SAFMIs: Segmented Atomic Force Microscope Images

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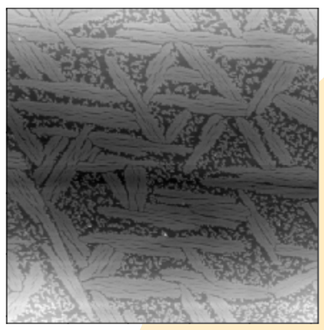
scikit-image
image processing in python

Background Subtraction



The background approximation and subtraction function uses Morphological Filtering from scikit-image. It returns all bright spots in the image that are smaller than the structuring element that the user defines (rectangular, square or ellipsoidal/circular). It outputs a foreground with some threshold, deletes the background, while preserving the relative height values to use later.

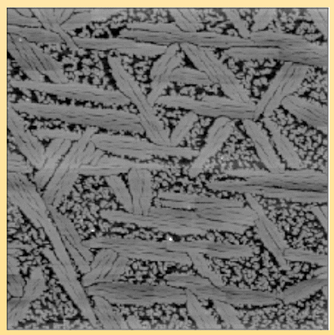


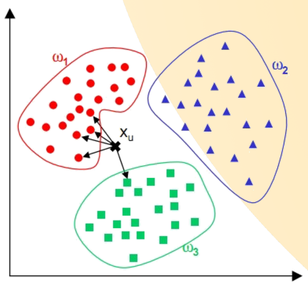
Image Segmentation: Random Walk

Random walker segmentation from scikit-image was employed for this step. Random walk solves an anisotropic diffusion equation with tracers starting from a pre-determined pixel with a certain label (initial marker position). Diffusivity is high, if neighboring pixels have similar values, whereas widely varying pixels values results in low diffusion. Thus, diffusion has a inverse relationship to the gradient height.

Generation of Image Descriptors from Segmented Images

Percentile Filter from scikit-ndimage module allowed for separation of ordered and disordered ratios. Furthermore, a percent coverage was calculated; these two parameters are image descriptors that are specific to the experimental conditions of the surface under the microscope

Prediction of Bio/Nano Interface Parameters using KNN Clustering and Regression



K-Nearest Neighbor Clustering was performed on 50 images where a random test/train split was performed. Images were clustered based on pH and concentration of the peptide solution used to create the bio-interface observed under AFM. Next, regression was used to predict order/disorder ratio and percent coverage for a given input AFM image with the same clustering parameters.

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