

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

Course Title	Code	Semester	T+U Hours	Credit	ECTS
NEURAL NETWORKS	ECE-560	FALL+SPRING	3 + 0	3	7,5

Prerequisites and co-requisites	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
Adjunct	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	<ol style="list-style-type: none"> 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	<ul style="list-style-type: none"> • Perceptrons • Network training • Error functions • Regularization • Bayesian neural networks • Self organizing maps • Extreme learning machine

WEEKLY TOPICS AND PRELIMINARY STUDY		
Week	Topics	Preliminary 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, Adadelata, 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	<p>Course Textbook:</p> <ol style="list-style-type: none"> 1. Neural Networks and Learning Machines, 3rd edition, Simon Haykin, 2009. <p>Additional Materials:</p> <ol style="list-style-type: none"> 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 Mathematics	%50
Engineering	%50
Social Sciences	%0

RELATIONSHIPS BETWEEN LEARNING OUTCOMES AND PROGRAM QUALIFICATIONS

		Contribution Level				
		1	2	3	4	5
No	Program Qualifications					
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
Internet 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			7,5