ROBOTICS AND INTELLIGENT SYSTEMS MASTER PROGRAM
COURSE SYLLABUS

Course Details				
Code	**Academic Year**			**Semester**
RIS511	1			1
Title	**T**	**A**	**L**	**ECTS**
Machine Learning	2	2	0	7

Language	English					
Level	**Undergraduate**		**Graduate**	**X**	**Postgraduate**	
Department / Program	Robotics and Intelligent Systems					
Forms of Teaching and Learning	Face-to-Face, Group Study, Individual Study, programming.					
Course Type	**Compulsory**		**Elective**	**X**		
Objectives	The course will give the student the basic ideas and intuition behind modern machine learning methods as well as a formal understanding of how, why, and when they work; and gain the ability to use this knowledge in the development of various learning models.					
Content	- Perceptron, Convergence, Generalization - Linear Regression, Bias and Variance - Logistic Regression - Over- and Underfitting, Regularisation - Maximum Margin Classification, Support Vector Machines (SVM) - Non-linear Predictions, Kernels - Neural Networks, Multilayer Perceptron, Backpropagation, Intro to Deep Learning - Unsupervised Learning, K-Means Algorithm - Principal Component Analysis (PCA) - Model selection, model selection criteria					
Prerequisites						
Coordinator	DI Dr. Canan Yıldız					
Lecturer(s)	DI Dr. Canan Yıldız					
Assistant(s)						
Work Placement						

Recommended or Required Reading	
Books / Lecture Notes	- Maschine Learning, Tom Mitchell, McGraw-Hill, 1997. - Artificial Intelligence: A Modern Approach, S. Russel und P. Norvig, Prentice Hall, Englewood Cliffs, 2003.
Other Sources	- Hands-on machine learning with Scikit-Learn, Keras and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, Aurélien Géron, O'Reilly Media, 2019.

Additional Course Material	
Documents	-
Assignments	-
Exams	-

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Course Composition		
Mathematics und Basic Sciences	20	%
Engineering		%
Engineering Design		%
Social Sciences		%
Educational Sciences		%
Natural Sciences		%
Health Sciences		%
Expert Knowledge	80	%

Assessment		
Activity	**Count**	**Percentage (%)**
Midterm Exam	1	40
Quiz		
Assignments	1	10
Attendance		
Recitations		
Projects		
Final Exam	1	50
	Total	**100**

ECTS Points and Work Load			
Activity	**Count**	**Duration**	**Work Load (Hours)**
Lectures	14	2	28
Self-Study	1	94	98
Assignments	9	4	36
Presentation / Seminar Preparation			
Midterm Exam	1	3	3
Recitations	14	2	28
Laboratory			
Projects			
Final Exam	1	3	3
		Total Work Load	**196**
		ECTS Points (Total Work Load / 28)	**7**

Learning Outcomes	
1	Understand the complexity of Machine Learning algorithms (regression, classification, clustering, and dimensionality reduction) and their limitations.
2	Select the appropriate machine learning algorithms for real-life applications.

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3	Be capable of confidently applying common Machine Learning algorithms in practice and implementing their own.
4	Be capable of performing experiments in Machine Learning using real-world data.
5	Assess the model quality in terms of relevant performance/error metrics for each application.

Weekly Content	
1	Introduction, supervised and unsupervised learning, model representation, cost function
2	Gradient Descent, Gradient Descent for Linear Regression
3	Multiple Variables, Feature Scaling, Learning Rate, Polynomial Regression
4	Classification, Logistic Regression
5	Decision Boundary, Multiclass Prediction, One-vs-All
6	Neural Networks, Model Represenation
7	Cost Function and Backpropagation, Gradient Checking, Random Initialization
8	Evaluating Learning Algorithms, Train/Validation/Test Sets, Bias and Variance, Learning Curves
9	Midterm Exams
10	Large Margin Classification, Optimization Objective, Intuition
11	Kernels, Support Vector Machines
12	Unsupervised Learning, K-Means Algorithm
13	Dimensionality Reduction, Data Compression, Principal Component Analysis
14	Principal Component Analysis (cont.)
15	Summary, Recitation

Contribution of Learning Outcomes to Program Objectives (1-5)

	P1	**P2**	**P3**
1	5	5	4
2	5	5	4
3	5	5	4
4	5	5	4
5	5	5	4

Contribution Level	1: Low 2: Low-intermediate 3: Intermediate 4: High 5: Very High
Compiled by:	DI Dr. Canan Yıldız
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