Course Specification

(Postgraduate)

Course Title:	Deep Learning
Course Code:	501825-3
Program:	Master in Artificial Intelligence
Department:	Computer Science
College:	Computers and Information Technology
Institution:	Taif University
Version:	V2
Last Revision Date:	5 May 2024

قسم علوم الحاسب
Computer Science Department
TU
جامعة الطائف
TAIF UNIVERSITY

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A. General information about the course:

1. Course Identification:

1. Credit hours: (3)				
2. Course type				
A.	☐University	☐College	☒ Department	☐Track
B.	☒ Required		☐ Elective	
3. Level/year at which this course is offered: (Year: 1, Level: 1)				
4. Course general Description:				
This course will introduce the students to neural networks, and how to train them with high-performance algorithms using different neural network architectures, such as convolutional networks (CNN), recurrent neural networks (RNN), long short-term memory (LSTM) networks, and capsule networks. Students will learn how to solve problems in the fields of computer vision, natural language processing (NLP), and speech recognition. Students will learn generative model approaches such as variational autoencoders (VAE) and Generative Adversarial Networks (GANs) to generate images. Finally, the course will introduce the students to the state-of-the-art algorithms of reinforcement learning that are the main components behind popular game applications.				
5. Pre-requirements for this course (if any)**:**				
None.				
6. Co-requirements for this course (if any)**:**				
None.				
7. Course Main Objective(s):				
The objectives of this course are as follows: ▪ To introduce students to the professional concepts and techniques of Deep Learning. ▪ To understand Deep Learning architectures and models including Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN), Long-Short Term Memory (LSTM), Generative Models (GAN, VAE), Transfer Learning (TL), and Reinforcement Learning (RL). ▪ To develop skills of using recent DL packages for solving practical real-word problems in computer vision, object detection, segmentation, language, and generative models.				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	**36**	**80%**
2	E-learning	**9**	**20%**
3	Hybrid ▪ Traditional classroom ▪ E-learning	**0**	**0%**

No	Mode of Instruction	Contact Hours	Percentage
4	Distance learning	**0**	**0%**

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

No	Activity	Contact Hours
1.	**Lectures**	**45**
2.	**Laboratory/Studio**	**-**
3.	**Field**	**-**
4.	**Tutorial**	**-**
5.	**Others (specify): Mid-Term and Final Exams**	**-**
	Total	**45**

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**			
1.1	Explain methods and foundations of deep learning.	**K1**	Lecture, Brainstorming, Discussion	**Direct:** Quiz, Exam **Indirect:** Survey
2.0	**Skills**			
2.1	Analyze methods of deep learning models and their architectures.	**S1**	Lecture, Problem Solving	**Direct:** Exam, Quiz, Assignment **Indirect:** Survey
2.2	Apply deep learning models in computer vision and language modeling.	**S2**	Lecture, Project, Problem Solving	**Direct:** Exam, Quiz, Assignment **Indirect:** Survey
2.3	Communicate methods and models to solve real-word applications for computer vision, object detection, segmentation, language, and generative models.	**S3**	Lecture, Project, Problem Solving	**Direct:** Exam, Quiz, Assignment **Indirect:** Survey
3.0	**Values, autonomy, and responsibility**			
3.1	Function effectively as a member or leader of a team engaged in activities appropriate to the field of data mining.	**V2**	Discussion, Problem Solving	**Direct:** Project, Presentation **Indirect:** Survey

C. Course Content:

No	List of Topics	Contact Hours
1.	Neural Networks: The mathematics of neural networks. their structure, how they make predictions (that's the feedforward part), and how to train them using gradient descent and backpropagation.	3
2.	Deep Learning (DL) Fundamentals: Deep neural networks (as opposed to shallow ones), most popular DL libraries and real-world applications of DL.	9
3.	Convolutional Neural Networks (CNN): CNN for computer vision tasks, their architecture and building blocks (the convolutional, pooling, and capsule layers) and how to use a convolutional network for an image classification task.	6
4.	Advanced Computer Vision: how to detect an object's location and segment every pixel of an image, advanced CNN architectures, and transfer learning.	6
5.	Generative Models: Generating Images with GANs and VAEs, and their applications.	6
6.	Recurrent Neural Networks (RNN) and Language Models: LSTM and gated recurrent unit (GRU), paradigms of NLP with RNN and the latest algorithms and architectures to solve NLP problems.	6
7.	Reinforcement Learning: paradigms and terms of RL, the link between DL and RL, RL for Games.	6
Total		**45**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Lab and Practical	Weekly	10%
2.	Assignments/Project	Week 3, 12	20%
3.	Quizzes	Week 3, 6, 9	10%
4.	Midterm Exam	Week 8	20%
5.	Final Exam	Week 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	▪ Python Deep Learning - Third Edition. By Ivan Vasilev. Packt Publisher, 2023. https://www.packtpub.com/product/python-deep-learning

Supportive References	▪ Deep Learning, An MIT Press book, Ian Goodfellow and Yoshua Bengio and Aaron Courville, https://www.deeplearningbook.org/ . ▪ Join GitHub project https://github.com/janishar/mit-deep-learning-book-pdf
Electronic Materials	▪ The world's most trusted open ecosystem for sourcing, building, and deploying data science and AI initiatives: https://www.anaconda.com/ ▪ https://www.w3schools.com/python/
Other Learning Materials	▪ Links provided by the instructor. ▪ Handouts and Presentations Slides prepared by the instructor. ▪ Blackboard.

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	▪ Classroom (20 students/class) ▪ Computer labs
Technology equipment (Projector, smart board, software)	▪ Video projector / data show ▪ White board
Other equipment (Depending on the nature of the specialty)	▪ To be announced during the course!

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students Coordinator	Indirect (Course exit survey) Indirect (Feedback from Course Coordinator)
Effectiveness of students assessment	Faculty member Coordinator	Indirect (Feedback from Faculty member) Indirect (Feedback from Course Coordinator)
Quality of learning resources	Students Faculty member Coordinator Council Curriculum Committees	Indirect (Course exit survey) Indirect (Feedback from Faculty member) Indirect (Feedback from Course Coordinator) Indirect (Feedback from council) Indirect (Feedback from Graduate Committees)
The extent to which CLOs have been achieved	Students Faculty member Coordinator Curriculum Committees	Indirect (Course exit survey) Indirect (Feedback from Faculty member/ Course Coordinator/ Graduate Committee)
Other	-	-

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	**GRADUATE PROGRAMS COMMITTEE – CS DEPT.**
REFERENCE NO.	**V2**
DATE	**5/5/2024**

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