The University of Jordan
King Abdullah II School for Information Technology
Computer Information Systems Department
First Semester 2014/2015

Course Name: Machine Learning(1902734), 3 Credit Hours
Prerequisite: None
Providing Dept: Computer Information Systems (CIS).
Instructor: Dr. Loai M. Alnemer
Office Hours: 12-1 STu. 1-2 Thur., 11-12 Wed
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Course Description: Machine learning is an exciting field in computer science. It is about designing machines that can learn from examples. This course covers the necessary theory, principles, and algorithms for machine learning. These methods are mainly built on statistics and probability which have become essential to designing systems exhibniting artifitial intellgence. This course will span the various methods that can be categorized into: supervised, unsupervised, and reinforcement learning. We will study the machine learning concepts and then work on various methods from each category.

Intended Learning Outcomes:

Successful completion of this course should lead to the following learning outcomes:

A- Knowledge and Understanding: Students should …

A1) Understand the concept of Machine learning.
A2) Understand each of the machine learning techniques.
A3) Understand the formal definition of any ML task
A4) Understand the diffrence between supervised, unsupervised, and reinforcemnet learning.

B- Intellectual skills: with the ability to …

B1) Distinguish between different machine learning techniques.
B2) Have breadth knowledge on supervised, unsupervised learning
B3) Obtain practical ability on applying the ML techniques on a given set of data
B4) Explain why we need different ML algorithms.

C- Subject specific skills- with ability to …

C1) analyze simple mathematical formulae.
C2) Analyze some computational aspects related to supervised learning tasks.
C3) Analyze some computational aspects related to unsupervised learning tasks.
C4) Analyze some Data reduction techniques.

D- Transferable skills – with ability to …

D1) Work individually and within a group to design a ML model.
D2) Work effectively, to implement a programs to classify a dataset.
D3) Perform a graduate-level research task via a self-selected project that ends up with a publishable quality research paper.
D4) Present the final project and make a demo.

Background: The student is expected to have the basic mathematical skills and algorithms, good knowledge in data structures and basic computer science background.

Associated Reading: The student is expected to read the associated reading for deeper knowledge of the topics in machine learning and better mathematical skills development. Additional course material will be available on the course website.

Programming Assignments: Python is the preferable language to use in your homework/assignment/project implementation. R-package is also a good package to implement some problems. **Self-learning** is part of the requirements of this course. Learning in groups is preferable for achieving the class assignments. The purpose of these assignments is to give depth and detailed understanding of specific learning models. Using another programming language is fine but more grades will be given for R.

Class Slides: PPT slides will be used over this class for presenting the various concepts and machine learning schemes. However, these slides are not intended for studying for this class. Textbooks reading are main material as per the schedule below. Discussion within the class is the most powerful tool to learn the introduced concepts. Your attendance is your most powerful way to do well in this class.

Schedule of Course Contents, TLA Methods and ILOs:

Week(s)	Topics:	Teaching/Learning & Assessment	ILOs
1	**Overview** Introduction to machine learning, its importance and relevance to various scientific fields.	**T**: lecture and presentation **L**: Mitchill 1.1-1.3	A1, A2, B1
2	**Supervised learning** Introduction to supervised learning, Difference between classification and regression, KNN	**T**: : lecture and presentation **L**: attendance, Discussion, handouts **A**: Homework on KNN.	A3, B2,B3, C2, D1
3	**Decision Tree** Information theory, Entropy, Information gain, DT and ID3	**T**: Lecture and presentation, Audio **L**: Mitchill 2.1-2.7 **A**: Homework in python	A3,B3,C2, D2
4,5	**Baysian Learning** Probability and Probability Distribution. Naïve Bays, Baysian Networks	**T**: Lecture, presentation, and handout **L**: attendance, discussion, reading: handout **A**: Homework	A3,B3,C2, D2
6,7	**Statistical Learning** Gaussian and Mixture of Gaussians.	**T**: Lecture, presentation, and handout **L**: attendance, discussion, reading: handout Bishop 2.3 **A**: homework..	A3,B3,C2, D2
8	**Nueral Networks**	**T**: : Lecture, presentation, and handout,Audio **L**: : attendance, discussion, reading: handout. **A**: Exam.	A3,B3,C2, D2
9	**Support Vector Machines** RSA cipher and others **Project Discussion**	**T**: Lecture, presentation, and handout **L**: attendance, discussion, reading: handout **A**: homework on arrays	A4,B3,C3, D2
10,11	**Unsupervised Learning** K-means. Density-based clustering	**T**: Lecture, presentation, and handout **L**: attendance, discussion, reading: handout **A**: Quiz	A5, B4, D3
12,13	**GENETIC ALGORITHMS** **ENSEMBLE LEARNING: BAGGING**	**T**: Lecture, presentation, and handout	A6,B5,C4, D2,D3

