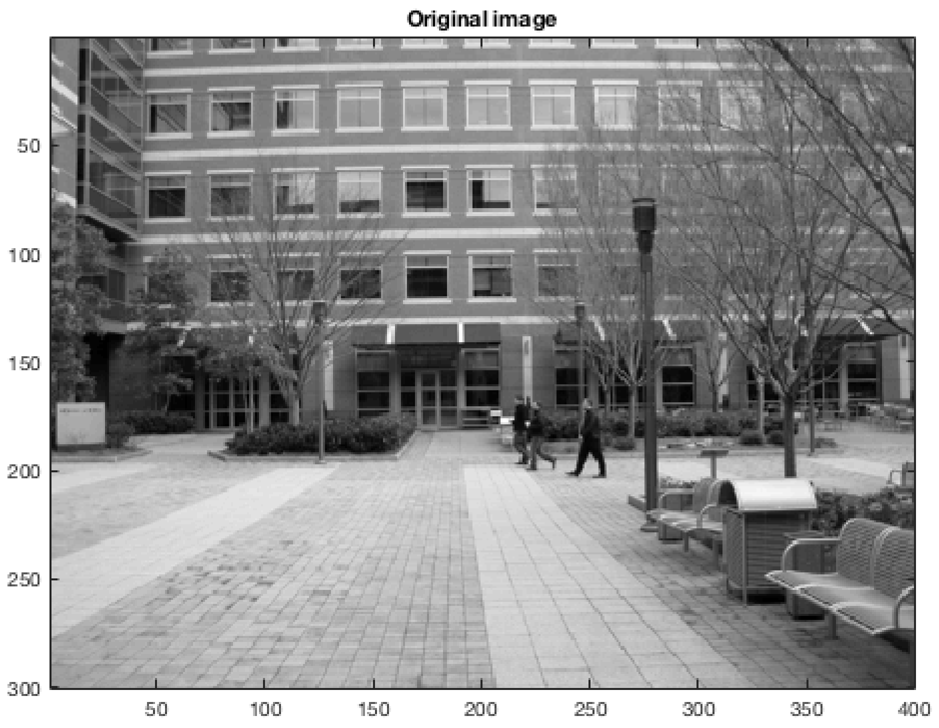
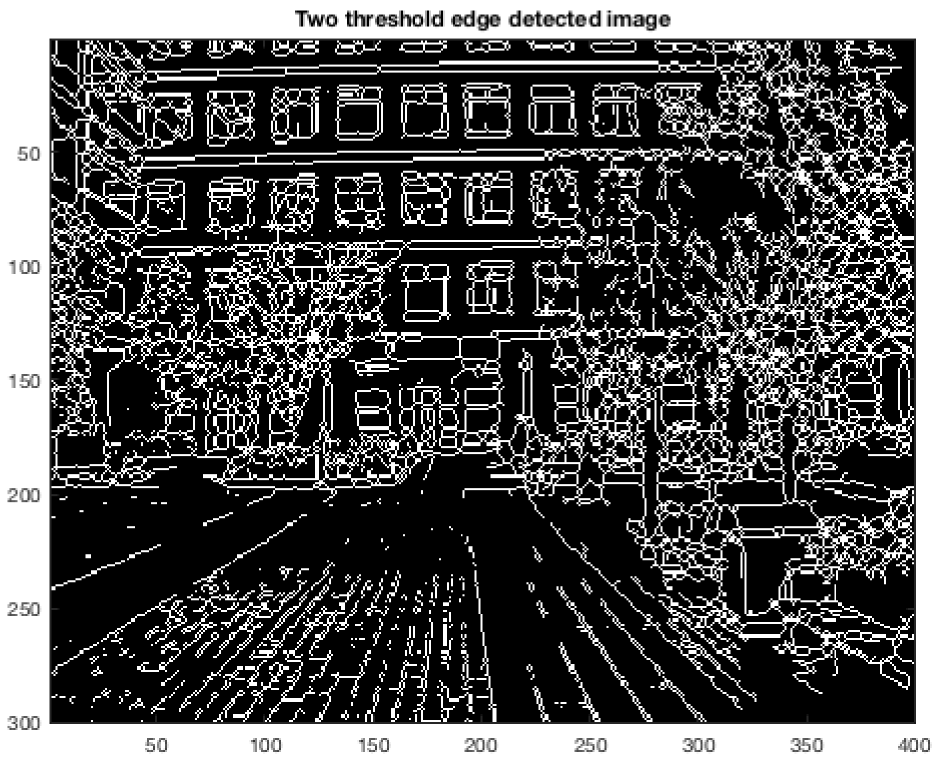
```
%===========================
%  Name:                 hw2_4.m
%
%  Author:               Kairi Kozuma
%
%===========================

%============================ hysteresisEdges ============================
%
%  script hysteresisEdges.m
%
%
%  Loads the edgethresh.mat Matlab file (make sure to have it in your
%  path or your current directory) and then applies hystersis-based
%  edge finding to identify which parts of the image reflect edge-like
%  structures.
%
%============================ hysteresisEdges ============================

%
%  Name:                 hysteresisEdges.m
%
%  Author:               Patricio A. Vela,                        pvela@gatech.edu
%
%  Created:              2014/01/18
%  Modified:     2014/01/18
%
%============================ hysteresisEdges ============================

%--[1] Load the edgethresh Matlab file.
load('edgethresh.mat');
I = double(I);          % Convert to double or crazy stuff happens.

highT = 145;
lowT = 120;

fprintf('High threshold: %d\nLow threshold: %d\n', highT, lowT);

%--[2] Run the edge finding function to get a binary image.
detect = edgefind(I, highT, lowT);

%--[4] Plot the image and also visualize the detected edge locations.
figure(1);
  imagesc(I);
  colormap('gray');
  title('Original image');
  axis image;

figure(2);
  imagesc(detect);
  colormap('gray');
  title('Two threshold edge detected image');

fprintf('The results are better than using a single\n');
fprintf('threshold, since two thresholds captures more edges that have lower\n');
fprintf('contrast with its environment. For example, the image obtained from\n');
fprintf('two thresholds shows more of edges in the trees and sidewalk, while\n');
fprintf('the edge detection with one threshold does not capture them.');
```

```
%================================ edgefind ================================
%
%  edgeIm = edgefind(I, highT, lowT)
%
%  INPUTS:
%    I                   - the image (should be double!)
%    highT               - the upper threshold.
%    lowT       - the lower threshold.
%
%  OUTPUTS:
%    escore              - the edge score.
%
%================================ edgefind ================================

%
%  Name:                 edgefind.m
%
%  Author:               Patricio A. Vela,                       pvela@gatech.edu
%
%  Created:              2014/01/17
%  Modified:    2014/01/17
%
%================================ edgefind ================================
function [detected] = edgefind(I, highT, lowT)


%-- Compute the gradient of the image.
cdx = [-1 0 1]/2;
cdy = cdx';

dIdx = imfilter(I, cdx, 'replicate');
dIdy = imfilter(I, cdy, 'replicate');

%-- Compute the edge score (sum of squares of derivatives).
score = dIdx.^2 + dIdy.^2;

%--Perform hysteresis with the upper and lower score thresholds.
highDetect = score > highT ; % Apply the upper threshold first.
[i, j] = find(highDetect);  % Using find, get indices of detected points.

lowDetect  = score > lowT;  % Apply the lower threshold second.

detected = bwselect(lowDetect, i, j);
                      % Using bwselect with the detected points on the
                      % low detection binary image, get more candidates.

detected = bwmorph(detected, 'thin', inf);
                      % Apply some thinning to get skinny edge lines.


end
```

