

MSc thesis project: Inclusion detection and rating in microscopy images of alloys using image analysis

Company: Alleima, Pune RnD

Description:

The microstructure describes an alloy's constituents and parts (arrangement of volumes, internal surfaces, lines and points) and contributes to its quality and features. Characterizing the microstructure includes determining different phases, grain sizes and shapes, boundaries, cracks, and inclusions etc. According to the ASTM E45 standard, inclusions are assigned to a category based on similarities in morphology (size, shape, concentration, and distribution/position). Automatic image analysis approaches have been described for the detection and rating of inclusions (JK (Jernkontoret)- type inclusion rating using automated image analysis). They are however sensitive to image acquisition parameters (magnification, illumination and exposure etc.) and require extensive manual adaptation to new image sets as well as manual curation of the results. In a production or RnD setting, thousands of images are typically imaged and screened daily so methods that robustly reduce the number of images requiring manual/visual inspection are desirable as well as methods that reduce the manual curation (i.e improve the automatic results).

The aim of the project is to refine conventional image processing for inclusion rating of scanning electron microscopy images of steel/alloys according to the ASTM E45 standard and to compare/combine with learning based approaches for efficient screening of large numbers of images. This could for example be a prescreening step to detect all kinds of abnormal images prior to inclusion detection and rating.

Some relevant literature:

- Standard Test Methods for Determining the Inclusion Content of Steel, ASTM E45-18a
- Literature on learning based outlier detection

Prerequisites

Image processing, machine/deep learning, some kind of programming, linear algebra

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30 credits