اعتماد
NCAAA

T4

2020

Course Specifications

Course Title:	Machine Learning
Course Code:	**425CSS-3**
Program:	**BSc in Computer Science**
Department:	**Computer Science**
College:	**Computer Science and Information Systems**
Institution:	**Najran University**

Table of Contents

A. Course Identification

1. Credit hours:	
2. Course type	
a. University ☐ College ☐ Department ☑ Others ☐	
b. Required ☑ Elective ☐	
3. Level/year at which this course is offered: Year 4 / Level 12	
4. Pre-requisites for this course (if any)**:** 211CSS-3	
5. Co-requisites for this course (if any)**:** None	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	60	100%
2	**Blended**		
3	**E-learning**		
4	**Distance learning**		
5	**Other**		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	30
2	**Laboratory/Studio**	20
3	**Tutorial**	10
4	**Others** (specify)	0
	Total	60

B. Course Objectives and Learning Outcomes

1. Course Description

This course introduces various algorithm design paradigms and the basics of computational complexity analysis using different models of computations with the overview of mathematical essentials, space and time complexities, asymptotic notations. Design and analysis of algorithms covers linear programming, greedy algorithms, divide-and-conquer, backtracking, branch-and-bound, search methods, graph algorithms and introduction to NP-Completeness. Machine Learning is a science of getting machines to learn, more specifically, designing algorithms that allow computers to learn from empirical data. In this course you will learn about definition and examples of machine learning, inductive learning, statistical based learning, reinforcement learning, supervised learning, unsupervised learning, learning decision trees, neural networks, belief networks, nearest neighbor algorithm, clustering, learning theory, the problem of over fitting, and computational learning theory.

2. Course Main Objective

After successful completion of this course students should be able to:

1. Comprehend the fundamental concepts of Machine Learning (ML).
2. Developing an appreciation for what is involved in learning from data.
3. Understand outline paradigms for learning, challenges in data, model selection, model complexity and model evaluation.
4. Explain several machine learning algorithms and their weaknesses and strengths.
5. Design a ML solution to real problem using different ML algorithms.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	Comprehend the fundamental concepts of Machine Learning (ML).	K1
1.2	Understand outline paradigms for learning, challenges in data, model selection, model complexity and model evaluation.	K1
1.3	Explain several machine learning algorithms and their weaknesses and strengths.	K1
1...		
2	**Skills :**	
2.1	Developing an appreciation for what is involved in learning from data.	S4, S5
2.2	Design a ML solution to real problem using different ML algorithms.	S1, S2
2.3		
2...		
3	**Values:**	
3.1		
3.2		
3.3		
3...		

C. Course Content

No	List of Topics	Contact Hours
1	Introduction	6
2	Linear Regression with One Variable	6
3	Linear Regression with Multiple Variables	6
4	Logistic Regression	6
5	Regularization	6
6	ML Project Design	6
7	Neural Networks: Representation	6
8	Neural Networks: Learning	6
9	Bayesian Decision Theory	6
10	Decision Trees / Clustering	6
Total		40

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	Comprehend the fundamental concepts of Machine Learning (ML).	1. Review of the previous topics before the new lecture that relates and has an impact on new lecture topics. 2. Explain questions during the lectures. 3. Encourage students to bring up with new ideas related to the topics/lectures. 4. Assignments 5. Tutorials	• Projects • Midterm exam Final Exam
1.2	Understand outline paradigms for learning, challenges in data, model selection, model complexity and model evaluation.	1. Compose more real life examples in the lecture relating to the surroundings of the students to draw attention that certainly helps them to concentrate more on the specific topic. 2. In some cases, pick one student who understood best a specific topic and let him describe in front of	• Projects • Midterm exam Final Exam
1.3	Explain several machine learning algorithms and their weaknesses and strengths.		• Projects • Midterm exam Final exam

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		the class in his own manner. 3. Represent more easily understandable graphs/pictures in the class to describe certain topic and in that process use interesting words or interactive sounds to help students to improve their receptive memory. 4. Dictate students on certain topics during the lectures. 5. Recall the topics of last lecture and the critical issues based on different topics, which certainly helps students to recall memory frequently and store that topic in their memory for long term. 6. Before start a new topic or at the end of each topic, students are given couple of minutes to imagine the real life scenarios relating to that topic including implementation, advantages, deficiencies etc. to improve their logical thinking.	
2.0	**Skills**		
2.1	Developing an appreciation for what is involved in learning from data.	1. Assignment or research on selected topic: Divide students in to small groups and randomly select the team leader of the group (one member at a time) who will distribute workloads among group members and responsible to collect, merge, modify the content if needed,	• Lectures • Projects
2.2	Design a ML solution to real problem using different ML algorithms.		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		represent in front of the class. 2. Quiz tournament among groups: After every two weeks all groups must participates a quiz competition where one group will produce questions from the last four lectures topics and the others will answer. 3. Delivering speech on a topic: Students will be chosen randomly to deliver speech in front of the class on the topics covered in the class in their own fashion.	
…			
3.0	**Values**		
3.1			
3.2			
…			

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Midterm	6	20
2	Project-1	5	10
3	Project-2	8	10
4	Final lab	11th	10
5	Final Theory Exam	12th or 13th	50

Assessment task (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

Arranged office hours are scheduled as follows:
Sunday: 9am -12pm
Monday: 8-9.30am
Tuesday:8am-12pm
Wednesday: 8am,12pm
Thursday: 8-10am

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	1. Ethem Alpaydin, **Introduction to Machine Learning**, Third Edition, The MIT Press (ISBN: 9780262028189). 2. Tom Mitchell, **Machine Learning**, McGrawHill, (ISBN: 0070428077)
Essential References Materials	
Electronic Materials	
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	1.Well-equipped lecture room containing board and data show device. 2.Well-equipped laboratory for practical work.
Technology Resources (AV, data show, Smart Board, software, etc.)	Lecture room should contain a PC attached to the data show device with MS Office and Adobe Acrobat Reader packages being installed
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Strategies for Obtaining Student Feedback on Effectiveness of Teaching	Students and Instructor	At the end of the semester, the university always conducts an online faculty evaluation survey for all courses registered in the semester.

Evaluation Areas/Issues	Evaluators	Evaluation Methods
• Assistance from colleagues.	Peers	• Independent assessment of standard achieved by students.
Processes for Improvement of Teaching	Instructor	Surveying for published state-of-the-art recommended teaching methodologies
Other Strategies for Evaluation of Teaching by the Instructor or by the Department 4. Processes for Verifying Standards of Student Achievement (e.g. check marking by an independent member teaching staff of a sample of student work, periodic exchange and remarking of tests or a sample of assignments with staff at another institution)	Faculty, Instructor	teaching staff of a sample of student work, periodic exchange and remarking of tests or a sample of assignments with staff at another institution) • Every exam papers are reviewed by the course coordinator. Samples of students' assignments and exams are collected every semester and reviewed from time to time as per NCAAA and ABET standards.

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	Computer Science Departmental Council
Reference No.	14440203-0185-00002
Date	1st Sep, 2022