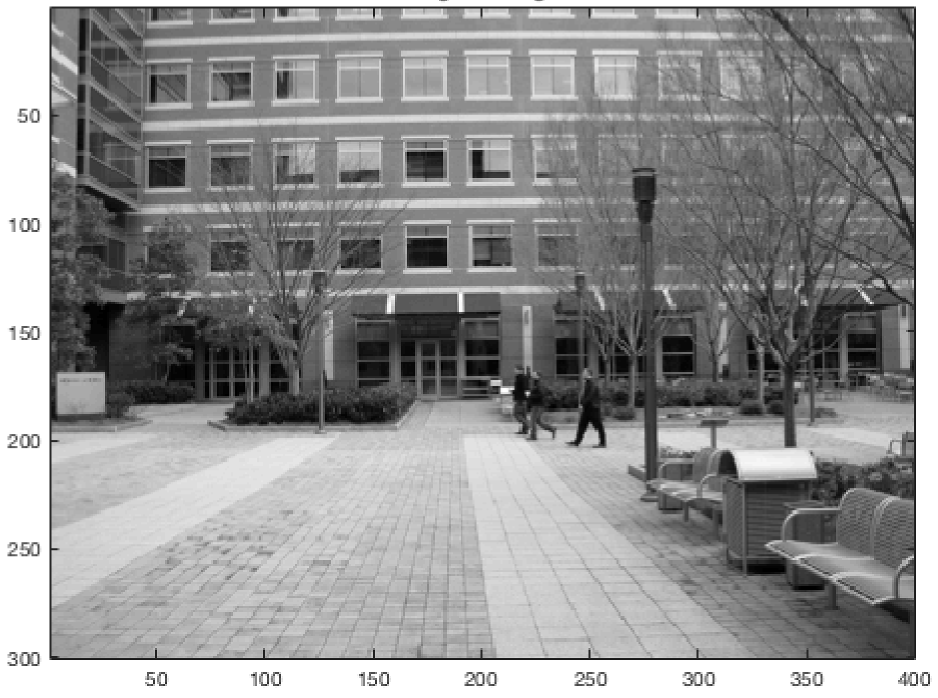
```
High threshold: 145
Low threshold: 120
Warning: Ignoring out-of-range input coordinates.
The results are better than using a single
threshold, since two thresholds captures more edges that have lower
contrast with its environment. For example, the image obtained from
```

