DeCAIR Course Syllabus Form

Author(s)	Ahmad Aljaafreh		
Author Organization Name(s)	Tafila Technical University		
Work Package Number & Title	Work Package 2: Development of new MSc and BSc programs in AIR		
Activity Number & Title	Activity 2.2: Designing and developing syllabi and content for the agreed upon courses in the new programs		
Work Package Leader	Francesco Masulli, University of Genoa		
Due Date of Delivery	1/2/2022	**Project Month**	M14
Submission Date	1/11/2021	**Project Month**	M7

Revision History

Version	Date	Author	Description	Action *	Page(s)
1	1/11/2021	Ahmad Aljaafreh	Original (base) document	C	1-6
2	13/12/2021	TTU Team	Revision	U	1-6
3	16/01/2022	Ahmad Aljaafreh	Revised based on a peer review	U	1-6
4	2/2/2022	Ahmad Aljaafreh	Revised based on an expert review	U	1-6

(*) Action: C = Creation, I = Insert, U = Update, R = Replace, D = Delete

Disclaimer

This project has been co-funded by the Erasmus+ Programme of the European Union.

Email: DeCAIR@ju.edu.jo

Project Website: http://DeCAIR.ju.edu.jo/

<table>
<tr><td>Course title</td><td>Artificial Neural Network and Deep Learning</td></tr>
<tr><td>Course number</td><td>0112564</td></tr>
<tr><td>Credit hours (lecture and lab)</td><td>3 (3 + 0)</td></tr>
<tr><td>ECTS (weekly contact and self-study load)</td><td>6 (3 + 3)</td></tr>
<tr><td>Prerequisites/co-requisites by course number and name</td><td>Introduction to Artificial Intelligence and Machine Learning (0112467),
Statistical Analysis and Data Science (0112550)</td></tr>
<tr><td>Prerequisites by topic (other than the formal prerequisites above)</td><td>Students are assumed to have good background in mathematics, particularly, calculus, linear algebra, statistics, and probability. Additionally, the students should have good programming skills, preferably, using Python.</td></tr>
<tr><td>Level and type (compulsory, elective)</td><td>Bachelor’ compulsory course</td></tr>
<tr><td>Year of study and semester</td><td>Fourth year, first or second semester</td></tr>
<tr><td>Catalogue description</td><td>“Deep Learning” systems, typified by deep neural networks, are increasingly taking over all AI tasks, ranging from language understanding, and speech and image recognition, to machine translation, planning, and even game playing and autonomous driving. In this course students will learn the basics of deep neural networks, and their applications to various AI tasks. By the end of the course, it is expected that students will have significant familiarity with the subject, and be able to apply Deep Learning to a variety of tasks.</td></tr>
<tr><td>Objectives</td><td>1- Understanding neural networks
2- Comprehending the deep models that do AI tasks
3- Familiarity with some of deep learning terminology
4- Design, build and train networks for various tasks</td></tr>
<tr><td>Intended learning outcomes</td><td>Upon successful completion of this course, students will be able to:
<table>
<tr><th>No</th><th>Intended learning Outcome (ILO)</th><th>Program learning outcome (PLO)*</th></tr>
<tr><td>1</td><td>Identify the Deep Learning (DL) algorithms which are more appropriate for various types of learning tasks in various domains.</td><td>1,6</td></tr>
<tr><td>2</td><td>Implement DL algorithms</td><td>1,2</td></tr>
<tr><td>3</td><td>Utilize the DL algorithms to solve real-world problems</td><td>2,5</td></tr>
<tr><td></td><td></td><td></td></tr>
</table>
(*) The PLOs are listed in the appendix</td></tr>
<tr><td>Teaching and learning methods</td><td>Development of ILOs is promoted through the following teaching and learning methods:
• Lectures will be delivered through Microsoft Teams and will be recorded for</td></tr>
</table>

