For **Step-1** Crop images of objects:

It shows the result with use box in the first image to crop image is better than using the box at the previous time t-1, due to the fact that the first image have the ground truth cropped image

For **Step_4** Estimate translation displacement:

1. Original pipeline provided:

Average euclidean distance between the center of predicted box and ground-truth box is **24.83.**

2. least square with window:

I select the most significant match point as the center of matching window, and tried different window size to get subwindow from ground truth image(image 1) and current image, A is computed by calculating x and y axes derivative respectively, b is calculated from time derivative which is one and multiply difference between two subwindows.

Window Size=7 average euclidean distance =**13.08**

Window Size=9 average euclidean distance =**13.01**

Which means least square method is quite robust with window size

3. RANSAC:

In every iteration, I randomly select one point to get the fitting line, and calculate the total error of all the other points using the current fitting model, after 50 iterations, I choose the one with minimum error to get the best fitting model.

average euclidean distance =**13.26**