MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

| **Module Information**  **معلومات المادة الدراسية** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Module Title** | Artificial Intelligence | | | | **Module Delivery** | | |
| **Module Type** | Core | | | | * **☒ Theory** * **☐ Lecture** * **☒ Lab** * **☐ Tutorial** * **☐ Practical** * **☐ Seminar** | | |
| **Module Code** | BMI311 | | | |
| **ECTS Credits** | 5 | | | |
| **SWL (hr/sem)** | 125 | | | |
| **Module Level** | | UGx1 3 | **Semester of Delivery** | | | | 5 |
| **Administering Department** | | BID | **College** | BMIC | | | |
| **Module Leader** | Mohammed Fadhil | | **e-mail** | mfadhil@uoitc.edu.iq | | | |
| **Module Leader’s Acad. Title** | | Lecturer | **Module Leader’s Qualification** | | | | Ph.D. |
| **Module Tutor** | Mohammed Fadhil | | **e-mail** | mfadhil@uoitc.edu.iq | | | |
| **Peer Reviewer Name** | | omar A. M | **e-mail** | omara.m@uoitc.edu.iq | | | |
| **Scientific Committee Approval Date** | | 18/06/2023 | **Version Number** | | | 1.0 | |

| **Relation with other Modules**  **العلاقة مع المواد الدراسية الأخرى** | | | |
| --- | --- | --- | --- |
| **Prerequisite module** | Data analysis and visualization /BID225  Bioinformatics programming / BID221 | **Semester** | 4 |
| **Co-requisites module** | None | **Semester** |  |

| **Module Aims, Learning Outcomes and Indicative Contents**  **أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية** | |
| --- | --- |
| **Module Aims**  **أهداف المادة الدراسية** | 1. To provide students with an introduction to the field of artificial intelligence (AI) and machine learning (ML). Students will gain a clear understanding of what AI is and how it differs from traditional programming approaches. 2. To familiarize students with the three main types of machine learning: supervised learning, unsupervised learning, and reinforcement learning. Students will understand the differences between these types and their respective applications. 3. Focus on supervised learning, specifically regression and classification. Students will learn the concepts and techniques used for building models that predict continuous values (regression) or assign data points to specific categories (classification). 4. To provide students with a comprehensive understanding of the end-to-end process of building a machine learning pipeline. They will learn about data preprocessing, feature engineering, model selection, and model training. Additionally, the module will cover strategies for troubleshooting common issues that arise during the machine learning process. 5. To equip students with the knowledge and skills required to evaluate the performance of machine learning models. Students will learn various performance metrics, such as accuracy, precision, recall, and F1 score, and understand how to interpret and use them effectively. |
| **Module Learning Outcomes**  **مخرجات التعلم للمادة الدراسية** | 1. Understand the fundamentals of AI and machine learning. 2. Differentiate between traditional programming and machine learning approaches. 3. Explain the applications and impact of AI and ML in various fields. 4. Identify and describe supervised, unsupervised, and reinforcement learning. 5. Apply regression techniques for predicting continuous values. 6. Utilize classification algorithms for assigning data points to categories. 7. Construct a machine learning pipeline and troubleshoot common issues. 8. Evaluate model performance using accuracy, precision, recall, and F1 score. 9. Interpret and analyze model evaluation results for decision-making. |
| **Indicative Contents**  **المحتويات الإرشادية** | Indicative content includes the following.  Module 1: Introduction to AI and Machine Learning   * Introduction to AI and its applications * Overview of machine learning and its types * Difference between traditional programming and machine learning * Impact of AI and ML in various fields   Module 2: Types of Machine Learning: Supervised, Unsupervised, and Reinforcement Learning   * Supervised learning: concepts and examples * Unsupervised learning: concepts and applications * Reinforcement learning: principles and real-world applications   Module 3: Supervised Learning: Regression and Classification   * Introduction to regression and its techniques * Implementation of regression models * Introduction to classification and its techniques   Module 4: Building the Machine Learning Pipeline and Troubleshooting Models   * Data preprocessing: cleaning, transformation, and normalization * Feature engineering: selection and extraction * Model selection and training * Troubleshooting common issues in machine learning   Module 5: Model Evaluation and Performance Metrics   * Evaluation metrics: accuracy, precision, recall, F1 score * Interpreting evaluation results and making decisions |

| **Learning and Teaching Strategies**  **استراتيجيات التعلم والتعليم** | |
| --- | --- |
| **Strategies** | This strategy incorporates lectures and presentations to introduce key concepts, while also emphasizing project-based learning and practical exercises. Students work on hands-on projects, implementing machine learning solutions, and engaging in coding exercises to reinforce their understanding and develop practical skills in AI and machine learning. |

| **Student Workload (SWL)**  **الحمل الدراسي للطالب** | | | |
| --- | --- | --- | --- |
| **Structured SWL (h/sem)**  **الحمل الدراسي المنتظم للطالب خلال الفصل** | 64 | **Structured SWL (h/w)**  **الحمل الدراسي المنتظم للطالب أسبوعيا** | 4 |
| **Unstructured SWL (h/sem)**  **الحمل الدراسي غير المنتظم للطالب خلال الفصل** | 61 | **Unstructured SWL (h/w)**  **الحمل الدراسي غير المنتظم للطالب أسبوعيا** | 4 |
| **Total SWL (h/sem)**  **الحمل الدراسي الكلي للطالب خلال الفصل** | 125 | | |

