A Clustering Based Image Segmentation Procedure to Automatically Detect Grains in Polycrystalline Materials

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Research

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Abstract

The physical and mechanical properties of a polycrystalline material depend on its microstructure characteristics such as the size and morphology of grains. In practice, different imaging methods are used to visualize the grain structure of such materials. To analyze microstructural changes in case of applied stress and to predict its performance in a given application, the quantitative information about the grain structure must be taken into account. In this work, an efficient and reproducible algorithm, which automatically detects grains in different types of microstructure images, is proposed. Due to the diversity between the analyzed images and a limited number of labeled data, a clustering patch-based approach is followed. The algorithm aims to distinguish between patches in homogeneous grain areas and those lying on grain boundaries through Gaussian Mixture Modeling. The identified groups of grain patches are used to create the seed image for a Seeded Region Growing algorithm, enabling nally a pixelwise image segmentation.

Full Text

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Figures

Figure 1

The main steps of the proposed workflow.

Figure 2

The proposed workflow in details.

Figure 3

The effect of different denoising methods.

Figure 4

Results for FIB images.

Original

Clustering output
(NL-means)

Clustering output
(Gaussian Blur)

Figure 5

The effect of denoising methods on clustering output.

Figure 6

Results for SEM images.