

UE-ML1: Statistical Learning		Semester 1
Contributes to	MICAS	
Coordinators:	Hadi GHAUCH, Telecom Paris Aslan TCHAMKERTEN, Telecom Paris	
Volume:	30h	3 ects
Hours:	Lectures: 24h, Exercises: 4.5h	
Assessment:	Final Exam	
Language:	English	
Objectives:	The course provides a mathematical introduction to supervised and unsupervised statistical learning. -	
Outcomes:	On completion of the course students should be able to: -	
	<ul style="list-style-type: none"> • Identify the different types of inference problems (supervised/unsupervised) • Apply algorithms • Know certain intrinsic limitations to inference problems. 	
Prerequisite	-	
	<ul style="list-style-type: none"> • Linear algebra • Introduction to Convex Optimization • Introduction to Probability and Statistics 	
Syllabus	-	
	<ul style="list-style-type: none"> • Statistics vs. learning approaches • Supervised learning <ul style="list-style-type: none"> – Binary classification – Empirical risk – VC theory – Boosting – SVM – Prediction with expert advice – Linear methods for regression • Unsupervised learning <ul style="list-style-type: none"> – Cluster analysis – K-Means – Principal components 	
Bibliography:	-	
	<ul style="list-style-type: none"> • Felipe Cucker and Steve Smale, "On the Mathematical Foundations of Learning", Bulletin of the American Mathematical Society, 2002. • Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", 2008. • Philippe Rigollet, "Mathematics of Machine learning", MIT lecture notes, 2015 • Martin Wainwright, High-Dimensional Statistics A Non-Asymptotic Viewpoint, Cambridge University Press, 2019. • P. Bishop, "Pattern recognition and machine learning", 2006. • L. Bottou, F. Curtis and J. Norcedal, "Optimization Methods for Large-Scale Machine Learning", SIAM Rev., 60(2), 223–311, 2018. 	