<table>
<tr><td></td><td>later access.
• The AI lab is open for the students to practice the practical aspects and solve the programming homework assignments.
• The student attends the class presentations and participates in the discussions.
• The student joins the related online team/group and participates in its discussions.
• The student studies the reference material, including books and videos.
• The student solves the programming assignments
• The student carries out a term project for solving a problem using deep learning techniques.
• The student develops a professional report for the term report.
• The student presents the term project in class.</td></tr>
<tr><td>Learning material type</td><td>Textbook, class handouts, some instructor keynotes, selected YouTube videos, and access to a personal computer and the internet.</td></tr>
<tr><td>Resources and references</td><td>A- Required book(s), assigned reading and audio-visuals:
1. Dive Into Deep Learning By Aston Zhang, Zachary C. Lipton, Mu Li, and Alexander J. Smola PDF, 2020
2. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016. …

B- Recommended book(s), material and media:
3. Deep Learning By Ian Goodfellow, Yoshua Bengio, Aaron Courville Online book, 2017
4. Neural Networks and Deep Learning By Michael Nielsen Online book, 2016
5. Deep Learning Step by Step with Python: A Very Gentle Introduction to Deep Neural Networks for Practical Data Science By N. D. Lewis</td></tr>
<tr><td>Topic outline and schedule</td><td>
<table>
<tr><th>Week</th><th>Topic</th><th>ILO</th><th>Resources</th></tr>
<tr><td>1</td><td>Introduction to ANN and DL</td><td>1</td><td>1, 4</td></tr>
<tr><td>2</td><td>Feedforward neural networks</td><td>4</td><td>5</td></tr>
<tr><td>3</td><td>Training Neural Networks</td><td>1, 2, 4</td><td>1</td></tr>
<tr><td>4
5</td><td>Optimizers and Regularizers, Choosing a divergence (loss) function, Batch normalization, and dropout.</td><td>1, 2, 4</td><td>1</td></tr>
<tr><td>6
7</td><td>Deep Learning: Architectures, models, and tools</td><td>1, 2</td><td>1</td></tr>
<tr><td>8
9</td><td>Models of vision,
Convolutional Neural Networks</td><td>1, 2</td><td>1</td></tr>
<tr><td>10
11</td><td>Time Series and Recurrent Networks (RNN, LSTM, GRU, and Encoders)</td><td>1, 2</td><td>1</td></tr>
<tr><td>12</td><td>Sequence to Sequence methods</td><td>1, 2</td><td>1</td></tr>
</table>
</td></tr>
</table>

	13	Attentions and Transformers	1, 2	1
	14	Generative Adversarial Networks	1, 2	1
	15	Term Project Presentations	1, 2	1

Evaluation tools

Opportunities to demonstrate achievement of the ILOs are provided through the following assessment tools:

Assessment tool	Mark	Topic(s)	Time
Homework assignments	10%	Programming aspects	W2-W14
Midterm exam	30%	Introduction through classical techniques	W8
Term project report and presentation	20%	Practical and presentation aspects	W15
Final exam	40%	All material	W16
Total	**100%**		

Student requirements

The student should have a computer and internet connection.

Course policies

A- Attendance policies:

- Attendance is required. Class attendance will be taken every class and the university polices will be enforced in this regard.

B- Absences from exams and not submitting assignments on time:

- A makeup exam can be arranged for students with acceptable absence causes.
- Assignments submitted late, but before announcing or discussing the solution can be accepted with 25% penalty.
- The project report must be handed in in time.

C- Health and safety procedures:

- All health and safety procedures of the university and the school should be followed.

D- Honesty policy regarding cheating, plagiarism, misbehavior:

- Open-book exams
- All submitted work must be of the submitting student.
- Other text or code must be properly quoted with clear source specification.
- Cheating will not be tolerated.

E- Available university services that support achievement in the course:

- Microsoft Teams team and Moodle course page
- AI Lab for practicing the practical aspects and solving the programming assignments.
- Program announcements Facebook group

Additional information

None

Appendix

Learning Outcomes for B.S. IN INTELLIGENT SYSTEMS ENGINEERING

Students who successfully complete the B.S. IN INTELLIGENT SYSTEMS ENGINEERING will have:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.