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Lecture 1: Manifold learning, dictionary learning & sparsity

This lecture will provide an overview of different representation learning techniques for images. We will start by providing an introduction into manifold learning which encompasses a class of machine learning techniques that convert data from a high dimensional representation to a lower dimensional representation while respecting the intrinsic geometry of the data. Different linear and non-linear techniques (including PCA, MDS, LLE, IsoMap, Laplacian Eigenmaps) will be introduced and discussed in detail. The second part of the lecture will cover a related topic, namely sparse representations and dictionary learning, and their application to compressed sensing problems

Lecture 2: Machine learning for segmentation and reconstruction

This lecture will focus on machine learning techniques for the analysis of medical images and the quantification of clinically useful information from medical images. The first part will focus on applications of manifold learning and dictionary learning for image segmentation and image classification. In particular, we will discuss the relationship of dictionary learning and patch-based image analysis techniques that have been recently shown to perform very well for image segmentation and classification. The second part will discuss how machine learning techniques based on manifold learning, sparsity and compressed sensing that can be used for image reconstruction, e.g. the acceleration of MR imaging.