

COURSE RECORD

Code	ECE 509
Name	Advanced Big Data Analytics
Hour per week	3+0 (Theory + Practice)
Credit	3
ECTS	7,5
Level/Year	Graduate
Semester	Fall, Spring
Type	Elective
Location	
Prerequisites	Calculus, Probability and Statistics, Linear Algebra, Data Mining
Special Conditions	
Coordinator(s)	Mustafa Coskun
Webpage	
Content	This course provides an introduction to big data analytics. It covers fundamental mathematical background of data mining and machine learning applications. The course also provides applications of graph mining tasks such as PageRank, etc. Methods will be implemented by a software and applied on various machine learning and data mining problems.
Objectives	01. Gain an understanding of mathematical background of data mining 02. Learn the techniques used for solving problems involving very large datasets 03. Gain practice by completing programming assignments 04. Apply the concepts to a real problem by completing a course project
Learning Outcomes	L01. Explain the mathematical and algorithmic principles of deep learning models L02. Solve a machine learning/ data mining problem using efficient numerical algebra methods L03. Implement a big data analytics models model using a software L04. Apply big data analytic methods to a real problem
Requirements	A GPA higher than 3.0 or high letter grades from prerequisite courses.
Reading List	1. Applied Numerical Algebra by J.W Demmel 2. Numerical Optimization by Jorge Nocedal 3. Iterative Methods by Yousef Saad 3 rd edition
Ethical Rules and Course Policy	Cheating in assignments and exams is strictly prohibited.

LEARNING ACTIVITIES

Activities	Number	Weight (%)
Lectures (on-site)	14	30%
Lectures (online videos)	7	20%
Problem solving and assignments	12	30%
Project and Presentations	1	20%
	Total	100

ASSESSMENT

Evaluation Criteria	Weight (%)
Quizzes	10%

Homework Assignments	30%
Project Assignment and Presentation	20%
Midterm Exam	20%
Final Exam/Submission	20%
Total	100%

For a detailed description of grading policy and scale, please refer to the website <https://goo.gl/HbPM2y> section 28.

COURSE LOAD

Activity	Duration (hour)	Quantity	Work Load (hour)
Lectures	3	14	42
Research (web, library)	5	1	5
Required Readings	1	14	14
Online course videos	1	7	7
Assignments	7	12	84
Project	40	1	40
Pre-work for Presentation	4	1	4
Pre-work for Quizzes	1	5	5
Pre-work for Midterm	20	1	20
Pre-work for Final	30	1	30
General Sum			251

ECTS: 7,5 (Work Load/25-30)

CONTRIBUTION TO PROGRAMME OUTCOMES*

	PO1	PO2	PO3	PO4	PO5	PO6
LO1	5	5	3	3	3	3
LO2	5	5	4	4	4	3
LO3	4	5	5	5	3	3
LO4	4	5	5	5	5	4

* Contribution Level: 0: None, 1: Very Low, 2: Low, 3: Medium, 4: High, 5: Very High

WEEKLY SCHEDULE

W	Topic	Outcomes
1	Numerical linear algebra review, optimization problems, linear least squares Activity: Online video lectures, readings	L01, L02
2	Tikhonov regularization / ridge regression, Lasso, pivoted QR Activity: Online video lectures, readings, homework	L01, L02, L03
3	Basics of iterative solvers and sparse linear least squares Activity: Online video lectures, readings, quiz, homework	L01, L02, L03
4	Latent factor models, linear dimensionality reduction, and matrix factorization Activity: Online video lectures, readings, homework	L01, L02, L03
5	Basics of Krylov subspace methods, LSQR, LSMR Activity: Online video lectures, readings, homework	L01, L02, L03, L04
6	Randomized numerical linear algebra Activity: Readings, quiz, homework	L01, L02, L03, L04
7	Midterm Exam	L01, L02
8	Semester break	
9	Eigenvectors and decompositions, PageRank Random Walk With Restarts Activity: Online video lectures, readings, homework	L01, L02, L03, L04
10	Basic network analysis, structure, heavy tails, random graph models Activity: Readings, quiz, homework	L01, L02, L03, L04
11	Learning on graphs: unsupervised network clustering and community	L01, L02, L03

	detection	
	Activity: Readings, quiz, homework	
12	Graph-based semi-supervised learning	L01, L02, L03
	Activity: Readings, homework	
13	Node Representation Learning (Node Embedding)	L01, L02, L03
	Activity: Readings, homework	
14	Small patterns in networks (Graphlet)	L01, L02, L03,
	Activity: Readings, homework, quiz	L04
15	Ranking and network centrality, Recommendation Systems, Katz, HITs	L01, L02, L03,
	Activity: Online video lectures, readings, homework	L04
13	Final exam	L01, L02, L04
	Activity: Project presentations	

Prepared by
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