Alex Chen, J Material Sci Eng 2012, 1:3
http://dx.doi.org/10.4172/2169-0022.S1.006

OMICS Group Conferences
Accelerating Scientific Discovery

International Conference and Expo on
Materials Science & Engineering

October 22-24, 2012 DoubleTree by Hilton Chicago-North Shore, USA

Enhancement and recovery in atomic force microscopy images

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Atomic force microscopy (AFM) has recently become the state of the art in nanoscale imaging due to its ability to resolve fine details and dynamic processes. Since it is not limited by the diffraction, AFM is able to scan at resolutions finer than optical microscopes and does not require treatments that may damage the sample. However, AFM images require a longer scan time than most optical images. Thus, avoiding the scanning of unnecessary details becomes important. In this talk, we review various interpolation and inpainting techniques from the image processing literature and study their adaptability to reconstructing AFM images.

Lower resolution AFM data is simulated by subsampling the number of scan lines in an image. The methods studied can be placed into the categories of linear interpolation, nonlinear interpolation, and inpainting. We also study the techniques based on qualitative and quantitative measures and show how much scan times can be reduced while preserving the essential features. Another application is in the removal of streaks, which are artifacts created by the scanning and post-processing of AFM images. Regions that have been identified as streaks are then reconstructed using inpainting techniques.

Biography

Alex Chen received the Ph.D. degree in mathematics from UCLA in 2011. Since then he has been a postdoctoral researcher at the Statistical and Applied Mathematical Sciences Institute (SAMSI) and the University of North Carolina at Chapel Hill. His research interests include image processing for large data sets and on efficient scanning for atomic force microscopy. He has also worked on the simulation of biological processes and on a model for landscape evolution.

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