Content

Course Code	Course Name	Semester	Theory	Practice	Lab	Credit	ECTS
MATH 601	Mathematical Foundations of Machine Learning	1	3	0	0	3	7

Prerequisites	
Admission Requirements	

Language of Instruction	English
Course Type	Elective
Course Level	Doctoral Degree
Objective	Öğrencilere makine öğrenmesi prensiplerini öğretmek ve onları veri analizi, sınıflandırma, regresyon, kümeleme ve boyut indirgeme tekniklerini uygulamaları için matematiksel araçlarla donatmak.
Content	Bu ders, makine öğrenmesi prensiplerini kapsar, özellikle matematiksel temelleri üzerinde yoğunlaşır. Öğrenciler, veri analizi, regresyon, sınıflandırma, kümeleme ve boyut indirgeme teknikleri gibi temel makine öğrenmesi konularını öğrenir ve bunları uygulamak için matematiksel araçları kullanır.
References	Learning Theory from First Principles, Francis Bach Deep Learning, Ian Goodfellow, Yoshua Bengio and Aaron Courville High-Dimensional Probability, Vershynin Convex Optimization, Boyd ve Vandenberghe Elements of Information Theory, Cover ve Thomas Understanding Machine Learning, Shalev-Shwartz ve Ben-David Pattern Recognition and Machine Learning, Christopher Bishop, Machine Learning: A Probabilistic Perspective, Kevin Murphy

Theory Topics

Week	Weekly Contents
1	Linear Algebra Basics
2	Spectral Theory
3	Singular Value Decomposition
4	Positive Matrices and Perron--Frobenius
5	Calculus Refresher
6	Convex Sets and Functions
7	Convex Optimization
8	Nonconvex Optimization
9	Probability Theory Foundations
10	Concentration Inequalities
11	Advanced Probability for Machine Learning
12	Statistical Estimation
13	High-Dimensional Statistics
14	Information Theory Essentials

Content

Course Code	Course Name	Semester	Theory	Practice	Lab	Credit	ECTS
MATH 691	(Directed Research	2	3	0	0	3	9

Prerequisites	
Admission Requirements	

Language of Instruction	English
Course Type	Compulsory
Course Level	Doctoral Degree
Objective	
Content	
References	

Theory Topics

Week	Weekly Contents

Content

Course Code	Course Name	Semester	Theory	Practice	Lab	Credit	ECTS
MATH 602	Statistical Inference & Learning Theory	1	3	0	0	3	7

Prerequisites	
Admission Requirements	

Language of Instruction	English
Course Type	Elective
Course Level	Doctoral Degree
Objective	
Content	
References	

Theory Topics

Week	Weekly Contents

Content

Course Code	Course Name	Semester	Theory	Practice	Lab	Credit	ECTS
MATH 642		2	3	0	0	3	7

Prerequisites	
Admission Requirements	

Language of Instruction	English

Course Type	Elective
Course Level	Doctoral Degree
Objective	
Content	
References	

Theory Topics

Week	Weekly Contents

Content

Course Code	Course Name	Semester	Theory	Practice	Lab	Credit	ECTS
MATH 690	Graduate Seminar	1	0	2	0	0	9

Prerequisites	
Admission Requirements	

Language of Instruction	English
Course Type	Compulsory
Course Level	Doctoral Degree
Objective	
Content	
References	

Theory Topics

Week	Weekly Contents

Content

Course Code	Course Name	Semester	Theory	Practice	Lab	Credit	ECTS
MATH 608		2	3	0	0	3	7

Prerequisites	
Admission Requirements	

Language of Instruction	English
Course Type	Elective
Course Level	Doctoral Degree
Objective	
Content	
References	

Theory Topics

Week	Weekly Contents

Content

Course Code	Course Name	Semester	Theory	Practice	Lab	Credit	ECTS
MATH 604	Theory of Deep Learning	1	3	0	0	3	7

Prerequisites	
Admission Requirements	

Language of Instruction	English
Course Type	Elective
Course Level	Doctoral Degree
Objective	
Content	
References	

Theory Topics

Week	Weekly Contents

Content

Course Code	Course Name	Semester	Theory	Practice	Lab	Credit	ECTS
MATH 614		2	3	0	0	3	7

Prerequisites	
Admission Requirements	

Language of Instruction	English
Course Type	Elective
Course Level	Doctoral Degree
Objective	
Content	
References	

Theory Topics

Week	Weekly Contents