**MODULE DESCRIPTION FORM**

**نموذج وصف المادة الدراسية**

| **Module Information**  **معلومات المادة الدراسية** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Module Title** | Machine learning | | | | **Module Delivery** | | |
| **Module Type** | Core | | | | * **☐ Theory** * **☒ Lecture** * **☒ Lab** * **☐ Tutorial** * **☐ Practical** * **☐ Seminar** | | |
| **Module Code** | BMI322 | | | |
| **ECTS Credits** | 5.00 | | | |
| **SWL (hr/sem)** | 125 | | | |
| **Module Level** | | 3 3 | **Semester of Delivery** | | | | 6 |
| **Administering Department** | | BID | **College** | BMIC | | | |
| **Module Leader** | Mohammed Abdul Ameer Jabbar | | **e-mail** | mohammedaji@uoitc.edu.iq | | | |
| **Module Leader’s Acad. Title** | | Assis. lecturer | **Module Leader’s Qualification** | | | | MSc |
| **Module Tutor** | Mohammed Abdul Ameer Jabbar | | **e-mail** | mohammedaji@uoitc.edu.iq | | | |
| **Peer Reviewer Name** | | Omara.m | **e-mail** |  | | | |
| **Scientific Committee Approval Date** | |  | **Version Number** | | | 1.0 | |

| **Relation with other Modules**  **العلاقة مع المواد الدراسية الأخرى** | | | |
| --- | --- | --- | --- |
| **Prerequisite module** | Artificial Intelligence / BMI311 | **Semester** | 5 |
| **Co-requisites module** | None | **Semester** |  |

| **Module Aims, Learning Outcomes and Indicative Contents**  **أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية** | |
| --- | --- |
| **Module Aims**  **أهداف المادة الدراسية** | It will cover some of the main models and machine learning algorithms for regression, classification, and probabilistic classification. Topics such as linear and logistic regression, regularization, probabilistic (Bayesian) inference, SVMs and neural networks, and dimensionality reduction. The module will use and create an accurate machine learning model using python and ski-learn library. |
| **Module Learning Outcomes**  **مخرجات التعلم للمادة الدراسية** | By the end of the module, students should be able to:   1. comprehend the fundamentals and guiding principles of machine learning 2. examine how a task behaves using machine learning 3. Develop an appreciation for what is involved in Learning models from data 4. Understand a wide variety of learning algorithms 5. Understand how to evaluate models generated from data 6. Apply the algorithms to a real problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models 7. To comprehend supervised learning algorithm concepts 8. To resolve issues with medical datasets using preprocessing and visualization techniques. 9. Possess knowledge of how to use classification algorithms 10. To have knowledge and skills of how to design, create, and assess intelligent machine learning systems that can analyze real-world medical data |
| **Indicative Contents**  **المحتويات الإرشادية** | Indicative content includes the following.  **Part I introduction**  The first part included lectures from 1 to 4 that concern with introduction and methods for classification task, data load and splitting and Understanding Data with Statistics & Visualization. [16 hrs]  **Part II – classification algorithms**  The second part includes lectures from 5 to 9 concern with understanding the super vised leaning algorithms how it works, build a model and applied to real world dataset. [20 hrs].  **Part III – project and seminar**  The students most apply each knowledge were obtained from this curse into areal data and build intelligent system based on ML algorithms to solve real medical problems. [continues]. |

| **Learning and Teaching Strategies**  **استراتيجيات التعلم والتعليم** | |
| --- | --- |
| **Strategies** | The main strategy is to using examples from real-world applications, to describe how to create systems that learn and adapt. The course will be self-contained (i.e., I won't assume any prior knowledge), and the chapters that require background knowledge will be preceded by a review of probability and information theory using the NB algorithm. Main topics include supervised learning, reinforcement learning, neural networks, decision trees, random forest, and linear discriminants. |

| **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** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **A** | | **Time/Number** | **Weight (Marks)** | **Week Due** | **Relevant Learning Outcome** |
| **Formative assessment** | **Quizzes** | 2 | 10% (10) | 5, 12 | LO #1, 2, 7 and 10 |
| **Assignments** | 2 | 10% (10) | 4, 6,11,12 | LO # 3, 4, 6 and 9 |
| **Projects / Lab.** | 1 | 10% (10) | Continuous |  |
| **Report** | 1 | 10% (10) | 14 | LO # 5, 8 and 10 |
| **Summative assessment** | **Midterm Exam** | 2 hr | 10% (10) | 13 | LO # 1-6 |
| **Final Exam** | 3 hr | 50% (50) | 16 | All |
| **Total assessment** | | | 100% (100 Marks) |  |  |

| **Delivery Plan (Weekly Syllabus)**  **المنهاج الاسبوعي النظري** | |
| --- | --- |
| **Week** | **Material Covered** |
| **Week 1** | Introduction - methods for Machine learning |
| **Week 2** | data load and splitting methods |
| **Week 3** | Understanding Data with Statistics & Visualization |
| **Week 4** | linear regression on binary classes   * Hypothesis * Loss function * Parameter update and GD learning |
| **Week 5** | Naïve Bayes classifier   * Bayes theory * Types of NB classifier * Mathematical concept |
| **Week 6** | Preprocessing and normalization techniques   * L1, L2 normalization * Standard scale * Binarization * Label and features encoding / decoding |
| **Week 7** | **Mid-term Exam** |
| **Week 8** | Logistic Regression and relationship between two or more variables   * Hypothesis of multi-classes * Loss function of multi-classes * Parameter update and GD learning of multi-classes |
| **Week 9** | Decision tree via information gain   * Entropy formulas * Weighted sum and max - min gains * Mathematical concepts |
| **Week 10** | Ensample methods   * random forest algorithm |
| **Week 11** | Ensample methods   * AGD boosting algorithm |
| **Week 12** | Classification using lazy algorithms   * KNN * WKNN |
| **Week 13** | SVM algorithm   * Basic concepts of the algorithm * Types of SVM * SVM in predication and classification * Hyperparameter controller |
| **Week 14** | Review |
| **Week 15** | projects discussion |

| **Delivery Plan (Weekly Lab. Syllabus)**  **المنهاج الاسبوعي للمختبر** | |
| --- | --- |
| **Week** | **Material Covered** |
| **Week 1** | install python and ML libraries (ski-learn, pandas, seaborn, etc.) |
| **Week 3** | data splitting methods |
| **Week 3** | data understanding and Visualization using pandas |
| **Week 4** | data understanding and Visualization using seaborn |
| **Week 5** | python coding of classification algorithms using (LR, NB) |
| **Week 6** | preprocessing coding using sikit-learn |
| **Week 7** | **Midterm exam** |
| **Week 8** | models’ evaluation metrics (confusion matrix and plot methods) |
| **Week 9** | python coding of classification algorithms using (DT) |
| **Week 10** | python coding of classification algorithms using (RF, AGD boosting) |
| **Week 11** | Training testing model results and Visualization using matplotlib |
| **Week 12** | Lazy algorithms implementation in python (KNN, WKNN) |
| **Week 13-14** | python coding of classification algorithms using (SVC) |
| **Week 15** | **Projects presentation and discussion** |

| **Learning and Teaching Resources**  **مصادر التعلم والتدريس** | | |
| --- | --- | --- |
|  | **Text** | **Available in the Library?** |
| **Required Texts** | Introduction to Machine Learning with Python: A Guide for Data Scientists | No |
| **Recommended Texts** | Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems | No |
| **Websites** | https://www.coursera.org/learn/machine-learning-with-python | |

| **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. | | | | |