The goal of digital image processing is to capture, transmit, and display images as efficiently as possible. Such tasks are computationally intensive because an image is digitally represented by large amounts of data. It is possible to render an image by reconstructing it with a subset of the most relevant data. One such procedure used to accomplish this task is commonly referred to as sparse coding. For our purpose, we use images of handwritten digits that are presented to an artificial neural network. The network implements Rozell's locally competitive algorithm (LCA) to generate a sparse code. This sparse code is then presented to another neural network, a classifier that attempts to place the image in one of ten categories, each representing one of the digits zero through nine. Furthermore, the LCA approach is unique in that it produces quality sparse codes by utilizing highly parallel architectures. Pattern recognition problems have been of interest by industries that rely heavily on data as a core part of their business. Social networking companies use it to analyze, predict, and even influence user behavior. However, as data becomes more cost-effective to collect, it will be important for companies in other industries to extract useful information from said data. Manufacturing companies use it to analyze the performance of their products and financial service companies use it to flag customers likely to default on their loans. Interestingly, the image processing techniques described above can be generalized for use on data other than image data.

An image reconstruction and its components where each row represents a different thresholding level. The first column is the original image, the second column is the reconstruction, and the remaining columns are the components of the reconstruction. The grid on the left does not apply coefficients to the components while the image on the right does.

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