Limited-projection-angle hybrid fluorescence molecular tomography of multiple molecules.

Abstract:
An advantage of fluorescence methods over other imaging modalities is the ability to concurrently resolve multiple moieties using fluorochromes emitting at different spectral regions. Simultaneous imaging of spectrally separated agents is helpful in interrogating multiple functions or establishing internal controls for accurate measurements. Herein, we investigated multimoiety imaging in the context of a limited-projection-angle hybrid fluorescence molecular tomography (FMT), and x-ray computed tomography implementation and the further registration with positron emission tomography (PET) data. Multichannel FMT systems may image fluorescent probes of varying distribution patterns. Therefore, it is possible that different channels may require different use of priors and regularization parameters. We examined the performance of automatically estimating regularization factors implementing priors, using data-driven regularization specific for limited-projection-angle schemes. We were particularly interested in identifying the implementation variations between hybrid-FMT channels due to probe distribution variation. For this reason, initial validation of the data-driven algorithm on a phantom was followed by imaging different agent distributions in animals, assuming superficial and deep seated activity. We further
demonstrate the benefits of combining hybrid FMT with PET to gain multiple readings on the molecular composition of disease.