OSTIM TECHNICAL UNIVERSITY
FACULTY OF ECONOMICS AND ADMINISTRATIVE SCIENCES
MANAGEMENT INFORMATION SYSTEMS DEPARTMENT
COURSE SYLLABUS FORM

MIS 449 Big Data							
Course Name	**Course Code**	**Period**	**Hours**	**Application**	**Laboratory**	**Credit**	**ECTS**
Big Data	MIS 449	7	2	1	0	3	4

Language of Instruction	English
Course Status	Elective
Course Level	Bachelor
Learning and Teaching Techniques of the Course	Lecture, Question-Answer, Problem Solving, Computer Applications

Course Objective

The objective of this course is to provide students with an understanding of the concepts and technologies used to collect, store, process, and analyze large and complex data sets. This includes learning about distributed computing frameworks and deep learning techniques for data analysis and predictive modeling. The goal is to equip students with the skills and knowledge necessary to work with big data in a variety of industries and applications.

Learning Outcomes

The students who become successful in this course will be able;

- to understand how to make data-driven business decisions.
- to develop the advanced techniques in large data sources.
- to build industry-valued skills
- to participate in or lead data science efforts at any organization.
- to know the current trends in big data and the ability to stay up-to-date with new developments in the field.

Course Outline

This course includes application of tree-based algorithms like Decision Trees and Random Forests to solve big data problems. The course also focusses on common forecasting algorithms used to solve Time Series problems. The emphasis will be placed on various concepts involved in Deep Learning, learn about the problems where Feed-Forward, Convolutional, and Graph Neural Networks find use, and understand how and where to apply these deep learning algorithms. In addition, the difference between traditional prediction and recommendation systems are introduced.

Weekly Topics and Related Preparation Studies		
Weeks	**Topics**	**Preparation Studies**
1	Decision Trees	– Introduction to Decision Trees – The Power of Decision Trees and their advantages – Classification: The Main Idea – Building a Decision Tree from data – Misclassification and error criterion – Decision Trees for categorical data – Defining and optimizing splits, Entropy, Information Gain, Greedy algorithm for the split
2	Introduction to Bagging and Random Forest	– The Bias-Variance tradeoff – Overfitting and Pruning of Decision Trees – Ensemble Learning – Reduction in Variance – Bagging, Bootstrapping and Random Forests with examples – Sampling features at every node and their effects – Extensions to the above processes
3	Time Series	– Introduction to Time Series and domains of Time Series analysis – Time Series Implementations – Stationarity in data and its importance – Testing stationarity and Transformations to get stationary series – Autocorrelation, Methods for Time Series, AR, ARMA, controlled series – Estimation of AR models, Similarity of MA, data dependence
4	Practice Project: Applied Data Science	– Case study
5	Introduction to Deep Learning	– Concept of Neurons – Activation functions – Multiple Layers – Architecture – Cross-Entropy Loss – Gradient Descent – Basic Training Algorithms - SGD, Minibatch
6	Convolutional Neural Networks	– Locality, Translation invariance – Filters/Convolutions – Pooling and Max-Pooling – Architecture of CNN – Illustration of what CNNs learn
7	Graph Neural Networks	– The ideas of Pre-Training, Transfer

		Learning, and Augmentation – Contrastive Learning – From Images to Graphs – Graph Convolutions
8	**MIDTERM EXAM**	
9	Practice Project: Deep Learning	– Case study
10	Intro to Recommendation Systems	– Recommendation systems: why and what? – Evaluation of specific metrics – The sparsity of data – Exploring Yelp and Movielens datasets – Modeling process and simple solutions – Content-based recommendation systems
11	Matrix	– Improving solutions – Clustering-based recommendation systems – Collaborative Filtering – Introduction to matrix estimation – Singular Value Thresholding – Optimization with least squares
12	Tensor, NN for Recommendation Systems	– Model and the estimation algorithm – Matrix estimation with content-based – Matrix estimation over time
13	Practice Project: Recommendation systems	– Case study
14	Capstone Project	– Presentations
15	**FINAL EXAM**	

Textbook(s)/References/Materials:
Textbook: Chollet, F. (2021). Deep learning with Python. Simon and Schuster.
Supplementary References:
Other Materials: -

