Supplementary Material

Steps for Canny edge detection.

3.1.1 Smoothing

The image is then converted from RGB scale to Greyscale and is blurred in order to remove the noise that is accompanied during the image acquisition. The noise is removed using the Gaussian filter by specifying a double threshold value.

3.1.2 Finding Gradients

The edges should be marked where the gradients of the image have large magnitudes. We are also computing the orientation of gradients "theta = arctan (Gy / Gx)" (Gy and Gx are gradients in x-direction and y-direction respectively)

3.1.3 Non-Maximum Suppression

In this step we are trying to relate the edge direction to a direction that can be traced along the edges based on the previously calculated gradient strengths and edge directions. At each pixel location we have four directions. We check all directions if the gradient is maximum at this point. Perpendicular pixel values are compared with the value in the edge direction. If their value is lower than the pixel on the edge, then they are suppressed. So, only local maxima should be marked as edges.

3.1.4 Edge Tracking by Hysteresis

Hysteresis is a way of linking the broken lines produced in the previous step. This is done by iterating over the pixels and checking if the current pixel is an edge. If it's an edge, then check the surrounding area for edges. If they have the same direction,p then we mark them as an edge pixel. We also use 2 thresholds, a high and low. If the pixels are greater than the lower threshold it is marked as an edge. Then pixels that are greater than the lower threshold and are greater than high threshold, are also selected as strong edge pixels. When there are no more changes to the image we stop

Steps for Histogram of Oriented Gradients.

3.2.1 Gradient Computation

To calculate a HOG descriptor, we need to first calculate the horizontal and vertical gradients. This method requires filtering the gray scale image. The x-gradient fires on vertical lines and the y-gradient fires on horizontal lines. The magnitude of gradient fires wherever there is a sharp change in intensity. None of them fire when the region is smooth.

3.2.2 Orientation binning

This involves creating cell histograms. One of the important reasons to use a feature descriptor to describe a patch of an image is that it provides a compact representation.

3.2.3 Descriptor Blocks

In this step we normalize the gradient strengths. we "normalize" the histogram so they are not affected by lighting variations.