

Announcement of a Defense of a Dissertation

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“Computational Analysis of Neutron Scattering Data”

ABSTRACT

This work explores potential methods for use in the detection and classification of defects within crystal structures via analysis of diffuse scattering data generated by single crystal neutron scattering experiments. The proposed defect detection methodology uses machine learning and image processing techniques to perform image texture analysis on neutron diffraction patterns generated by neutron scattering simulations. Once the methodology is presented, it is tested via a series of defect detection problems of increasing difficulty which utilize neutron scattering data simulated by a number of simulation techniques. As the problem difficulty is increased, the defect detection methodology is refined in order to adapt to challenges presented by the more difficult detection problems. The refinement process includes the development of a data-driven scaling method that aids in the texture analysis process by enhancing diffuse scattering textures in the diffraction patterns. The evaluation process for the defect detection methodology includes analysis and comparison of the computational complexities of the machine learning and image processing techniques. As part of this complexity analysis, a detailed study of the ORB keypoint extraction algorithm is also conducted and the computational complexity of the ORB algorithm is derived.