# The University of Jordan

## School of Engineering

## Computer Engineering Department

## Spring Term 2019/2020

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| **Course** | Machine Learning: Advanced Topics in Computer Engineering and Networks – 0907751 (3 Cr. – Elective Course) |
| **Catalog Description** | The course helps the student gain an advanced level understanding of Machine Learning (ML) applications and algorithms. It also covers neural networks and deep learning. The course concentrates on the practical skills to use ML to solve real-life problems and includes a term project on designing and implementing a ML solution to solve a problem of the student choice. |
| **Prerequisites by Course** | None |
| **Prerequisites by Topic** | 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. |
| **Textbooks** | 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.<br>2. François Chollet, Deep Learning with Python, Manning Pub. 2018. |
| **References** | 1. Prateek Joshi, Artificial Intelligence with Python, Packt Publishing, 2017.<br>2. Theodoridis S, Koutroumbas K, Pattern Recognition, 3rd ed. Academic Press, 2006.<br>3. Richard O. Duda, Peter E. Hart and David G. Stork, Pattern Classification, 2nd ed. Wiley Interscience, 2001. |
| **Course Website** | http://www.abandah.com/gheith/?page_id=2314 |
| **Facebook group** | https://www.facebook.com/groups/315669882258644/ |
| **Schedule & Duration** | 15 weeks; 45 lectures, 60 minutes each (including exams) |
| **Student Material** | Textbook, class handouts, some instructor keynotes, selected YouTube videos, and access to a personal computer and the internet. |
| **College Facilities** | Classroom with whiteboard and projection display facilities with speakers, library, and computer laboratory. |
| **Course Objectives** | The objectives of this course are:<br>1. Introduce students to the techniques used in ML including data preparation, training models, classification, neural networks, and deep learning.<br>2. Introduce students to the practical techniques used in developing ML systems including sample collection, training, and evaluation.<br>3. Introduce students to the programming techniques and libraries used in ML (Python, Scikit-Learn, Keras, and TensorFlow). |
| **Course Outcomes and Relation to ABET Program Outcomes** | Upon successful completion of this course, a student should be able to:<br>1. Solve an AI problem by developing an appropriate ML system [3].<br>2. Communicate the development of a ML system through a detailed technical report and a short presentation [5, 7]. |

3. Use Python and its specialized libraries to develop programs for solving ML problems [3].

**Course Topics**
- Introduction
- Python programming language
- Data preparation and regression
- Classification
- Training Models
- Classical Techniques: SVM, Decision Trees and Ensembles
- Neural networks

*Midterm Exam*

- Deep neural networks
- Convolutional neural networks
- Recurrent neural networks
- Reinforcement learning
- Recommendation Systems

**Computer Usage**    Practical aspects of the course are covered in class and through the term project.

**Important Dates**

| Date | Event |
|---|---|
| Tue 4 Feb, 2020 | Classes Begin |
| Tue 24 Mar, 2020 | Midterm Exam |
| Tue 7 Apr, 2020 | Term project proposal is due |
| Tue 5 May, 2020 | Term project report is due and project demonstrations |
| Tue 5 May, 2020 | Last Lecture |
| Thu 7 May, 2020 | Last Date to Withdraw |
| May 13 – 21, 2020 | Final Exam Period |

**Policies**
- Attendance is required. Class attendance will be taken every class and the university's polices will be enforced in this regard.
- All submitted work must be yours
- Cheating will not be tolerated
- Open-book exams
- Join the Facebook group of this course
- Check department announcements at: https://www.facebook.com/Master-in-Computer-Engineering-and-Networks-in-the-University-of-Jordan-257067841079897/ for the program announcements.

**Assessments**    Exams and term project

**Grading policy**
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|---|---|
| Term project report and presentation | 30% |
| Midterm Exam | 30% |
| Final Exam | 40% |

**Instructors**    **Prof. Gheith Abandah**

**Email:**  abandah@ju.edu.jo
**Homepage**:  http://www.abandah.com/gheith
**Office Hours**:  Sun, Tue:  10:30-11:30
Mon, Wed:  1-2

**Time and Location**    Section 1:    Tue: 4:30–7:30, CPE 001

**Last Updated**    Jan 29, 2020

# Learning Outcomes for the Master's program in Computer Engineering and Networks

**Upon completion of the Computer Engineering and Networks program, the student is expected to be able to:**

1. Discuss and analyze the basic concepts, principles, techniques and theories in the fields of computer architecture, wired and wireless networks, and security of computer network systems.

2. Employ higher-order thinking skills, critical and creative thinking, and practice scientific thinking and logical analysis in investigating, diagnosing and addressing the issues and problems related to computer engineering and networks.

3. Perfectly use the methods and techniques related to the fields of computer engineering in the design, analysis and management of systems and resources.

4. Show an interest in independent self-learning and continuous professional development, demonstrate commitment to acquire and generate unique knowledge and skills, and propose new ideas and programs that contribute to the development of the science of computer engineering and networks.

5. Demonstrate the proficiency and practice precision in achievement, work effectively in a team environment, and prepare presentation on important and modern topics that will develop the techniques used in the fields of computer engineering and networks.

6. Fulfill his/her responsibilities, exercise his/her rights and duties within the value system of the society, and properly deal with the national institutions and the local community.

7. Efficiently employ the research methodologies and the tools emerging from them, the methods for data collection, analysis and interpretation in the preparation of his/her thesis, and the preparation of different types of research related to computer engineering and networks. Accordingly, he/she prepares qualitative reports in the light of its results.

8. Assess changes that have been occurred in the field of computer engineering and networks, analyze various factors that control it domestically, regionally and globally, investigate and diagnose the network of relations and international interactions that influence it, and provide scenarios for its possible future developments.