Important points

* recent advances in computer vision (CV) and machine learning (ML) offer new approaches for extracting information from microstructural images

Supervised ML involves training a system based on human-determined ground-truths. For example, given

a set of photographs with metadata noting the presence or absence of a cat, a supervised ML system can learn to

identify images of cats. Unsupervised learning algorithms find relationships between image representations

without ground-truth data or human intervention, typically by generating clusters of related images.

Across application domains, however, there are two basic approaches to CV: feature-based representations and representations based on convolutional neural networks (CNNs). Feature-based methods create an

image representation that is in essence a statistical representation of the visual features in the image.

CNN> feature based representations. The primary difference between feature-based and CNN image representations is that while the filters for feature-based methods are selected by human experts, the CNN filters are learned during the training and optimization of the CNN. We will focus on two methods that are particularly suitable for microstructural images: CNN layers and hypercolumn pixels.

The first part of the CNN pipeline—encoding the image as a feature vector—is termed the feature learning stage, and the second part—drawing a conclusion—is the classification stage.