EE566: Adaptation and Learning (EPFL) **Spring 2021**
Prof. Ali H. Sayed **February 22, 2021**

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)
Elsa Rizk (Email: elsa.rizk@epfl.ch)

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 core concepts related to inference and learning from data. Emphasis is on mathematical foundations and 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. 22	Vector Differentiation. Convex Functions.
2		Mar. 1	Proximal Operator. Gradient-Descent.
3	**HW1 due**	Mar. 8	Stochastic Optimization.
4		Mar. 15	Maximum-Likelihood. MSE Inference.
5		Mar. 22	Linear Regression. Least-Squares.
6	**HW2 due**	Mar. 29	Regularization. LASSO. Basis Pursuit.
	NO CLASS	Apr. 5	**EASTER HOLIDAY (NO CLASS)**
7	**EXAM OUT**	Apr. 12	Bayes Classifier. Discriminant Analysis.
8	**EXAM IN**	Apr. 19	PCA, Logistic Regression. Perceptron.
9		Apr. 26	Support Vector Machines. Naïve Bayes. Nearest-Neighbor Rule.
10	**HW3 due**	May 3	k-Means Clustering. Decision Trees. Bagging and Boosting.
11		May 10	Generalization Theory. Kernel Methods.
12		May 17	Neural Networks.
13		May 24	Convolutional Networks.
14	**HW4 due**	May 31	Explainable Learning. Adversarial Attacks.
	FINAL EXAM		FINAL EXAMINATION DURING WEEK JUNE 21-JULY 10, 2021