



# **Materials Science and Engineering: Chapter 20. Data Intensive Imaging and Microscopy: A Multidimensional Data Challenge**

*Krishna Rajan*

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# Materials Science and Engineering: Chapter 20. Data Intensive Imaging and Microscopy: A Multidimensional Data Challenge

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This chapter provides an introduction to how data-mining techniques can help to correlate multiple modalities of signals to extract information from images. The discussion is built around two genres of applications of imaging/spectral informatics. One is exploration of the role of informatics to enhance the resolution of detection of spatial correlations in chemistry through examples of chemical imaging techniques based on electron energy loss spectroscopy (EELS) and cathodoluminescence (CL). These case studies serve to highlight the use of data dimensionality reduction techniques to link the multiple modalities of imaging contrast that serve to enhance the “information contrast” that helps to uncover subtle but important spatial correlations in chemistry. The other set of case studies is built around the use of Fourier transform infrared spectroscopy (FTIR). These examples serve to highlight a different role in the application of informatics methods in materials characterization, namely to track changes in physical/structural properties of materials associated with processing variations. Here it is demonstrated how data dimensionality reduction methods can uncover correlations between features in spectra that cannot be detected by visual inspection. Hence spectral informatics provides a methodology to monitor structural and chemical pathways that govern processing–property relationships in materials.

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