Washington University in St. Louis
Office of Technology Management

DEEP LEARNING-ASSISTED IMAGE RECONSTRUCTION FOR TOMOGRAPHIC IMAGING

Anastasio, Mark, Kelly, Brendan, Matthews, Thomas

Maland, Brett

T-017311

Background

Image reconstruction for any modern imaging technique is an optimization problem. Most image reconstructions methods are iterative in nature and produce sequential intermediate images that are compared to the raw acquisition data and subsequently updated to maximize the likelihood that the image is a correct image estimation. The inability to incorporate detailed *a priori* information about the class of objects to be imaged limits the effectiveness of current reconstruction methods. If data is incomplete or noisy, the data may not be sufficient for reconstruction of a useful image.

Technology Summary

Deep learning combined with classic image reconstruction methods to produce higher fidelity images. A deep learning model is trained with images and corresponding images produced at intermediate iterations of an optimization-based reconstruction method. The deep learning model thus provide *a priori* information to guide the iterative reconstruction algorithm. An intermediate estimate, containing artifacts and noise, can be mapped to an object that contains reduced artifact and noise levels and is representative of the collection of objects to be imaged. The deep learning data can be applied at certain iterations in the algorithm or applied at every iteration.

Computer-simulation studies have demonstrated the effectiveness of this novel reconstruction method compared to existing state-of-the art image reconstruction methods (Figure 1).

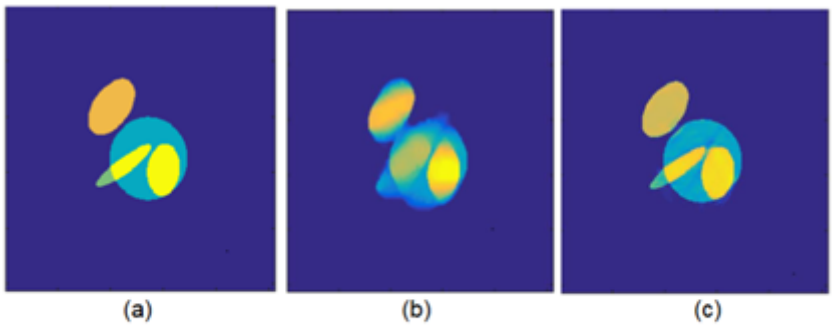

Figure 1. Computer-simulation studies: (a) True object; (b) Estimate of object produced by use of a conventional (state-of-the-art) image reconstruction method; (c) Estimate of the object produced by use of the proposed DL-assisted image reconstruction method.

Key Advantages

- Accurate reconstruction from incomplete or noisy data

- Reduced image acquisition time and reduced radiation doses
- Applicable to microscopy systems including electron tomography

Patents

US 11,403,792