Tyler Mullins

Utah Tech University

Poster

Using Computational Strategies to Measure Nanoparticle Sizes from SEM Images

Nanoparticles are extremely small materials whose chemical and physical properties depend strongly on their size and shape. Accurately determining nanoparticle size is essential for understanding their behavior. Nanoparticles and the knowledge of their size can be applied to applications like consumer products, energy, and medicine. The central question of this project is: *Can automated image analysis using Python provide a faster and more reliable way to measure nanoparticles from scanning electron microscope (SEM) images compared to traditional methods?*

To address this question, I collaborated with faculty from the Chemistry, Computer Science, and Physics departments to develop a Python-based tool. The tool automates the measuring of nanoparticles area and counts the amount of nanoparticles within the image. Previously, researchers measured particles manually by drawing lines on SEM images or by using a software called ImageJ. These are processes that are time consuming and prone to human error. My Python program streamlines this workflow by reading the imputed SEM images, calibrating the distances using the provided micron-to-pixel scale, and detecting particle edges through image processing techniques. The program uses functions from the OpenCV and NumPy libraries to detect nanoparticles and compute their areas, therefore producing a set of size measurements for each image.

Currently, I am validating the program by comparing the automated measurements from the Python program to manually obtained data from previous researchers to assess accuracy. Preliminary results indicate the automated method significantly reduces measurement time and produces consistent results across multiple images. Future improvements include saving the data automatically to a file, creating a UI for the program, and automated micron-to-pixel ratio calculations.

This project demonstrates how computational tools can bridge the gap between chemistry, physics, and computer science to solve practical challenges. By automating SEM image analysis, the Python script enhances efficiency, minimizes human bias, and provides a framework that can be adapted for other nanoparticle systems or microscopy techniques.

Mentor Information:

Dr. Wendy Schatzberg
wendy.schatzberg@utahtech.edu
Utah Tech University

Dr. Samuel Tobler
samuel.tobler@utahtech.edu
Utah Tech University