CODE WALKTHROUGH

Edge Detection:

I used the following Roberts edge operators

$$\begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$$

I used the following Sobel edge operators

$$\begin{bmatrix} -1 & 0 & 1 \\ -2 & 0 & 2 \\ -1 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 2 & 1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{bmatrix}$$

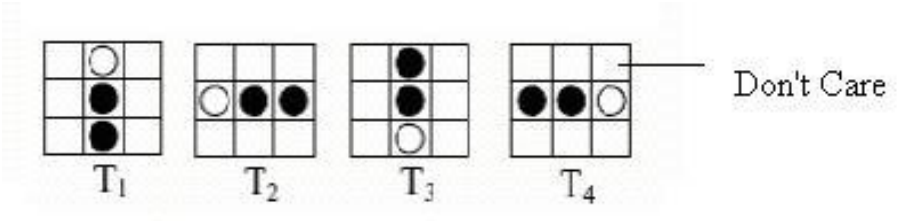
Found the gradient magnitude and direction for both the edge operators and plotted

Thresholding:

I manually used a value to threshold or binarize the image in the code. I implemented histogram and used equal frequency bimodal separator to select the threshold but the image was losing the structure. So, set it up manually.

Thinning:

I used Stentiford iterative thinning algorithm. These are the templates used iteratively in this algorithm



Used following formula to find the connectivity

$$C_n = \sum_{k \in S} N_k - (N_k \cdot N_{k+1} \cdot N_{k+2})$$

Where: N_k is the colour of the eight neighbours of the pixel analyzed. N_0 is the center pixel. N_1 is the colour value of the pixel to the right of the central pixel and the rest are numbered in counter clockwise order around the center.

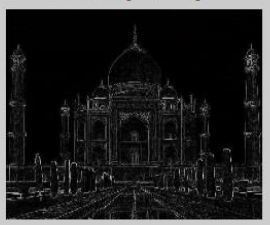
RESULTS:

Please run the code as follows

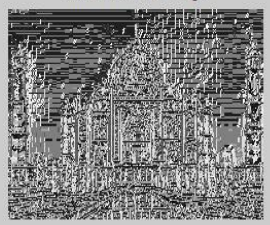
>> prog1(image_filename);

It outputs the images as follows in Matlab window and even writes back the images to current folder

Roberts Magnitude Image



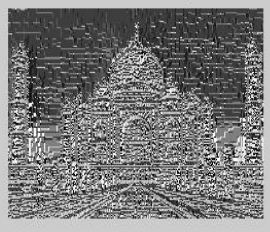
Roberts Direction Image



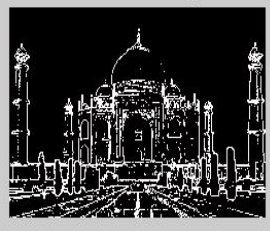
Roberts Threshold Image

Sobel Magnitude Image

Sobel Direction Image



Sobel Threshold Image



Roberts Thinned Image

Sobel Thinned Image

Original Image

Roberts Magnitude Image

Roberts Direction Image

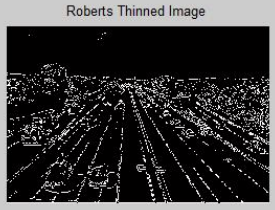
Roberts Threshold Image

Sobel Magnitude Image

Sobel Direction Image

Sobel Threshold Image

Roberts Thinned Image



Sobel Thinned Image

Original Image

When applied Roberts edge operator, the resulted images look a little dull than the results of Sobel operator. It is evident from the above output images. I think it is because of the 3*3 template used in the Sobel operator.

The first row in the above images correspond to gradient magnitude, gradient direction and thresholding on applying Roberts edge operators.

The second row in the above images correspond to gradient magnitude, gradient direction and thresholding on applying Sobel edge operators.

The final row in the above images correspond to thinning or skeletonization of Roberts and Sobel thresholded gradient magnitude images.

Sobel edge operators work better than Roberts on the two input images.