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CNDE Webinar Presentation

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This webinar will be recorded and made available on the CNDE website

Maximum Likelihood based Phase-Retrieval using Fresnel Propagation Forward Models with Optional Constraints

Presented by:

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Abstract:

X-ray phase-contrast tomography (XPCT) is widely used for high contrast 3D imaging using either synchrotron or laboratory microfocus X-ray sources. XPCT enables an order of magnitude improvement in image contrast of the reconstructed material interfaces with low X-ray absorption contrast. The dominant approaches to 3D reconstruction using XPCT relies on the use of phase-retrieval algorithms that make one or more limiting approximations for the experimental configuration and material properties. Since many experimental scenarios violate such approximations, the resulting reconstructions contain blur, artifacts, or other quantitative inaccuracies. Our solution to this problem is to formulate new iterative non-linear phase-retrieval (NLPR) algorithms that avoid such limiting approximations. Compared to the widely used state-of-the-art approaches, we show that our proposed algorithms result in sharp and quantitatively accurate reconstruction with reduced artifacts. Unlike existing NLPR algorithms, our approaches avoid the laborious manual tuning of regularization hyper-parameters while still achieving the stated goals. As an alternative to regularization, we propose explicit constraints on the material properties to constrain the solution space and solve the phase-retrieval problem. These constraints are easily user-configurable since they follow directly from the imaged object's dimensions and material properties.

Speaker:

Dr. K. Aditya Mohan is a Principal Investigator and a Staff Engineer in the Computational Engineering Division at Lawrence Livermore National Laboratory. He received his MS and PhD degrees in Electrical and Computer Engineering from Purdue University. His research is in the areas of computational imaging, inverse problems, and signal/image processing. He has formulated, published, and patented numerous image reconstruction and data analysis methods for several imaging modalities including Phase-Contrast Computed Tomography (CT), Time-Space 4D CT, Dual-Energy CT, Electron CT, and Magnetic Resonance Imaging (MRI).

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