



Mechanical Engineering Seminar Series

Modern Challenges in Inverse Problems

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Tuesday, September 28, 2021

Room 3150 DOW

4:00 p.m.

This seminar will also be streamed live at the following link

[ME Seminar Zoom link](#) (QR Code below)

Password 413824



Abstract

Emerging fields such as data analytics, machine learning, and uncertainty quantification heavily rely on efficient computational methods for solving inverse problems. With growing model complexities and ever increasing data volumes, state of the art inference method exceeded their limits of applicability and novel methods are urgently needed. In this talk, we discuss modern challenges in inverse problems and introduce novel approaches to overcome such challenges. For instance, we discuss massive least squares problems, where the size of the forward process exceeds the storage capabilities of computer memory or the data is simply not available all at once. Here, randomized methods may be used to approximate solutions. We introduce sampled limited memory approaches, where an approximation of the global curvature of the underlying least squares problem is used to speed-up initial convergence while automatically addressing potential ill-posedness. We further discuss, how deep neural networks may benefit inversion processes. Numerical experiments such as superresolution, tomographic reconstruction, and deblurring will illustrate our presented approaches.

Bio

Matthias (Tia) Chung is an Associate Professor in the Department of Mathematics at Virginia Tech and member of the Computational Modeling and Data Analytics division and the Systems Biology division in the Academy of Integrated Science. He joined the Virginia Tech in 2012, holds a Dipl. math. (Master of Science equivalent) from the University of Hamburg, Germany, and a Dr. rer. nat. (Ph.D. equivalent degree) in Computational Mathematics from the University of Luebeck, Germany. Before joining Virginia Tech, he was a Post-Doctoral Fellow at Emory University and Assistant Professor at Texas State University. Tia Chung is a Humboldt Fellow and active member of the Society for Industrial and Applied Mathematics (SIAM).

Tia Chung's research concerns various forms of cross-disciplinary inverse problems. Driven by its application, he and his lab develops and analyzes efficient numerical methods for inverse problems. Applications of interest include, but are not limited to, systems biology, medical and geophysical imaging, and dynamical systems. Challenges such as ill-posedness, large-scale, and uncertainty estimates are addressed by utilizing tools from and developing methods for regularization, randomized methods, stochastic learning, Bayesian inversion, and machine learning.

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