	AND BOOSTING	**L**: attendance, discussion, reading: handout **A**: homework	
14	**CASE STUDY IN MACHINE LEARNING**	**T**: Lecture, presentation, and handout **L**: attendance, discussion, reading: handout	A7
15,16	**PROJECT DISCUSSION** **FINAL EXAM**	**To be scheduled**	D4

Evaluation:

Basis	Weight
Midterm Exam	**30%**
Quizzes and assignments	**10%**
Project	**20%**
Final Exam	**40%**

Project and Assignment policy:

- All projects and assignments are to be uploaded to the course website.
- Upload assignments to elearning.ju.edu.jo (moodle) by 11:55 PM on its due date.
- Everyone should check their e-mail and moodle regularly. Students are responsible for information posted there. If critical information is posted in moodle that you must read today, an announcement to check
  moodle will be sent to the mailing list.
- Project should be determined by the end of the 7th week of the semester. I'll provide you with some suggested project. And these projects will be distributed as a queue.
- By the end of the 9th week the group should send me a project proposal. 30% of the project grade is for the proposal.

Course Policies:

1. Students are allowed up to 3 absences. If you exceed this number, you will fail the class.
2. Tardiness will not be tolerated. If you come to class after I take attendance, you are welcome to attend but you will be considered absent.
3. Participation is an essential part of course works.

Regulations

1. Every student is expected to completely adhere to the exams dates and projects strict deadlines, absolutely no exceptions will be given.
2. Maximum allowable absence 15% of number of Lectures/Semester

- الامتناع المدبر عن حضور المحاضرات أو الدروس أو عن الأعمال الاخرى التي تقضي الأنظمة بالمواظبة عليها ، وكل تحريض على هذا الامتناع سوف يؤدي الى حرمان الطالب من المادة المعنية.
- في حالة التغيب عن امتحان ال Mid Term لن يكون هناك امتحان تعويضي الا في حالة وجود عذر وحالة طارئة من المستشفى. على الطالب ابراز العذر لمدرس المادة في فتره لا تتجاوز الثلاثة ايام من تاريخ الامتحان, وللمدرس الحق في قبول او رفض العذر , وحسب التعليمات.

Concerns or complaints should be expressed in the first instance to the module lecturer; if no resolution is forthcoming then the issue should be brought to the attention of the module coordinator (for multiple sections) who will take the concerns to the module representative meeting. Thereafter problems are dealt

with by the Department Chair and if still unresolved the Dean and then ultimately the Vice President. For the final complaints, there will be a committee to review grading the final exam
Read more regulations here: http://www2.ju.edu.jo/units/registration/Pages/regulations.aspx

Coperation-Plagiarism Policy

Discussion of the concepts and principles between students is fine and very welcomed. Also, students are allowed to debug each other's code. However, Student cooperation should not result in identical or near identical answers/code/documentation. ALL THE MATERIAL SUBMITTED FOR GRADING MUST BE YOUR OWN EFFORT.

If this policy is violated then the following steps may be taken**: (1) reduction of points by dividing by the number of students involved in an incident, (2) assignment of a grade of ZERO for all students involved in an incident.**

Text book:

Text1: Tom Mitchell, Machine Learning, MIT press and McGraw-Hills 1997.
Text2: Bishop, C.M., Pattern Recognition and Machine Learning. Springer. 2007.