MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

| **Module Information**  **معلومات المادة الدراسية** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Module Title** | **Convolutional Neural Network** | | | | **Module Delivery** | | |
| **Module Type** | Core | | | | * **☒ Theory** * **☐ Lecture** * **☒ Lab** * **☐ Tutorial** * **☐ Practical** * **☐ Seminar** | | |
| **Module Code** | BID422 | | | |
| **ECTS Credits** | 5 | | | |
| **SWL (hr/sem)** | 125 | | | |
| **Module Level** | | 4 | **Semester of Delivery** | | | | 8 |
| **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** |  | | **e-mail** |  | | | |
| **Peer Reviewer Name** | | omar A.M | **e-mail** | omara.m@uoitc.edu.iq | | | |
| **Scientific Committee Approval Date** | | 18/6/2023 | **Version Number** | | | 1.0 | |

| **Relation with other Modules**  **العلاقة مع المواد الدراسية الأخرى** | | | |
| --- | --- | --- | --- |
| **Prerequisite module** | Artificial neural network / BID412 | **Semester** | 7 |
| **Co-requisites module** | None | **Semester** |  |

| **Module Aims, Learning Outcomes and Indicative Contents**  **أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية** | |
| --- | --- |
| **Module Aims**  **أهداف المادة الدراسية** | The aims of the Deep Learning syllabus lectures are as follows:   1. Introduce students to the fundamental concepts and applications of Deep Learning. 2. Provide a clear understanding of the differences between Deep Learning and traditional machine learning approaches. 3. Develop students' proficiency in implementing and analyzing Feedforward Neural Networks and Convolutional Neural Networks. 4. Equip students with the knowledge and techniques for regularization, normalization, and preprocessing to optimize model performance. 5. Train students in troubleshooting Deep Learning models and improving their performance. 6. Explore advanced topics in Deep Learning to broaden students' understanding and abilities. 7. Assess students' comprehension through exams and consolidate their learning through a course review. |
| **Module Learning Outcomes**  **مخرجات التعلم للمادة الدراسية** | The learning outcomes of the Deep Learning syllabus lectures are as follows:   1. Understand the fundamental concepts and applications of Deep Learning. 2. Differentiate between Deep Learning and traditional machine learning techniques. 3. Implement and analyze Feedforward Neural Networks and Convolutional Neural Networks (CNN). 4. Apply regularization techniques and normalization layers to enhance model performance. 5. Troubleshoot Deep Learning models and employ strategies to improve their performance. |
| **Indicative Contents**  **المحتويات الإرشادية** | Here are indicative contents for a Deep Learning lecture:  1. What is Deep Learning?  - Definition and overview of deep learning  - Comparison with traditional machine learning  - Key characteristics and advantages  2. Neural Networks Basics  - Structure and components of neural networks  - Activation functions and their properties  - Forward propagation and prediction  3. Training Neural Networks  - Loss functions and their role in training  - Backpropagation algorithm and gradient descent  - Stochastic gradient descent and mini-batch learning  4. Optimization Techniques  - Regularization methods (L1/L2 regularization, dropout)  - Weight initialization strategies  - Optimizers (e.g., Adam, RMSprop)  5. Deep Learning Architectures  - Feedforward neural networks  - Convolutional neural networks (CNNs)  6. Deep Learning Frameworks and Tools  - Overview of popular deep learning frameworks (TensorFlow, PyTorch)  - High-level APIs and their advantages  - Tools for model development and evaluation  7. Applications of Deep Learning  - Computer vision tasks (image classification, object detection) |

| **Learning and Teaching Strategies**  **استراتيجيات التعلم والتعليم** | |
| --- | --- |
| **Strategies** | Learning and teaching strategies for the deep learning course involve a combination of theoretical instruction, practical application, and interactive engagement. Lectures are used to introduce key concepts, historical background, and milestones in the field of deep learning. Hands-on activities and projects provide opportunities for students to apply their knowledge through the implementation of feedforward neural networks and convolutional neural networks. Discussions and troubleshooting sessions allow students to analyze and improve deep learning models. Additionally, regular assessments and exams measure students' understanding and progress. These strategies aim to foster active learning, critical thinking, and practical skills development, |

| **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) | 4,10 | LO #1,2,3,4 and 9 |
| **Project Assignment** | 2 | 10% (10) | 12 | All |
| **Lab. Assignment** | 1 | 10% (10) | Continuous | All |
| **Seminar** | 1 | 10% (10) | The student chooses the week and the topics | All |
| **Summative assessment** | **Midterm Exam** | 2hr | 10% (10) | 7 | LO # 1-9 |
| **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 Deep Learning |
| **Week 2** | Historical background and key milestones |
| **Week 3** | Deep learning vs. traditional machine learning |
| **Week 4** | Feedforward Neural Networks |
| **Week 5** | Regularization techniques (dropout, L1/L2 regularization) |
| **Week 6** | Normalization and preprocessing layers |
| **Week 7** | 1st Exam |
| **Week 8** | Convolutional neural network |
| **Week 9** | CNN layers |
| **Week 10** | Transfer learning |
| **Week 11** | Trublshooting deep learning models |
| **Week 12** | How to improve your deep learning model's performance? |
| **Week 13** | Advanced Topics in Deep Learning |
| **Week 14** | 2nd Exam |
| **Week 15** | Course Review |

| **Delivery Plan (Weekly Lab. Syllabus)**  **المنهاج الاسبوعي للمختبر** | |
| --- | --- |
| **Week** | **Material Covered** |
| **Week 1** | Introduction to Deep Learning |
| **Week 2** | Historical background and key milestones |
| **Week 3** | Deep learning vs. traditional machine learning |
| **Week 4** | Feedforward Neural Networks |
| **Week 5** | Regularization techniques (dropout, L1/L2 regularization) |
| **Week 6** | Convolutional Neural Networks (CNNs) |
| **Week 7** | Mid-First Exam |
| **Week 8** | Popular CNN architectures (LeNet-5, AlexNet, VGG, ResNet) |
| **Week 9** | Recurrent Neural Networks (RNNs) |
| **Week 10** | Long Short-Term Memory (LSTM) networks |
| **Week 11** | Generative Models |
| **Week 12** | Deep Reinforcement Learning |
| **Week 13** | Advanced Topics in Deep Learning |
| **Week 14** | Deep Learning Applications |
| **Week 15** | Mid-Second Exam |

| **Learning and Teaching Resources**  **مصادر التعلم والتدريس** | | |
| --- | --- | --- |
|  | **Text** | **Available in the Library?** |
| **Required Texts** | Deep Learning for Computer Vision" by Adrian Rosebrock | No |
| **Recommended Texts** | Deep Learning Illustrated" by Jon Krohn | No |

| **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. | | | | |