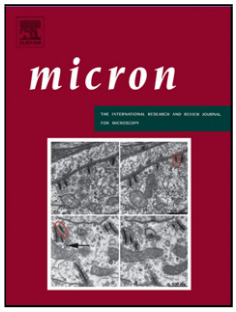

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(Revision 1) Slanted Support Window-Based Stereo Matching for Surface Reconstruction of Microscopic Samples

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Abstract

This work is to address the limitations of 2D Scanning Electron Microscopy (SEM) micrographs in providing 3D topographical information necessary for various types of analysis in biological and biomedical sciences as well as mechanical and material engineering by investigating modern stereo vision methodologies for 3D surface reconstruction of microscopic samples. To achieve this, micrograph pairs of the microscopic samples are acquired by utilizing an SEM equipped with motor controlled specimen stage capable of precise translational, rotational movements and tilting of the specimen stage. After pre-processing of the micrographs by SIFT feature detection/description followed by RANSAC for matching outlier removal and stereo rectification, a dense stereo matching methodology is utilized which takes advantage of slanted support window formulation for sub-pixel accuracy stereo matching of the input images. This results in a dense disparity map which is used to determine the true depth/elevation of individual surface points. This is a major improvement in comparison to previous matching methodologies which require additional post-processing refinement steps to reduce the negative effects of discrete disparity assignment or the blurring artifacts in near the edge regions. The provided results are great representatives of the superior performance of the slanted support window assumption employed here for surface reconstruction of microscopic samples.

Keywords: 3D Surface Reconstruction, Scanning Electron Microscopy (SEM), Stereo Matching, PatchMatch Stereo