Computational Imaging at Oak Ridge National Lab (ORNL)

Abstract: Computational imaging (CI) systems play a critical role in making scientific discoveries in diverse fields including biology, material sciences and additive manufacturing at ORNL. These systems essentially solve an inverse problem to reconstruct an image/volume which is then used to extract information. In this talk, I will present algorithms for improving the performance of CI systems - enabling faster, more accurate and novel tomographic imaging capabilities. The first part of the talk will focus on model-based image reconstruction (MBIR) algorithms that formulate the inversion as solving a high-dimensional optimization problem involving a data-fidelity term and a regularization term. By accurately modeling the measurement and combining it with useful regularizers, I will demonstrate how we can significantly improve system performance for neutron tomography, X-ray micro-CT, single particle Cryo-EM and ultrasound tomography systems. The next part of the talk will focus on how to improve the performance of MBIR algorithms using data-driven convolutional dictionary regularizers with a "plug-and-play" priors approach. Finally, I will highlight some recent results of using direct deep-learning techniques for X-ray micro-CT and ultrasound tomographic imaging systems and present challenges that exist in extending the use of such techniques for a generic instrument.

Bio: S.V.Venkatakrishnan is a research scientist at the Imaging, Signals and Machine Learning group at ORNL leading the development of computational imaging algorithms for several applications. He received a B.Tech. degree in ECE from the National Institute of Technology Trichy (2007), and an M.S. (2009) and Ph.D. (2014) in ECE from the School of Electrical and Computer Engineering at Purdue University. He was awarded a Presidential Scholar Award at the Microscopy and Microanalysis conference (2014) and a Eugene P. Wigner Distinguished Fellowship by ORNL (2016). His research interests include Computational Imaging, Inverse Problems, Statistical Signal Processing and Machine Learning. Dr. Venkatakrishnan is a senior member of the IEEE, an associate editor for the IEEE Transactions on Computational Imaging and a member of the IEEE SPS Technical Committee on Computational Imaging.