two thresholds shows more of edges in the trees and sidewalk, while the edge detection with one threshold does not capture them.

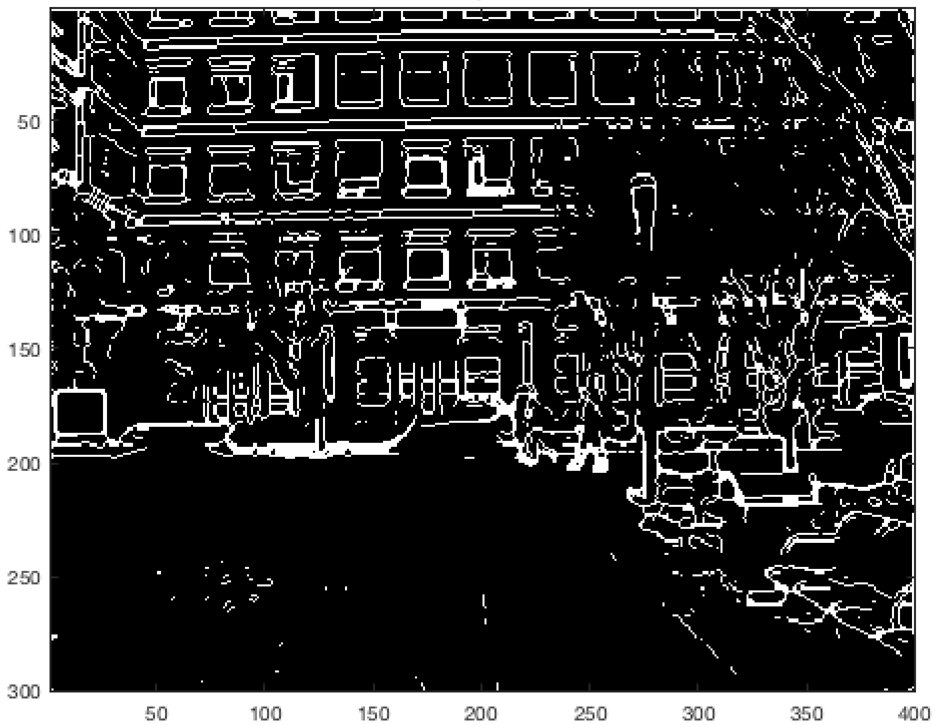




Original image



Edge 1


50
100
150
200
250
300
50
100
150
200
250
300
350
400