UNIVERSITY of HOUSTON

Department of Mathematics

Scientific Computing Seminar

Dr. Umberto Villa
Oden Institute for Computational Engineering and Sciences
UT Austin

Dynamic Imaging of Tumor Vascular Perfusion using 4D Photoacoustic Computed Tomography

Thursday, April 13, 2023
1 PM- 2 PM
Room 646 PGH

Abstract:

The ability to perform dynamic imaging of time-varying physiological processes in small animal models is critically needed to understand the progression of human disease and develop new therapies. Although dynamic imaging methods have been used to evaluate tumor vascular perfusion in small animal models, the available methods typically provide only two-dimensional (2D) spatial imaging, lack the precision needed for quantitative measurements, or suffer from other drawbacks. Photoacoustic computed tomography (PACT) can circumvent the limitations of existing methods and has been recognized as a promising tool for dynamic small animal imaging. By exploiting the optical absorption of hemoglobin or exogenous contrast agents, dynamic PACT holds great potential for measuring important time-varying biomarkers such as tumor vascular perfusion and oxygenation and improving the assessments of anti-cancer and other therapies. However, the data acquisition design of commercially available PACT imagers poses significant challenges for dynamic imaging because only a few tomographic views are available to reconstruct each temporal frame. As such, the image reconstruction problem is severely ill-posed. In this work, I will present a spatiotemporal image reconstruction method to address this challenge by exploiting redundancies in the sought-after time-varying image. This approach uses a low-rank matrix estimation to construct an image prior that not only mitigates the ill-posedness of the reconstruction problem but also reduces the computational and memory burden. Numerical studies demonstrate that the proposed method accurately estimate the temporal evolution of a contrast agent in a tumor model by use of an anatomically realistic numerical mouse phantom.

* This is a joint work with Luke Lozenski (WashU), Refik Cam (UIUC), and Dr. Mark Anastasio (UIUC).

This seminar is easily accessible to persons with disabilities. For more information or for assistance, please contact the Mathematics Department at 743-3500.