DeCAIR Course Syllabus Form

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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		
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Revision History

Version	Date	Author	Description	Action *	Page(s)
1	18/7/2021	Gheith Abandah	Original (base) document	C	1-6
2	23/11/2021	Gheith Abandah	Drop “AI” from the course name	U	1-3
3	3/1/2022	Gheith Abandah	Revision based on Peer Review 1	U	1-3
4					

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

Disclaimer

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Course title	Applied Machine Learning
Course number	0907726
Credit hours (lecture and lab)	3 (3 + 0)
ECTS (weekly contact and self-study load)	6 (3 + 3)
Prerequisites/co-requisites by course number and name	None
Prerequisites by topic (other than the formal prerequisites above)	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.
Level and type (compulsory, elective)	Masters' compulsory course
Year of study and semester	First year, first semester
Catalogue description	This graduate course concentrates on the application of state-of-the-art machine learning (ML) algorithms for solving real-world problems. This course starts with reviewing the Python programming language and its important related packages. The covered topics include data preparation, training, evaluation, various evaluation metrics, supervised learning (regression, classification, neural networks, deep learning, convolutional neural networks, and recurrent neural networks), basics of unsupervised and reinforcement learning, and recommender systems. This course has practical assignments and term project.
Objectives	1. Introduce students to the techniques used in ML including data preparation, training models, regression, classification, neural networks, and deep learning. 2. Introduce students to the practical techniques used in developing ML systems including sample collection, training, and evaluation. 3. Introduce students to the programming techniques and libraries used in ML (Python, Scikit-Learn, Keras, and TensorFlow). 4. Enable the students to gain practical skills in solving wide range of problems using ML techniques.
Intended learning outcomes	Upon successful completion of this course, students will be able to:

No	Intended learning Outcome (ILO)	Program learning outcome (PLO)*
1	Demonstrate a sound understanding of the main techniques and algorithms in ML.	1
2	Solve a practical problem by developing an appropriate ML system.	3
3	Communicate the development of a ML system through a detailed technical report and a short	4

	presentation.	
4	Use Python and its specialized libraries to develop programs for solving ML problems.	3

(*) The PLOs are listed in the appendix

Teaching and learning methods

Development of ILOs is promoted through the following teaching and learning methods:

- 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 in machine learning.
- The student carries out a term project for solving a problem using ML techniques.
- The student develops a professional report for the term report.
- The student presents the term project in class.

Learning material type

Textbook, class handouts, some instructor keynotes, selected YouTube videos, and access to a personal computer and the internet.

Resources and references

A- Required book(s), assigned reading and audio-visuals:

1. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras and TensorFlow: Concepts: Tools, and Techniques to Build Intelligent Systems, 2nd Edition, O'Reilly Media, Oct 2019.
2. François Chollet, Deep Learning with Python, Manning Pub. 2018.
3. Course web page at: …

B- Recommended book(s), material and media:

4. Prateek Joshi, Artificial Intelligence with Python, Packt Publishing, 2017.
5. Wes McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Ipython, O'Reilly Media, 2nd Edition, 2018.
6. Theodoridis S, Koutroumbas K, Pattern Recognition, 3rd ed. Academic Press, 2006.
7. Richard O. Duda, Peter E. Hart and David G. Stork, Pattern Classification, 2nd ed. Wiley Interscience, 2001.

Topic outline and schedule

Week	Topic	ILO	Resources
1	Introduction to ML	1	1
2	Python programming language	4	5
3	Data preparation and regression	1, 2, 4	1
4	Data preparation and regression	1, 2, 4	1
5	Classification	1, 2	1

	6	Training models	1	1
	7	Classical techniques: SVM, decision trees and ensembles	1, 2	1
	8	Unsupervised learning and clustering	1, 2	1
	9	Neural networks	1, 2	1
	10	Deep neural networks	1	1, 2
	11	Convolutional neural networks	1, 2	1
	12	Recurrent neural networks	1, 2	1
	13	Reinforcement learning	1, 2	1
	14	Recommendation systems	1, 2	4
	15	Term Project Presentations	3, 4	3

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 the MSc in Artificial Intelligence and Robotics

Students who successfully complete the MSc in Artificial Intelligence and Robotics (AIR) will be able to:

1. Demonstrate a sound understanding of the main areas of AIR including artificial neural networks, machine learning, data science, industrial and service robots, and intelligent and autonomous robots.

2. Apply a critical understanding of essential concepts, principles and practices of AIR, and critically evaluate tools, techniques and results using structured arguments based on subject knowledge.

3. Apply the methods and techniques of the AIR fields in the design, analysis and deployment of AIR solutions and solving practical problems.

4. Demonstrate the ability to produce a substantial piece of research work from problem inception to implementation, documentation and presentation.

5. Demonstrate life-long learning, independent self-learning and continuous professional development skills in the AIR fields.

6. Demonstrate a sound understanding of the ethical, safety and social impact issues of AIR solutions and products.