هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

T-104
2022

Course Specification

Course Title:	**Machine Learning**
Course Code:	**CS1759**
Program:	**Computer Science**
Department:	**Computer Science and Engineering**
College:	**Computer Science and information technology**
Institution:	**Albaha University**
Version: :	**T104 – V1**
Last Revision Date:	February 9, 2023

Table of Contents:

A. General information about the course:

Course Identification					
1. Credit hours:	3				
2. Course type					
a.	University ☐	College ☐	Department☒	Track☐	Others☐
b.	Required ☐	Elective ☒			
3. Level/year at which this course is offered: 9 / 3rd year **(Elective (AI track))**					
4. Course general Description Lecture: This course provides an overview of Machine Learning (ML). ML is a key to develop intelligent systems and analyze data in science and engineering. ML engines enable intelligent technologies such as Siri, Kinect or Google self-driving car, to name a few. At the same time ML methods help unlocking the information in our DNA and make sense of the flood of information gathered on the web, forming the basis of a new Science of Data. This course provides an introduction to the fundamental methods at the core of modern ML. It covers theoretical foundations as well as essential algorithms for supervised and unsupervised learning. Lab: Classes on theoretical and algorithmic aspects are complemented by practical lab sessions. Laboratory exercises will be used to demonstrate various aspects of machine learning. Lab sessions should demonstrate the power of ML algorithms in practice. Supervised and unsupervised ML algorithms such as K-Nearest Neighbors, K-Means, SVM, and Naïve Bayes Classifier should be demonstrated and the differences between all techniques should be noted and clarified to students. The instructor can choose a programing language/platform from wide-range of programming languages/platforms that suit ML algorithms and techniques. There is also a wide-range of free data sets that can be obtained from online data repositories					
5. Pre-requirements for this course (if any):Artificial Intelligence(CS1505)					
6. Co- requirements for this course (if any): none					
7. Course Main Objective(s) • **The main objective of this course is to teach students about the fundamentals of ML algorithms, and identify current real-world problems that can be solved with ML techniques**					

1. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1.	Traditional classroom	44	100%

No	Mode of Instruction	Contact Hours	Percentage
2.	E-learning		
3.	Hybrid ● Traditional classroom ● E-learning		
4.	Distance learning		

2. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	22
2.	Laboratory/Studio	22
3.	Field	-
4.	Tutorial	-
5.	Others (specify)	-
	Total	44

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	Describe the fundamentals of machine learning (ML), and the main research activities in this field.	K1	● Lectures ● Slide Presentation	● Homework ● Midterm exams ● Final Exam
1.2	Recognize suitable algorithms to tackle different machine learning problems.	K1	● Lectures ● Slide Presentation	● Homework ● Midterm exams ● Final Exam
1.3	Illustrate the strengths and weaknesses of multiple machine learning approaches.	K2	● Lectures ● Discussion	● Homework ● Midterm exams ● Final Exam
2.0	Skills			
2.1	Compare existing ML algorithms for selecting suitable model parameters.	S2	● Labs Lectures ● Case study ● Practical exercises	● Quizzes ● Midterm exam ● Lab exam ● Final Exam

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
2.2	Build models for prediction and data organization from data.	S2	• Labs Lecture, • Group Discussion	• Quizzes • Midterm exam • Lab Exam • Final Exam
2.3	Develop various machine learning algorithms in a range of real-world applications.	S2	• Lab Lectures • Group Discussion • Lab exercises	• Quizzes • Lab exam • Final Exam
2.4	Employ in groups collaboratively	S5	• Discussion	• Presentation • Assessment
2.5	Explain concepts and techniques in oral presentations	S5	• Multimedia • Presentations	• Presentation • Assessment
3.0	Values, autonomy, and responsibility			
3.1	React both independently and collaboratively	V1	• Group Projects	• Rubrics

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction to Artificial Intelligence and Machine Learning	1
2.	Math Refresher	3
3.	Data Pre-processing	3
4.	Regression	3
5.	Supervised learning- Classification	3
6.	Unsupervised learning- Clustering	3
7.	Semi-Supervised learning	1
8.	Reinforcement learning	1
9.	Deep Learning	3
10.	Project presentations	1
Total		22

No	List of Topics (Lab)	Contact Hours
1.	Introduction to Machine Learning tools and frameworks	4
2.	Data Pre-processing	2
3.	Regression	3
4.	Supervised learning- Classification	3
5.	Unsupervised learning- Clustering	3
6.	Semi-Supervised learning	1

7.	Reinforcement learning	3
8.	Deep Learning	3
Total		22

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Homework exercises and/or assignments	Every two weeks	5%
2.	Quiz	10	5%
3.	Midterm	6	20%
4.	Lab reports	Every two weeks	10%
5.	Lab evaluation (rubric)	12	10%
6.	Project Evaluation (rubric)	12	10%
7.	Final Exam	13	40%
	Total		**100%**

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	▪ Bishop, C. M. (2006). *Pattern recognition and machine learning*. springer. ISBN-13: 978-1493938438 ▪ Goodfellow, I., Bengio, Y., & Courville, A. (2016). *Deep Learning* (Illustrated edition). The MIT Press. ISBN-13: 978-0262035613 ▪ (Recommended for Lab): Sarkar, D., Bali, R., & Sharma, T. (2018). Practical machine learning with Python. *A Problem-Solvers Guide To Building Real-World Intelligent Systems. Berkely: Apress*. ISBN-13: 978-1484232064
Supportive References	▪ TKelleher, J. D., Mac Namee, B., &D'arcy, A. (2020). *Fundamentals of machine learning for predictive data analytics: algorithms, worked examples, and case studies*. MIT press. ISBN-13: 978-0262044691 ▪ Pedro Domingos. A few useful things to know about machine learning. Communications of the ACM CACM Homepage archive. Volume 55 Issue 10, October 2012 Pages 78-87.

	● T. Hastie, R. Tibshirani, and J. Friedman. The Elements of Statistical Learning: Prediction, Inference and Data Mining. Second Edition, Springer Verlag, 2009 (available for free on the author's website).
Electronic Materials	▪ ACM (Association for Computer Machinery) web site - http://www.acm.org ▪ IEEE Computer Society web site - http://www.computer.org/portal/web/guest/home ● Using the learning management system of the university – Rafid System (https://lms.bu.edu.sa/).
Other Learning Materials	▪ "Algorithm Design: Foundations, Analysis, and Internet Examples," by Raghu Michael T. Goodrich and Roberto Tamassia, John Wiley and Sons, 2001.

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	▪ A classroom or lecture hall with whiteboard. ▪ An instructor computer station with o High speed Internet connection o A desktop computer o Power outlets for instructor's laptop plug-in ● All laboratories should have computers with access to at least one major programming language compiler
Technology equipment (projector, smart board, software)	▪ All students should have laptops or access to a desktop computer. ▪ A digital image projection system with connection and switches. ▪ High speed Internet connection. Power outlets for student's laptop plug-in.
Other equipment (depending on the nature of the specialty)	None

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	● Exams Evaluation Committee ● Students	● Direct: Exam Review ● Indirect: Survey
Effectiveness of students assessment	● Faculty	● Direct: Exams
Quality of learning resources	● Faculty ● Students	● Indirect: Survey ● Indirect: Survey

Assessment Areas/Issues	Assessor	Assessment Methods
The extent to which CLOs have been achieved	● Faculty ● Program Leader ● Course Coordinator ●	● Student Results (direct) ● Comprehensive Course report (where we can find the CLO assessment results)
Other	None	None

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

G. Specification Approval Data

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	