



Monday, Jan. 13
2020
4 PM
1345 HSLC

Machine Learning for Medical Imaging (ML4MI) Initiative Seminar Series

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Understanding Geometry of Deep Learning for Medical Image Reconstruction

Abstract: Recently, deep learning approaches have been extensively used for various inverse problems thanks to its excellent performance. However, it is still difficult to obtain a coherent geometric view of why such deep learning architectures provide superior performance over mathematically-driven classical algorithms. Inspired by a recent theoretical understanding of the geometry of CNN as a combinatorial framelet representation, here we provide a unified theoretical framework that leads to a better understanding and optimized design of CNNs for various inverse problems. We also present our generalized cycleGAN framework for unsupervised learning that can be used for general inverse problems without having any matched training data set. We provide extensive experimental results using our supervised and unsupervised neural networks for several biomedical imaging reconstruction problems to verify the geometric understanding of CNNs for image reconstruction problems.