HomeWork-2: Scene Change Detection using Fitting Models

Due Date: 11:59 PM, 27th February, 2018

I_1	I_2
	

Let I_1& I_2be two registered images of size (n, m) as shown above. Let $D = \{d_{11}, d_{12}, \ldots, d_{nm}\}$ such that $d_{ij} = \{I_1(i,j), I_2(i,j)\}$ be a set of data points, where $I_1(i,j)$is the intensity of the pixel located at (i,j)in image I_1.

Assuming $I_1 \, and \, I_2$were grey scale images, $0 \leq I_1(i,j), I_2(i,j) \leq 255 \; \forall \; (i,j)$,

If the two images were equal, the plot of these points in the Euclidian space would be symmetrical as $I_1(i,j) = \; I_2(i,j) \forall \; (i,j)$, shown in Figure 1.

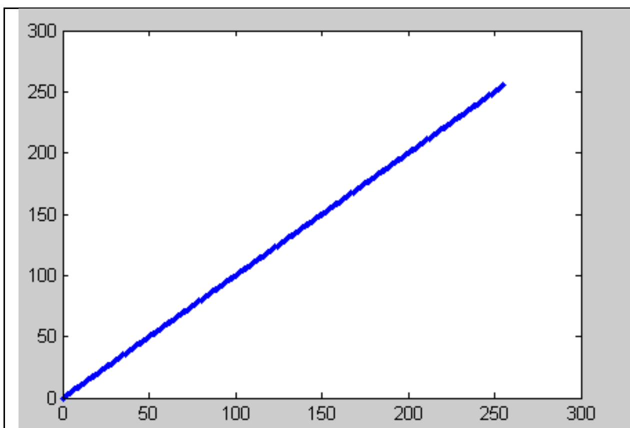

Figure 1

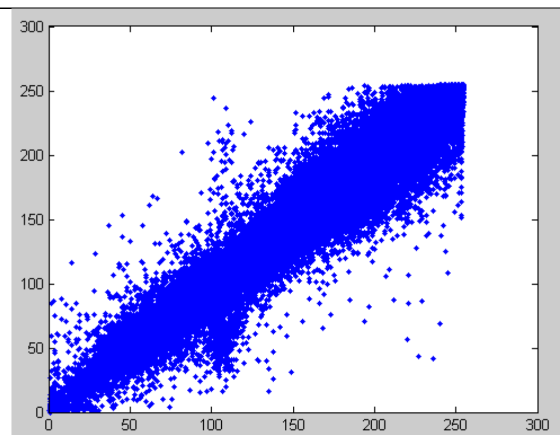

Figure 2

However, there is noise and the plot would look more like Figure 2.

If there was a model that represents these points, the data points that show a large deviation from the model would be considered as pixels that have undergone significant change. The goal of the homework is to use fitting approaches to identify the model. Then use the model to identify the pixels that show a large deviation from the scene.

A Create the data points (**1 Pts**)

B. Plot the data points on and image (**1 Pts**)

C. Change detection (**11 Pts**)

1. Least square line fitting (**4 Pts**):
   i. Use **least squares** to fit a line to the model, report and print the parameters of the line. Plot the line along with the data points. See Figure 3.

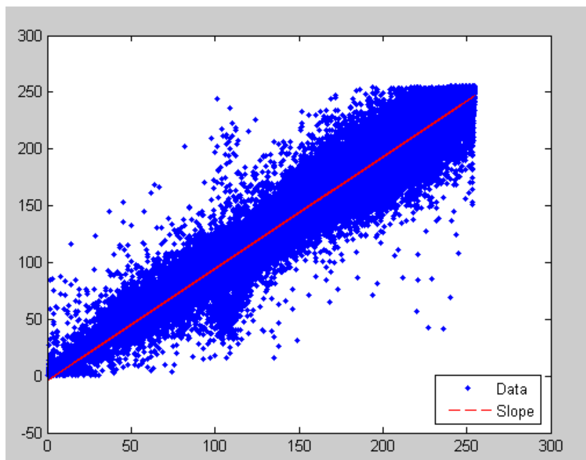

Figure 3

   ii. Changed pixel detection: For the line parameters obtained above, identify the pixels that are far from the line by thresholding the perpendicular distance. Report and justify the threshold value used. Plot the data points that are outside the threshold. See Figure 4

