DS625 Computing for Data Compression, Image and Signal Processing

Instructor: Prashant Shekhar, PhD

Tentative Schedule for Spring 2024

Week Number: Days	*Topic/Quizzes*	*Homework*	*Learning Outcome*
Linear Data Compression			
1: 11^{th} Jan (Th)	Course Introduction		1-10
2: 16^{th} Jan/ 18^{th} Jan (Tu,Th)	Singular Value Decomposition (SVD) Image Compression		2,3 3,4
3: 23^{th} Jan/ 25^{th} Jan (Tu,Th)	Image Encodings (eigenbases) No lecture on 25^{th} Jan	HW 1 released	3,4,5
4: 30^{st} Jan/ 1^{st} Feb 2 (Tu, Th)	Principal Component Analysis (PCA) Probabilistic PCA		3,5 1,5
Non Linear Data Compression and Variational Autoencoders (VAEs)			
5: 6^{th} Feb/ 8^{th} Feb (Tu,Th)	Quiz 1 Introduction to Autoencoders (AEs) Applications of AEs		 2,7,8 2,7,8,9
6: 13^{th} Feb/ 15^{th} Feb (Tu,Th)	VAEs: I VAEs: II	HW 1 due	2,9,10 2,9,10
7: 20^{st} Feb/ 22^{rd} Feb (Tu,Th)	VAEs: III VAEs: IV	HW 2 released	2,9,10 2,9,10
8: 27^{th} Feb/ 29^{nd} Mar (Tu,Th)	Advanced topics in VAEs: I Advanced topics in VAEs: II		9,10 9,10
Generative Adversarial Networks (GANs)			
9: 5^{th} Mar/ 7^{th} Mar (Tu,Th)	Quiz 2 GANs: I GANs: II		 9,10 9,10
10: 12^{th} Mar/ 14^{th} Mar (Tu,Th)	GANs: III No lecture on 14^{th} Mar		9,10
11: 19^{st} Mar/ 21^{rd} Mar (Tu,Th)	GANs: IV GANs: V	 HW 2 due	9,10 9,10
12: 26^{th} Mar/ 28^{th} Mar (Tu,Th)	Advanced Topics in GANs: I Advanced Topics in GANs: II		9,10 9,10
Computing for Data Compression			
13: 2^{th} Apr/ 4^{th} Apr (Tu,Th)	Quiz 3 Optimizing MLPs: Classification Optimizing MLPs: Classification		 2,6 2,6
14: 9^{th} Apr/ 11^{th} Apr (Tu,Th)	Optimizing MLPs: Regression Autoencoder with Linear Layers		2,6 2,6
15: 16^{th} Apr/ 18^{th} Apr (Tu,Th)	Autoencoders with Convolutional Layers Course Summary Quiz 4		2,6 2,6
Project			
16: 23^{th} Apr/ 25^{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. GANs and other deep generative models
11. Application to Real life problems