DS625 Computing for Data Compression, Image and Signal Processing

Instructor: Prashant Shekhar, PhD

Tentative Schedule for Spring 2023

Week Number: Days	*Topic/Quizzes*	*Homework*	*Learning Outcome*
Linear/Non-Linear Data Compression			
1: 12^{th} Jan (Th)	Course Introduction		1-10
2: 17^{th} Jan/ 19^{th} Jan (Tu,Th)	Singular Value Decomposition (SVD) Image Compression		2,3 3,4
3: 24^{th} Jan/ 26^{th} Jan (Tu,Th)	Image Encodings (eigenbases) Principal Component Analysis (PCA)	HW 1 released	3,4,5 3,5
4: 31^{st} Jan/ 2^{nd} Feb 2 (Tu, Th)	Introduction to Autoencoders (AE) Applications of AEs + Quiz 1		2,7,8 2,7,8,9
Latent Generative Models: VAE			
5: 7^{th} Feb/ 9^{th} Feb (Tu,Th)	Probabilistic PCA Variational Autoencoders (VAEs) Intro.		1,5 2,9,10
6: 14^{th} Feb/ 16^{th} Feb (Tu,Th)	VAEs: II VAEs: III	HW 1 due	2,9,10 2,9,10
7: 21^{st} Feb/ 23^{rd} Feb (Tu,Th)	VAEs: IV VAEs: V + Quiz 2	HW 2 released	2,9,10 2,9,10
Advanced Topics in VAEs			
8: 28^{th} Feb/ 2^{nd} Mar (Tu,Th)	Flexible priors in VAEs: I Flexible priors in VAEs: II		8,9,10 8,9,10
9: 7^{th} Mar/ 9^{th} Mar (Tu,Th)	Expressive posteriors for VAEs: I Expressive posteriors for VAEs: II		8,9,10 8,9,10
Spring Break			
11: 21^{st} Mar/ 23^{rd} Mar (Tu,Th)	Hierarchical VAEs: I Hierarchical VAEs: II	 HW 2 due	8,9,10 8,9,10
12: 28^{th} Mar/ 30^{th} Mar (Tu,Th)	Coding exercises VAEs summary + Quiz 3		2,8,9,10 8,9,10
Computing for Data Compression			
13: 4^{th} Apr/ 6^{th} Apr (Tu,Th)	Optimizing MLPs: Classification Optimizing MLPs: Classification		2,6 2,6
14: 11^{th} Apr/ 13^{th} Apr (Tu,Th)	Optimizing MLPs: Regression Autoencoder with Linear Layers		2,6 2,6
15: 18^{th} Apr/ 20^{th} Apr (Tu,Th)	Autoencoders with Convolutional Layers Course Summary + Quiz 4		2,6 2,6
Project			
16: 25^{th} Apr/ 27^{th} Apr (Tu,Th)	Project Presentation I Project Presentation II	 Project due	2,11 2,11

Learning outcome: After successful completion of this course, you will acquire knowledge in the following fields:

1. Basics of linear data compression
2. Python for data compression and image processing
3. SVD decomposition
4. Linear image compression and encoding
5. Linear dimensionality reduction
6. Computing/Optimization in neural networks
7. Basics of non-linear data compression
8. Autoencoders and its variants
9. Applications of non-linear data reduction
10. Deep generative models
11. Application to Real life problems