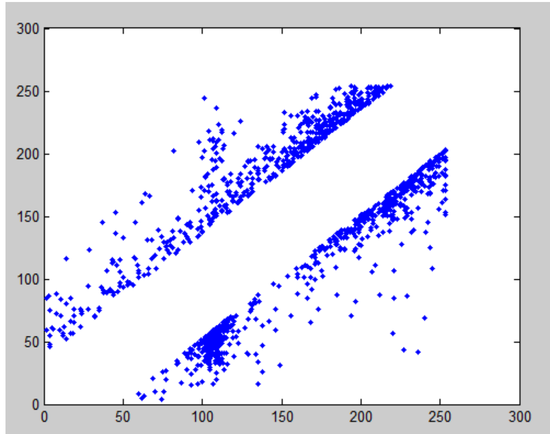

Figure 4

iii. Segmentation: Identify these pixels in the image that are detected in the previous step. Apply Image morphological operators to remove noise (Hint: Erosion, Dilution) See Figure 5 & 6

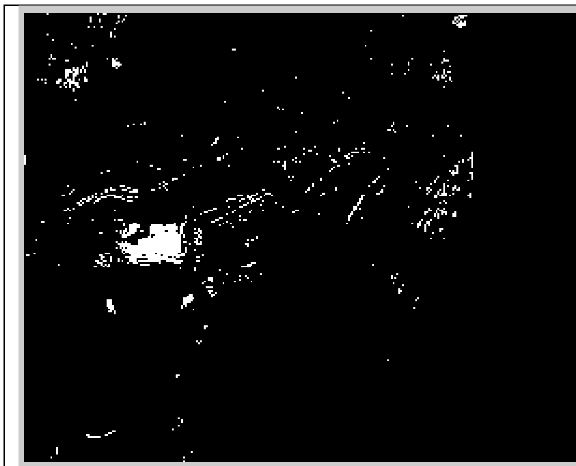

Figure 5

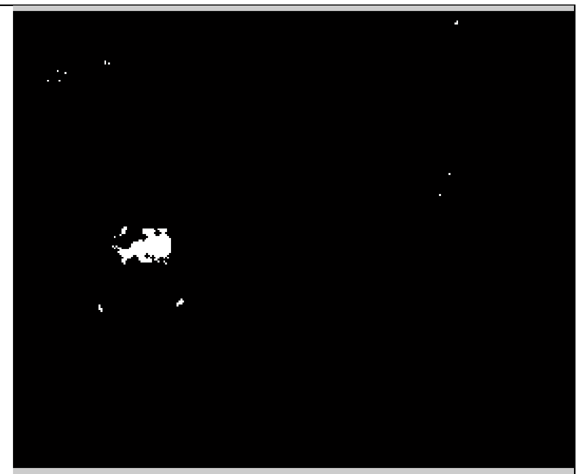

Figure 6

2. Robust Estimator (Repeat using Robust estimator) (**3 Pts**):

iv. Use least squares to fit a line to the model, report and print the parameters of the line. Plot the line along with the data points. See Figure 3.

v. Changed pixel detection: For the line parameters obtained above, identify the pixels that are far from the line by thresholding the perpendicular distance. Report and justify the threshold value used. Plot the data points that are outside the threshold. See Figure 4. Compare the parameters from least squared error with the parameters from Robust estimators.

vi. Segmentation: Identify these pixels in the image that are detected in the previous step. Apply Image morphological operators to remove noise (Hint: Erosion, Dilution) See Figure 5 & 6

3. Gaussian Fitting (Repeat using Gaussian) (**4 Pts**):
   i. Fit the data points to a Gaussian, report and print the parameters of the model. Plot the mean and the Gaussian using an ellipse along with the data points.
   ii. For the Gaussian parameters obtained above, Identify the pixels that are far from the model by thresholding the probability. Report the threshold values and justify.
   iii. Segmentation: Identify these pixels in the image that are detected in the previous step. Apply Image morphological operators to remove noise (Hint: Erosion, Dilution) See Figure 5 & 6

D. Report (**2 Pts**):
   a. Document your finding in the report.

--------------------See ReadMe file for implantation details---------------------