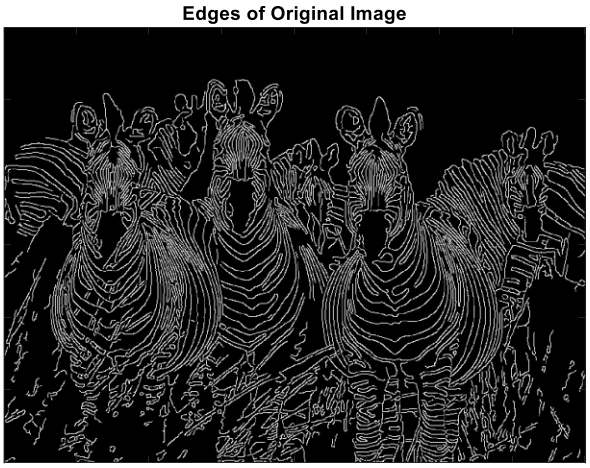
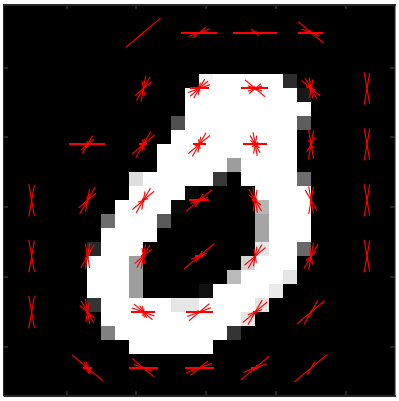
Histogram of Oriented Gradients (HOG)

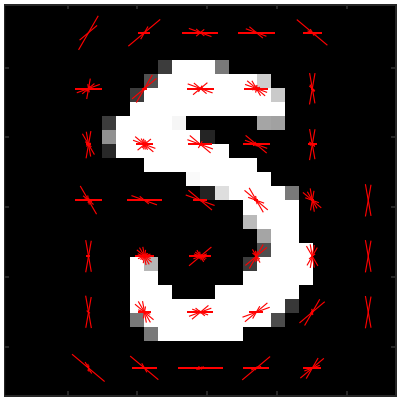
HOG is a feature descriptor that captures visual information similar to what we use to recognize shapes. The purpose of a feature descriptor is to capture the important information in an image by summarization. We've seen an edge detector and a corner detector which are simple feature descriptors. While an edge detector is able to capture a lot of information, it is hard to interpret and process by algorithms. The HOG feature provides a much more workable grid of data.



The HOG feature analyzes the distribution of edge orientations to capture information about shapes and appearances. These features are calculated from histograms of simple intensity gradients in local regions of images. The histogram is calculated for each locality and then the histograms are concatenated to form the HOG feature of an image. The density of the histograms can be adjusted using the cellsize parameter.

The histograms of gradients can be seen for digits 0 and 5 below.





This is a particularly useful feature and is used for object recognition and human identification. It is invariant to illumination changes but does not support rotation invariance.

The figure below shows the details of how the HOG feature is calculated form a local cell.