

# EE520 Data Driven Analysis of Complex Systems

Fall 2024

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Dates	Lectures	Group	Topic	Problems
<b>Linear Algebra and Singular Value Decomposition</b>				
M Aug 26		1	Meet the Data – What is a Complex System	<b>HW 1 Assigned</b>
W Aug 28		2	Our favorite Linear Dimension Reduction Method: SVD, PCA, POD, KL	
F,M Aug30,Sept2		2	SVD, PCA, POD, KL	
W,F Sept 4,6		2	INCL SVD Image Compression, Eigenfaces, POD-KLT (Karhunen-Loeve Transform).	
M,W, F Sept 9-13.		2	INCL SVD Image Compression, Eigenfaces, POD-KLT (Karhunen-Loeve Transform).	
M Sept 16		3	Regression, Model Selections, Inverse Problems	<b>HW 2 Assigned</b>
W Sept 18		3	Regression, Model Selections, Inverse Problems	<b>HW 1 Due Sept 18</b>
F Sept 20		3	Matrix Methods, SVD and Geometry of LS	
M Sept 23		3	Regression, Model Selections, Over-Under Fitting – Toward Tikhonov and Ridge Regression	
W,F,M,W S25-O2		3	Inverse Problems, Lasso, and Compressed Sensing	<b>HW 2 due M Oct 7</b>
<b>Data-Driven Forecasting and Analyzing Spatiotemporal Processes</b>				
W-W	Oct 2-16	4	DMD – Dynamic Mode Decomposition	<b>HW 3 Assigned on M Oct 7.</b>
<b>Neural Networks – Deep Learning</b>				
M,W	Oct 18-23	5	“Classic” feedforward ANN – deep learning	
F, M, W, F	Oct 25-Nov 4	5	Random ANN, Reservoir computing, Echo State. ELM – forecasting	<b>HW 3 Due on M Nov 4.</b>
<b>Classification and Clustering Problems</b>				
M-	Nov 6-	6	Clustering Methods – Kmeans then Spectral Clustering	<b>HW 4 Assigned on M Nov 4 .</b> <b>HW 4 Due on F Dec 2</b>

There is a HW 5 to be assigned third week of Nov and due at the end of the semester.

Coming to a class near you –

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