| **Module Evaluation**  **تقييم المادة الدراسية** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **As** | | **Time/Number** | **Weight (Marks)** | **Week Due** | **Relevant Learning Outcome** |
| **Formative assessment** | **Quizzes** | 2 | 10% (10) | 5, 9 | LO #1, 2, 7and 9 |
| **Assignments** | 2 | 10% (10) | 2, 12 | LO # 3, 4, 6 and 7 |
| **Projects / Lab.** | 1 | 10% (10) | Continuous |  |
| **Report** | 1 | 10% (10) | 13 | LO # 5, 8 and 9 |
| **Summative assessment** | **Midterm Exam** | 2 hr | 10% (10) | 7,14 | LO # 1-5 |
| **Final Exam** | 3hr | 50% (50) | 16 | All |
| **Total assessment** | | | 100% (100 Marks) |  |  |

| **Delivery Plan (Weekly Syllabus)**  **المنهاج الاسبوعي النظري** | |
| --- | --- |
| **Week** | **Material Covered** |
| **Week 1** | Introduction to AI and Machine Learning: An Overview of Concepts and Applications |
| **Week 2** | Supervised Learning: Algorithms and Techniques for Predictive Modeling |
| **Week 3** | Data Preprocessing: Cleaning, Transformation, and Feature Scaling |
| **Week 4** | Regression: Linear regression |
| **Week 5** | Optimization |
| **Week 6** | Classification Methods: Decision Trees |
| **Week 7** | 1st Exam |
| **Week 8** | Feature Engineering: Selection, Extraction, and Feature Importance |
| **Week 9** | Model Selection and Evaluation: Cross-Validation and Performance Metrics |
| **Week 10** | Model Training and Optimization: Regularization, Hyperparameter Tuning, and Validation Set |
| **Week 11** | Troubleshooting Machine Learning Models: Overfitting, Underfitting, and Bias-Variance Tradeoff |
| **Week 12** | Evaluation Metrics: Accuracy, Precision, Recall, F1 Score, and ROC Curve Analysis |
| **Week 13** | Interpreting Model Performance: Understanding Confusion Matrices and Business Applications |
| **Week 14** | 2nd Exam |
| **Week 15** | Review and discuss |

| **Delivery Plan (Weekly Lab. Syllabus)**  **المنهاج الاسبوعي للمختبر** | |
| --- | --- |
| **Week** | **Material Covered** |
| **Week 1** | Part 1/ Lab 1: Introduction to Python for AI and Machine Learning: Setting up the Environment and libraries |
| **Week 2** | Part 2/ Lab 1: Introduction to Python for AI and Machine Learning: Setting up the Environment and libraries |
| **Week 3** | Part 1 / Lab 2: Implementing Regression Models using Scikit-learn: Linear Regression |
| **Week 4** | Part 2 / Lab 2: Implementing Regression Models using Scikit-learn: Linear Regression |
| **Week 5** | Part 1/ Lab 3: Classification Algorithms using Scikit-learn: Building Decision Trees |
| **Week 6** | Part 2/ Lab 3: Classification Algorithms using Scikit-learn: Building Decision Trees |
| **Week 7** | Part 1/ Lab 4: Data Preprocessing and Feature Engineering in Python: Cleaning, Scaling, and Feature Extraction Techniques |
| **Week 8** | Part 2/ Lab 4: Data Preprocessing and Feature Engineering in Python: Cleaning, Scaling, and Feature Extraction Techniques |
| **Week 9** | Part 1/ Lab 5: Model Selection and Training in Python: Cross-Validation and Grid Search for Hyperparameter Tuning |
| **Week 10** | Part 2/ Lab 5: Model Selection and Training in Python: Cross-Validation and Grid Search for Hyperparameter Tuning |
| **Week 11** | Part 1/ Lab 6: Evaluating Model Performance in Python: Computing Accuracy, Precision, Recall, and F1 Score |
| **Week 12** | Part 2/ Lab 6: Evaluating Model Performance in Python: Computing Accuracy, Precision, Recall, and F1 Score |
| **Week 13** | Part 1/ Lab 7: Troubleshooting Machine Learning Models: Addressing Overfitting and Underfitting Issues |
| **Week 14** | Part 2/ Lab 7: Troubleshooting Machine Learning Models: Addressing Overfitting and Underfitting Issues |
| **Week 15** | Lab 8: Practical Project: Building a Machine Learning Pipeline in Python for Real-World Data Analysis |

| **Learning and Teaching Resources**  **مصادر التعلم والتدريس** | | |
| --- | --- | --- |
|  | **Text** | **Available in the Library?** |
| **Required Texts** | Machine Learning Bookcamp, Alexey Grigorev. | No |
| **Recommended Texts** | Python Data Science Handbook, Jake VanderPlas | No |
| **Websites** | https://github.com/microsoft/Data-Science-For-Beginners | |

| **Grading Scheme**  **مخطط الدرجات** | | | | |
| --- | --- | --- | --- | --- |
| **Group** | **Grade** | التقدير | **Marks (%)** | **Definition** |
| **Success Group**  **(50 - 100)** | **A -** Excellent | **امتياز** | 90 - 100 | Outstanding Performance |
| **B -** Very Good | **جيد جدا** | 80 - 89 | Above average with some errors |
| **C -** Good | **جيد** | 70 - 79 | Sound work with notable errors |
| **D -** Satisfactory | **متوسط** | 60 - 69 | Fair but with major shortcomings |
| **E -** Sufficient | **مقبول** | 50 - 59 | Work meets minimum criteria |
| **Fail Group**  **(0 – 49)** | **FX –** Fail | **راسب (قيد المعالجة)** | (45-49) | More work required but credit awarded |
| **F –** Fail | **راسب** | (0-44) | Considerable amount of work required |
|  |  |  |  |  |
| **Note:** Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above. | | | | |