems that arise when dealing with very small and very big data sets, and how to solve them.
a5 - Understand the basic mathematics necessary for constructing novel machine learning solutions.
a6 - Be able to design and implement various machine learning algorithms in a wide range of real-world applications.
a7 - Understand the background on deep learning and be able to implement deep learning models for language, vision, speech, decision making, and more.

b. Intellectual Skills:

b1 - Use machine learning software to solve real problems.

c. Professional and practical skills

c1 - Use machine learning software to solve real problems.

d. General and transferable skills

d1 - Solve problems and exhibit self-learning abilities in machine learning

Contents

Topic	Contact Hours	
	lecture	Ex/Lab
Introduction	2	2
Linear regression	2	2
Linear classification	2	2
Nonparametric Methods	2	2
Decision Trees	2	2
Probabilistic Classifiers	2	2
Neural Networks	2	2
Clustering	2	2
Mixture of Gaussians & Expectation-Maximization	2	2
Principal Components Analysis (PCA) & Autoencoders	2	2
Support Vector Machines	2	2
Ensemble Methods	2	2
Reinforcement Learning	2	2

Teaching and learning methods	
Teaching and learning methods	**Used**
Lectures	√
Tutorial Exercises	√
Practical Lab	-
Discussions.	√
Self – Learning (Reading material, Websites search,)	√
Self-studies	-
Group work	√
Presentation	√
Problem solving/problem solving learning based	√
Case study	√
Synchronous E-Learning	-
Video lectures	√
Asynchronous E-Learning	√

Student assessment methods & Schedule		
Methods	**Used**	**Week#**
Midterm Exam	√	8
Final Exam	√	16
Course Work & Quizzes	√	2-14
Practical Exam	√	15

Assessment Weight	
Assessment	**Weight %**
Mid Term Exam	15
Practical Exam and Project	15
Final Exam	60%
Course Work & Quizzes	10%
Total	100

Course Work &Quizzes
Short Exams, Assignments, Research, Reports, Presentations
Class/Project discussion

List of references	
Essential books (textbooks)	- HANDBOOK OF MACHINE LEARNING Volume 1: Foundation of Artificial Intelligence by Tshilidzi Marwala, World Scientific, 2018 - HANDBOOK OF MACHINE LEARNING Volume 2: Optimization and Decision Making by Tshilidzi Marwala, World Scientific, 2019
Course notes	E-Learning Portal
Recommended books	1. The Hundred-Page Machine Learning Book by Andriy Burkov, 2019 2. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow by Geron Aurelien, 2017
Periodicals, website	
Videos link	

Required Facilities		
Tools & SW (Technology facilities):	– Anaconda navigator – Microsoft TEAMS to create virtual classrooms for lectures, discussions for project. – Academy Portal (MOODLE) to make electronic quizzes and electronic midterm exam. – Academy Portal (MOODLE) to upload project deliverable and assignment. – Academy portal (MOODLE) to upload electronic material.	
Teaching facilities:	**Whiteboard**	√
	Computer Lab	√
	Data show	√
	E-Learning	√
	Videos	√
	Website	√

Course Content/ILO Matrix										
Course Contents	Knowledge & understanding							Intellectual skills	Professional and practical skills	General
	a1	a2	a3	a4	a5	a6	a7	b1	c1	d1
Introduction	x									
Linear Regression		x	x							
Linear Classification		x	x							
Logistic Regression		x	x		x					
Nonparametric Methods			x							
Decision Trees			x		x			x		x
Multi-class Classification				x						
Probabilistic Classifiers				x						
Neural Networks							x			
Clustering				x						
Mixture of Gaussians & Expectation-Maximization					x					
Principal Components Analysis (PCA) & Autoencoders					x			x	x	x
Support Vector Machines						x				
Ensemble Methods						x				
Reinforcement Learning						x				

Learning Method /ILOs Matrix										
Learning Methods	Knowledge and understanding							Intellectual skills	Professional and practical skills	General
	a1	a2	a3	a4	a5	a6	a7	b1	c1	d1
Lectures	x	x	x	x	x	x	x			
Tutorial Exercises	x	x	x	x	x	x	x	x	x	
Reading material										
Websites search										
Research and reporting										
Problem solving										
Group work										
Case study										
Practical Lab										
Discussions.									x	x

Assessment Methods /ILOs Matrix										
Assessment Methods	Knowledge & understanding							Intellectual skills	Professional & practical skills	General
	a1	a2	a3	a4	a5	a6	a7	b1	c1	d1
Mid Term Exam	x	x	x	x	X	x	x			
Final Exam	x	x	x	x	X	x	x	x	x	
Course Project	x	x	x	x	X	x	x			
Practical Exam								x	x	x
Course Work &Quizzes										

Course ILOs Vs. Program ILOs											
Prog ILOs / Course ILOs		Knowledge & understanding			Intellectual skills			Professional & practical skills		General	
		A1	A4	A7	B1	B3	B5	C1	C6	D1	D9
Knowledge and Understanding	a1	√									
	a2		√								
	a3	√		√							
	a4	√									
	a5			√							
	a6			√							
	a7			√							
Intellectual skills	b1				√	√	√				
Professional and practical skills	c1							√	√		
General skills	d1									√	√

Course Coordinator : Dr. Negm shawky **(** **)**
Head of Department: Dr. Ahmed El-Abbassy **(** **)**
Date: --/--/2023