ABDULLAH GÜL UNIVERSITY
INSTITUTE OF SCIENCE
ELECTRIC and COMPUTER ENGİNEERING ANABİLİM DALI
INDIVIDUAL COURSE DESCRIPTION

Course Ttitle	Code	Semester	T+U Hours	Credit	ECTS
NEURAL NETWORKS	ECE-560	FALL+SPRING	3 + 0	3	10

Prerequisities and co-re-requisities	Introduction to Computer Programming, Calculus, Probability and Statistics, Linear Algebra

Type	Elective
Language	English
Coordinator	Assist. Prof. Dr. Zafer Aydin
Instructor	Assist. Prof. Dr. Zafer Aydin
Adjunt	None
Aim	This course provides an introduction to neural networks. Students will learn the concepts behind the neural networks by exploring the fundamental theoretical principles and gain practical experience by applying the techniques on selected problems.
Learning Outcomes	1. Explain the mathematical and algorithmic principles of neural networks 2. Solve a machine learning problem by applying the appropriate neural network methodologies 3. Implement neural network methods using an appropriate software 4. Apply a neural network method to a real problem
Course Content	• Perceptrons • Network training • Error functions • Regularization • Bayesian neural networks • Self organizing maps • Extreme learning machine

WEEKLY TOPICS AND PRELIMINARY STUDY

Week	Topics	Prelimanary Study
1	**Introduction:** single and multi-layer perceptrons	
2	**Network training:** gradient descent algorithm, batch learning, mini-batch learning	
3	**Network training:** Error backpropagation algorithm	
4	**Error functions:** sum of squares, Minkowski, cross-entropy	
5	**Network training:** Hessian matrix**,** conjugate gradient, line search	
6	**Midterm 1**	
7	**Network training:** Quasi-Newton, Levenberg-Marquardt, Adadelta, Adagrad	
8	**Network training:** Adam, Adamax, NAG, RMSprop, CMAES	
9	**Regularization:** L1 and L2 norm, early stopping, tangent propagation, dropout	
10	**Combining neural networks**	
11	**Midterm 2**	
12	**Bayesian neural networks:** posterior parameter distribution	

13	**Data processing and feature selection by neural networks**	
14	**Self-organizing maps**	
15	**Extreme learning machine**	
16	**Final Exam**	

SOURCES	
Lecture Notes	Lecture slides
Other Sources	Course Textbook: 1. Neural Networks and Learning Machines, 3rd edition, Simon Haykin, 2009. Additional Materials: 1. Neural Networks for Pattern Recognition, Christopher Bishop, 1995. 2. Pattern Recognition and Machine Learning, Christopher Bishop, 2006.

COURSE MATERIALS SHARING	
Documents	Lecture notes, slides
Homeworks	10
Exams	2 Midterm and 1 Final Exam

EVALUATION SYSTEM		
SEMESTER STUDY	**NUMBER**	**CONTRIBUTION**
Midterm	2	30
Homework	10	25
Semester Project	1	25
Final Exam	1	20
Contribution of Semester Study		80
Contribution of Final Exam	1	20
TOTAL		100

Course Category	
Sciences and Mathemetics	%50
Engineering	%50
Social Sciences	%0

RELATIONSHIPS BETWEEN LEARNING OUTCOMES AND PROGRAM QUALIFICATIONS

No	Program Qualitications	Contribution Level				
		1	2	3	4	5
1	The skills of using mathematics, science and engineering information in advanced research				X	
2	The skills of analyzing, designing and/or implementing an original system that will be able to solve an engineering problem					X
3	The skills of using the required software, hardware and modern measurement equipments in their field of research					X
4	The skills of planning independent research and implementing in detail			X		
5	The skills of following literature, listening to and making technical presentation, writing a paper in academic level			X		
6	The skills of innovative and interrogative thinking and finding original solutions		X			

Increasing from 1 to 5

ECTS / WORK LOAD TABLE			
Activities	Number	Duration (Hours)	Total Work Load
Course Length (includes exam weeks: 16x total course hours)	16	3	48
Out of class study time (pre-study, practice)	16	8	128
İnternet search, library work, literature search	1	5	5

Presantation			
Homework	10	5	50
Midterm Exam	2	20	40
Final Exam	1	30	30
Total Work Load			291
Total Work Load / 30			291/30
Course ECTS Credit			10