

EE520 Data Driven Analysis of Complex Systems

Fall 2023

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Dates	Lectures	Group	Topic	Problems
Linear Algebra and Singular Value Decomposition				
M Aug 28	1,	1	Meet the Data – What is a Complex System	HW 1 Assigned
W Aug 30	2	2	Our favorite Linear Dimension Reduction Method: SVD, PCA, POD, KL	
F,M Sept 1, 4	3,4	2	SVD, PCA, POD, KL	
W,F Sept 6, 8	5,6	2	INCL SVD Image Compression, Eigenfaces, POD-KLT (Karhunen-Loeve Transform).	
M,W, F Sept 11, 13, 15,7,8		2	INCL SVD Image Compression, Eigenfaces, POD-KLT (Karhunen-Loeve Transform).	
M Sept 18	8,9	3	Regression, Model Selections, Inverse Problems	HW 2 Assigned
W Sept 20	8,9	3	Regression, Model Selections, Inverse Problems	HW 1 Due
F Sept 22	10	3	Matrix Methods, SVD and Geometry of LS	
M Sept 25	12	3	Regression, Model Selections, Over-Under Fitting – Toward Tikhonov and Ridge Regression	
W,F,M,W S27-O11		3	Inverse Problems, Lasso, and Compressed Sensing	HW 2 due F Oct 13
Data-Driven Forecasting and Analyzing Spatiotemporal Processes				
W, F, M, W Oct 11, 13, 16, 18,23, 26 4.			DMD – Dynamic Mode Decomposition	HW 3 Assigned on M Oct 16.
Neural Networks – Deep Learning				
M,W Oct 30, Nov 1		5	“Classic” feedforward ANN – deep learning	
F, M, W Nov 3, 6, 8, 10		5	Random ANN, Reservoir computing, Echo State. ELM – forecasting	HW 3 Due on M Nov 13.
Classification and Clustering Problems				
M- Nov 13-		6	Clustering Methods – Kmeans then Spectral Clustering	HW 4 Assigned on M Nov 10 . HW 4 Due on F Dec 1.

Coming to a class near you –

Applications with Cluster Methods, Kmeans and Clustering

Applications with Classification Methods, LDA, SVM, kSVM, ANN.
Applications of Manifold Learning And Dimension Reduction, Diffusion Maps, and
autoencoders