Integrating Multimodal Chemical Imaging Instrumentation by Data Reduction and Resolution Merge

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Purpose

Develop capabilities to integrate disparate images by data reduction and resolution merge

Create high-resolution images that cover large areas of a sample

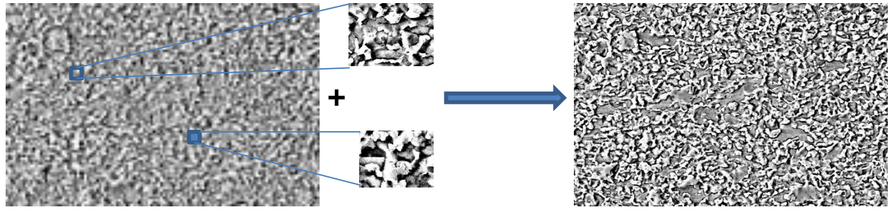
Expected Outcomes

Develop capability to integrate multimodal imaging from different length scales

Develop a suite of tools for data integration

Establish a bridge for hot spot identification, property prediction, etc.

Objectives



Large coarse image + multiple small high-resolution images
→ a large high-resolution image

Challenges

- New algorithms are needed
- Data set size is large
- Data generation rate is high

State of Arts

- Current information fusion on same area from multiple sensors (resolution merge, Bayesian reasoning…)
- New algorithm brings in image reduction and reconstruction to bridge scales

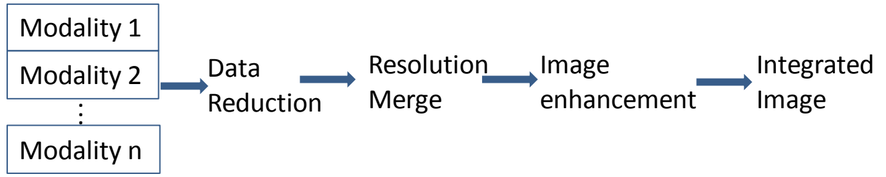
Impacts

- Complementary to activities in Thrust Area 3
- Supports multimodal experimental projects in Thrust Areas 1 and 2

Why it Matters

Crucial to materials science, biomedical imaging, fuel energy, nondestructive examination, and imaging control

Approaches



- Use a statistical correlation function in image reconstruction
- Use information from low-resolution images to serve as statistical input to reconstruct the high-resolution image
- Apply polynomial interpolation with a post-enhancement algorithm

Technical Milestones

09/2011: Develop scheme on data integration and identify a demonstration case
05/2012: Develop polynomial interpolation with enhancement algorithm calibrated by correlation functions. Apply the method on a case study