EE566: Adaptation and Learning (EPFL) **Spring 2020**
Prof. Ali H. Sayed **February 17, 2020**

PLACE AND TIME: Room DIA004, Mondays 11:15-13:00 and 14:15-16:00

INSTRUCTOR: Ali H. Sayed, Email: ali.sayed@epfl.ch

TEACHING ASSISTANTS: Virginia Bordignon (Email: virginia.bordignon@epfl.ch)
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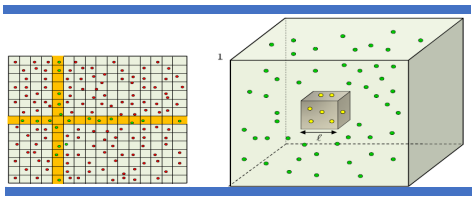
COURSE MATERIAL: Lecture notes authored and distributed by the instructor for exclusive use by students enrolled in the class.

PRE-REQUISITES: It is recommended that students have some familiarity with matrix theory, linear algebra, and probability. Supplemental material on these topics is provided by the instructor as needed.

GRADING: 4 homework assignments including some computer projects (40%) and two exams worth 30% each. The first exam is take-home, and the second exam is during the final examination week.



TOPICS : In this course, students learn to master tools, algorithms, and core concepts related to inference and learning from data. Emphasis is on the theoretical underpinnings and statistical limits of learning theory. Students learn how to design learning algorithms and how to quantify their limits of performance. In particular, the course covers topics related to optimal inference, regularization, proximal techniques, online and batch methods, stochastic learning, generalization, statistical learning theory, Bayes and naive classifiers, nearest-neighbor rules, clustering, decision trees, logistic regression, discriminant analysis, Perceptron, support vector machines, kernel methods, bagging, boosting, random forests, cross-validation, neural networks, and principal component analysis.

LECTURE	TASK	DATE	TENTATIVE TOPICS
1		Feb. 17	Vector Differentiation. Convex Functions. Proximal Operator.
2		Feb. 24	Deterministic and Stochastic Optimization.
3	HW1 due	Mar. 2	Motivation (Inference, Classification, Clustering). Maximum Likelihood.
4		Mar. 9	Expectation-Maximization. Mixture Models.
5		Mar. 16	Mean-Square-Error Inference. Linear Regression. Least-Squares.
6	HW2 due	Mar. 23	Regularization. LASSO. Basis Pursuit.
7	Exam out	Mar. 30	Bayesian Inference. Discriminant Analysis. Principal Component Analysis.
8	Exam in	Apr. 6	Logistic Regression. Cross Validation. Perceptron.
	HOLIDAY	**Apr. 13**	**EASTER HOLIDAY (NO CLASS)**
9		Apr. 20	Support Vector Machines. Naïve Bayes. Nearest-Neighbor Rule.
10	HW 3 due	Apr. 27	k-means Clustering. Decision Trees. Bagging and Boosting
11		May 4	Generalization Theory. Kernel-Based Learning.
12		May 11	Neural Networks.
13	HW4 due	May 18	Deep Networks.
14		May 25	Convolutional Networks.
	FINAL EXAM		FINAL EXAMINATION DURING WEEK JUNE 15-JULY 4, 2020