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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 ASSISTANT: Stefan Vlaski, E-mail: stefan.vlaski@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 take-home exam assignments worth 30% each.

EXAMS:
- Take-home exam I (out on April 1, 2019 after class; return on April 8, 2019 before class).
- Take-home exam II (out on May 27, 2019 after class; return on May 30, 2019 before 4PM).

TOPICS: In this course, students learn to master tools, algorithms, and core concepts related to inference from data, data analysis, and adaptation and learning theories. *Emphasis is on the theoretical underpinnings and statistical limits of learning theory.* In particular, the course covers topics related to optimal inference, regularization, proximal techniques, online and batch methods, stochastic learning, generalization and statistical learning theory, Bayes and naive classifiers, nearest-neighbor rules, clustering, self-organizing maps, decision trees, logistic regression, discriminant analysis, Perceptron, support vector machines, kernel methods, bagging, boosting, random forests, cross-validation, and principal component analysis.
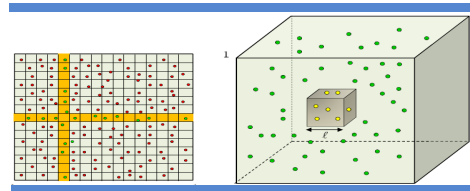
LECTURE	TASK	DATE	TENTATIVE TOPIC(S)
1		Feb. 18	Vector Differentiation. Convex Functions. Proximal Operator.
2		Feb. 25	Deterministic and Stochastic Optimization.
3	HW1 due	Mar. 4	Motivation (Inference, Classification, Clustering). Maximum Likelihood.
4		Mar. 11	Expectation-Maximization. Mixture Models.
5		Mar. 18	Mean-Square-Error Inference. Linear Regression. Least-Squares.
6	HW2 due	Mar. 25	Regularization. LASSO. Basis Pursuit.
7	Exam I out	Apr. 1	Bayesian Inference. Discriminant Analysis.
8	Exam I due	Apr. 8	Logistic Regression. Cross Validation. Perceptron.
9		Apr. 15	Support Vector Machines. Naïve Bayes. Nearest-Neighbor Rule.
	HOLIDAY	Apr. 22	EASTER HOLIDAY (NO CLASS)
10	HW 3 due	Apr. 29	k-means Clustering. Decision Trees.
11		May 6	Generalization Theory. Kernel-Based Learning. PCA
12		May 13	Neural Networks.
13	HW4 due	May 20	Deep Networks.
14	Exam II out	May 27	Convolutional Networks.
	Exam II due	May 30	Before 4 PM.