# Course Specification

(Bachelor)

| | |
|---|---|
| **Course Title:** | Machine Learning |
| **Course Code:** | CS 462 |
| **Program:** | Computer Science |
| **Department:** | Computer Science |
| **College:** | CCIS-Male |
| **Institution:** | Majmaah University |
| **Version:** | 2023 |
| **Last Revision Date:** | 14 September 2023 |

## Table of Contents

A. General information about the course: ..... 3

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods ..... 4

C. Course Content ..... 4

D. Students Assessment Activities ..... 5

E. Learning Resources and Facilities ..... 5

F. Assessment of Course Quality ..... 5

G. Specification Approval ..... 6

## A. General information about the course:

### 1. Course Identification

| 1. Credit hours: ( 3(3,1,0) | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| **2. Course type** | | | | | |
| **A.** | ☐University | ☐College | ☒ Department | ☐Track | ☐Others |
| **B.** | ☐Required | | ☒ Elective | | |
| **3. Level/year at which this course is offered: ( 7)** | | | | | |
| **4. Course general Description:** | | | | | |
| The course objective is to study the theory and practice of constructing algorithms that learn (functions) from data. Machine learning is a field with goals overlapping with other disciplines such as statistics, algorithms, engineering, or optimization theory. It also has wide applications in a number of scientific areas such as finance, life sciences, social sciences, or medicine. Python or R Language will be used for implementation of machine learning algorithms. | | | | | |
| **5. Pre-requirements for this course** (if any)**:** | | | | | |
| STAT 102 | | | | | |
| **6. Pre-requirements for this course** (if any)**:** | | | | | |
| | | | | | |
| **7. Course Main Objective(s):** | | | | | |
| 1. To know the mathematical principles required for machine learning<br>2. To understand various classification algorithms<br>3. To understand different regression algorithms and neural networks<br>4. To use graph models and ensemble models to solve problems in machine learning<br>5. To understand practical aspects of machine learning | | | | | |

### 2. Teaching mode (mark all that apply)

| No | Mode of Instruction | Contact Hours | Percentage |
|---|---|---|---|
| 1 | Traditional classroom | 60 | 100% |

| No | Mode of Instruction | Contact Hours | Percentage |
|---|---|---|---|
| 2 | E-learning | | |
| 3 | Hybrid<br>• Traditional classroom<br>• E-learning | | |
| 4 | Distance learning | | |

### 3. Contact Hours (based on the academic semester)

| No | Activity | Contact Hours |
|---|---|---|
| 1. | **Lectures** | 45 |
| 2. | **Laboratory/Studio** | 15 |
| 3. | **Field** | |
| 4. | **Tutorial** | |
| 5. | **Others (specify)** | |
| **Total** | | 60 |

## 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** | | | |
| | | | | |
| | | | | |
| | | | | |
| **2.0** | **Skills** | | | |
| 2.1 | **To know the mathematical principles required for machine learning** | **S2** | Classroom Teaching | Quizzes, Midterm Exam, Final Exam |
| 2.2 | **To understand various classification algorithms** | **S2** | Classroom Teaching | Quizzes, Midterm Exam, Final Exam |
| 2.3 | **To understand different regression** | **S2** | Classroom Teaching | Quizzes, Midterm Exam, Final Exam |

| Code | Course Learning Outcomes | Code of CLOs aligned with program | Teaching Strategies | Assessment Methods |
|---|---|---|---|---|
| | **algorithms and neural networks** | | | |
| 2.4 | **To understand practical aspects of machine learning** | **S4** | Mini Project, Lab Exercises | Lab project |
| **3.0** | **Values, autonomy, and responsibility** | | | |
| 3.1 | **To use graph models and ensemble models to solve problems in machine learning** | **V1** | Mini Project, Lab Exercises | Seminar |
| 3.2 | | | | |
| ... | | | | |

## C. Course Content

| No | List of Topics | Contact Hours |
|---|---|---|
| 1. | Introduction to Machine Learning and its applications | 4 |
| 2. | Supervised learning and Bayesian Decision theory | 8 |
| 3. | Parametric methods Multivariate methods | 4 |
| 4. | Dimensionality reduction Clustering | 8 |
| 5. | Nonparametric methods Decision trees | 4 |
| 6. | Linear discrimination, Multilayer perceptrons -Neural Network | 8 |
| 7. | Kernel machines , Graphical Models | 4 |
| 8. | Hidden markov models | 4 |
| 9. | Ensemble methods : Bagging, Boosting – Random Forests | 8 |
| 10. | Practical aspects in machine learning Data preprocessing-overfitting-accuracy estimation, parameter and model selection | 8 |
| | | |
| | | |
| **Total** | | **60** |

## D. Students Assessment Activities

| No | Assessment Activities * | Assessment timing (in week no) | Percentage of Total Assessment Score |
|---|---|---|---|
| 1. | Assignment 1 | 4 | 5% |
| 2. | Quiz 1 | 5 | 10% |
| 3. | Mid Term | 8 | 20% |
| 4. | Assignment 2 | 9 | 5% |
| 5. | Quiz 1 | 12 | 10% |
| 6. | Mini Project/ Seminar | 14 | 10% |
| 7. | Final Exam | 16 | 40% |

*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 | Introduction to Machine Learning, Ethem Alpaydın, MIT Press, 3rd ed, 2014, ISBN: 978-0-262-02818-9 |
| Supportive References | |
| Electronic Materials | |
| Other Learning Materials | |

### 2. Required Facilities and equipment

| Items | Resources |
|---|---|
| **facilities** (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.) | Classroom, Lab |
| **Technology equipment** (projector, smart board, software) | Projector, Smart Board, Python |
| **Other equipment** (depending on the nature of the specialty) | |

## F. Assessment of Course Quality

| Assessment Areas/Issues | Assessor | Assessment Methods |
|---|---|---|
| Effectiveness of teaching | Students | Indirect |
| Effectiveness of Students assessment | Instructor | Direct |
| Quality of learning resources | Instructor | Direct |

| Assessment Areas/Issues | Assessor | Assessment Methods |
|---|---|---|
| The extent to which CLOs have been achieved | | |
| Other | | |

**Assessors** (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

**Assessment Methods** (Direct, Indirect)

## G. Specification Approval

| | |
|---|---|
| **COUNCIL /COMMITTEE** | |
| **REFERENCE NO.** | |
| **DATE** | |