Assessment		
Studies	**Number**	**Contribution margin (%)**
Attendance		
Lab		
Class participation and performance	1	10
Field Study		
Course-Specific Internship (if any)		
Quizzes / Studio / Critical		
Homework		
Presentation		
Projects	1	20
Report		
Seminar		
Midterm Exam/Midterm Jury	**1**	**20**
General Exam / Final Jury	**1**	**50**
Total		**100**
Success Grade Contribution of Semester Studies		**50**
Success Grade Contribution of End of Term		**50**
Total		**100**

ECTS / Workload Table			
Activities	**Number**	**Duration (Hours)**	**Total Workload**
Course hours (Including the exam week): 15 x total course hours)	15	3	45
Laboratory			
Application			
Course-Specific Internship (if any)			
Field Study			
Study Time Out of Class	10	4	40
Presentation / Seminar Preparation			
Projects	1	10	10
Reports			
Homework			
Quizzes / Studio Review			
Preparation Time for Midterm Exams / Midterm Jury	1	12	12
Preparation Period for the Final Exam / General Jury	1	13	13
Total Workload	**(120/30 =4)**		**120**

Course' Contribution Level to Learning Outcomes						
Nu	**Learning Outcomes**	**Contribution Level**				
		1	**2**	**3**	**4**	**5**
LO1	to understand how to make data-driven business decisions.					X
LO2	to develop the advanced techniques in large data sources.					X
LO3	to build industry-valued skills					X
LO4	to participate in or lead data science efforts at any organization.					X
LO5	to know the current trends in big data and the ability to stay up-to-date with new developments in the field.					X

Relationship Between Course Learning Outcomes and Program Competencies (Department of Management Information Systems)							
Nu	**Program Competencies**	**Learning Outcomes**					**Total Effect (1-5)**
		LO1	**LO2**	**LO3**	**LO4**	**LO5**	
1	Recognize and distinguish the basic concepts such as data, information, and knowledge in the field of Management Information Systems and know the processes to be followed for data acquisition, storage, updating, and security	x		x		x	**5**
2	Develop and manage databases suitable for collecting, storing, and updating data			x	x		**5**
3	As a result of his/her ability to think algorithmically, easily find solutions to the problems concerning the basic business functions		x		x	x	**4**
4	Learn programming logic, have information about current programming languages			x			**5**
5	Be able to use up-to-date programming languages			x			**5**
6	Be able to take part in teamwork or lead a team using knowledge of project management processes	x	x				**5**
7	Know ethical and legal rules, use professional field knowledge within the scope of ethical and legal rules						
8	Have knowledge in the fundamental areas of business administration namely management and organization, production, finance, marketing, numerical methods, accounting, etc., and have the knowledge and skills to work in-depth in at least one of them						
9	Be able to solve the problems encountered in the field of internet programming by designing web applications			x	x		**1**

10	Develop and manage logistics and supply chain management activities.						
11	Adapt his/her theoretical knowledge and the experience he/she will gain through practice at the departments of businesses such as information technologies, R&D, and management to real life.						
12	Be able to develop strategies that will provide a competitive advantage with his/her advanced knowledge of management strategies and management functions						
13	Develop a business idea, commercialize the business idea, and design and manage his/her own venture using entrepreneurial knowledge						
14	By using English effectively, they can follow, read, write, speak and communicate universal information in the field of management information systems in a foreign language with professional competence.						
Total Effect							**30**

Policies and Procedures
Web page: https://www.ostimteknik.edu.tr/management-information-systems-english-1241/915
Exams: The exams aim at assessing various dimensions of learning: knowledge of concepts and theories and the ability to apply this knowledge to real-world phenomena, through analyzing the situation, distinguishing problems, and suggesting solutions. The written exams can be of two types, ie. open-ended questions, which can also be in the form of problems or multiple-choice questions.
Assignments: Homework (Assignments) might be applicable. Scientific Research Ethics Rules are very important while preparing assignments. The students should be careful about citing any material used from outside sources and reference them appropriately.
Missed exams: Any student missing an exam needs to bring an official medical report to be able to take a make-up exam. The medical report must be from a state hospital.
Projects: Not applicable.
Attendance: Attendance requirements are announced at the beginning of the term. Students are usually expected to attend at least 70% of the classes during each term.
Objections: If the student observes a material error in his/her grade, he/she has the right to place an objection to the Faculty or the Department. The claim is examined and the student is

notified about its outcome.