MECHATRONICS ENGINEERING
COURSE SYLLABUS

Course Details				
Code		**Academic Year**		**Semester**
INF502		3		Fall
Title		**T**	**A**	**L**	**ECTS**
Machine Learning		2	2	0	6

Language	German					
Level	**Undergraduate**	**X**	**Graduate**		**Postgraduate**	
Department / Program	Mechatronics Engineering					
Forms of Teaching and Learning	Face-to-Face, Group Study, Individual Study, programming.					
Course Type	**Compulsory**	**X**	**Elective**			
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	- Regression techniques - Classification - Training models - Support vector machines (SVM) - Decision trees - Ensemble learning and random forests - Dimensionality reduction, principal component analysis - Model selection - Unsupervised learning techniques					
Prerequisites	None					
Coordinator	Assoc. Prof. Dr. Emre Işık					
Lecturer(s)	Assoc. Prof. Dr. Emre Işık					
Assistant(s)	MSc. Ayşe Betül Yüce					
Work Placement	None					

Recommended or Required Reading	
Books / Lecture Notes	- Hands-on machine learning with Scikit-Learn, Keras and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, Aurélien Géron, O'Reilly Media, 2019.
Other Sources	- Machine learning, Ethem Alpaydın, MIT Press, 3rd Ed., 2020 - The hundred-page machine learning book, Andriy Burkov, 2019

Additional Course Material	
Documents	-
Assignments	-
Exams	-

Course Composition

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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		
Quiz		
Assignments		
Attendance		
Recitations		
Projects	1	40
Final Exam	1	60
	Total	**100**

ECTS Points and Work Load

Activity	Count	Duration	Work Load (Hours)
Lectures	14	2	28
Self-Study	1	66	66
Assignments	10	4	40
Presentation / Seminar Preparation			
Midterm Exam			
Recitations			
Laboratory	14	2	28
Projects	1	3	3
Final Exam	1	3	3
		Total Work Load	**168**
		ECTS Points (Total Work Load / 28)	**6**

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, machine learning methods, challenges, testing and validating
2	End-to-end machine learning project: data collection, cost function, data visualization
3	End-to-end machine learning project: data preparation, model selection, training, optimization
4	Classification (using MNIST database)
5	Training models I
6	Training models II
7	Support Vector Machines
8	Decision trees
9	Ensemble Learning und Random Forests
10	Dimensionality reduction
11	Unsupervised learning techniques I - clustering
12	Unsupervised learning techniques I – Gaussian mixtures (density estimation)
13	Hackathon
14	Presentations and discussions

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

	P1	P2	P3	P4	P5	P6	P7
1	5	5	4			3	1
2	5	5	4			3	1
3	5	5	4			3	1
4	5	5	4			3	1
5	5	5	4			3	1

Contribution Level	1: Low 2: Low-intermediate 3: Intermediate 4: High 5: Very High
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