Physics-based dictionary learning for image classification

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Classification, segmentation and anomaly detection are fundemental problems arising in areas such computational microscopy, astronomical imaging, materials science, remote sensing of the environment, and computational biology. The performance of the classification algorithm can always benefit from accurate physics-based forward models of the imaging modality. In most cases an analytical physical model that can be evaluated over the entire source domain is intractible. In some applications, however, the model can be approximated over a representative discrete subdomain. In this case, segmentation and classification can be formulated as a dictionary learning and matching problem. We illustrate this dictionary learning approach for electron backscatter diffraction microscopy for imaging polychrystaline materials.