Part 2 – Video Manipulation Basics:

The operator uses two 3×3 kernels which are convolved with the original image to calculate approximations of the derivatives – one for horizontal changes, and one for vertical. If we define  as the source image, and  and  are two images which at each point contain the vertical and horizontal derivative approximations respectively

The resulting gradients can be combined to give the gradient magnitude, using: and we can also calculate the gradient's direction:

The Sobel operator is used in image processing and computer vision, particularly within edge detection algorithms where it creates an image emphasising edges. It works by calculating the gradient of image intensity at each pixel within the image. It finds the direction of the largest increase from light to dark and the rate of change in that direction. The result shows how abruptly or smoothly the image changes at each pixel, and therefore how likely it is that that pixel represents an edge.

Part 3 – Harris corner detection:

The Harris corner detector is invariant to translation, rotation and to illumination change (As long the change is the same for all pixels). It should detect the same corners since the derivates will be the same.