

MOBILE ROBOTICS

Report - Assignment 3

Sathya Sravya.Vallabhajyosyula
20161121
ECE

TWO VIEW SPARSE RECONSTRUCTION

1)The main code lies in sparseReconstruction.m.

In this part normalisation of the obtained pixel co-ordinates and centering them is done ,to use in further computations.(using obtained matrix 'T1 and T2'(transform matrices)').

2) I implemented RANSAC , found number of inliers for the threshold fixed.Selected 8 points from the inliers ,constructed fundamental matrix and essential matrix.(from the formulae given)

From conditions $x_2^T F x_1 = 0$, a linear equation $Af = 0$ is made and svd is performed.

Later , the obtained "F" matrix is denormalized using $T_2^T F T_1$,

The noise issues are removed by making rank of this matrix 2 ,using ,

```
[u d v] = svd(F);  
new_d = diag([d(1,1) d(2,2) , 0]);  
F = u * new_d * v' ;
```

The essential matrix is computed from the formula ,

$$E = K' F K ;$$

3)Later, I took the normalised points corresponding to image1 and image2 ,found the corresponding world points using "decomposition of essential matrix code",thereby performing algebraic triangulation.

Algebraic triangulation :

$$[x_i; y_i; 1]^T [p_{1T} \ p_{2T} \ p_{3T}] X_i = 0$$

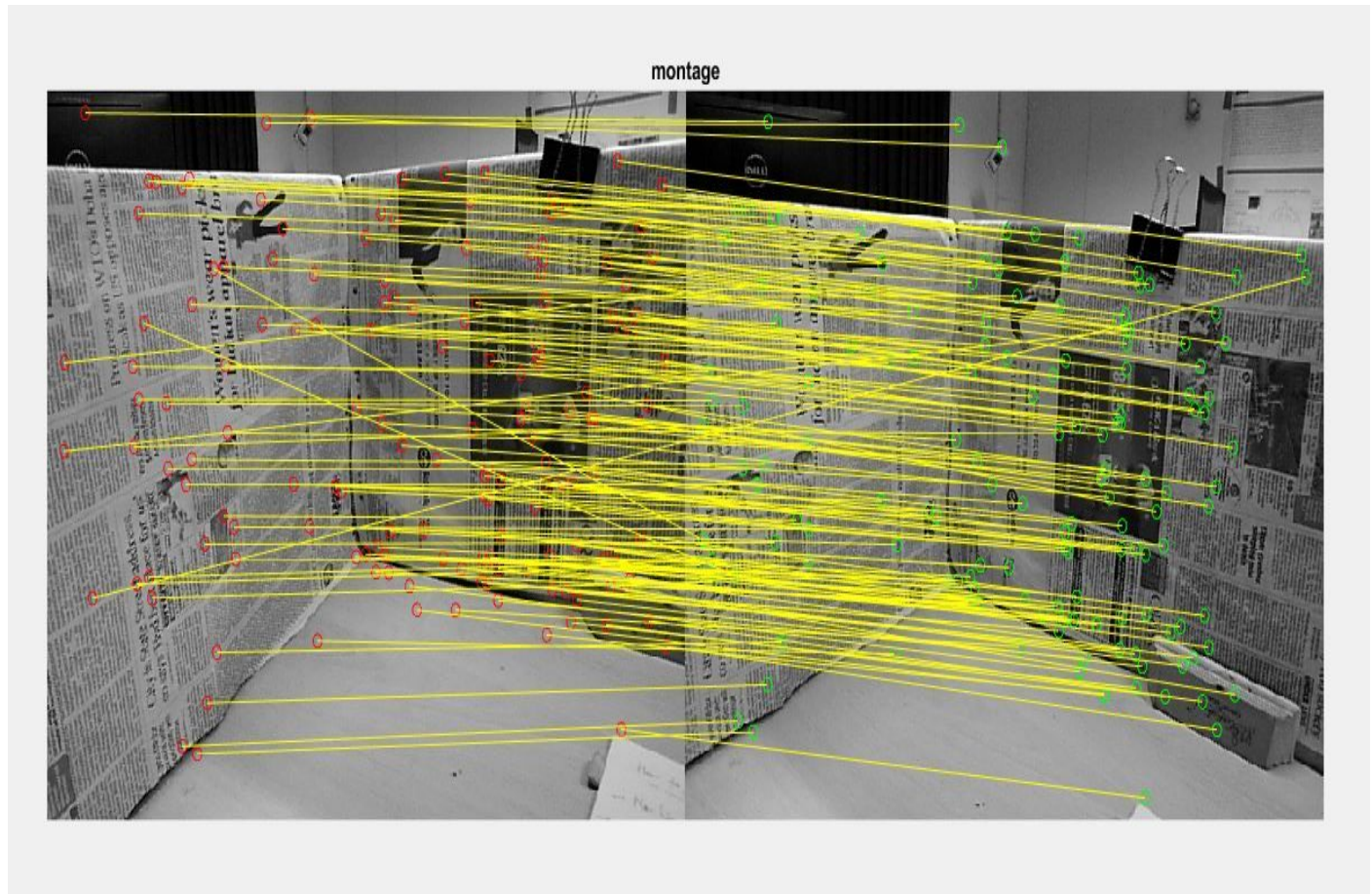
Here P is the projection matrix and xi yi are normalised coordinates in homogenised matrix.

X_i is the world points matrix.

Using SVD , we find X_i 's corresponding to all feature points.(pixel co-ordinates).

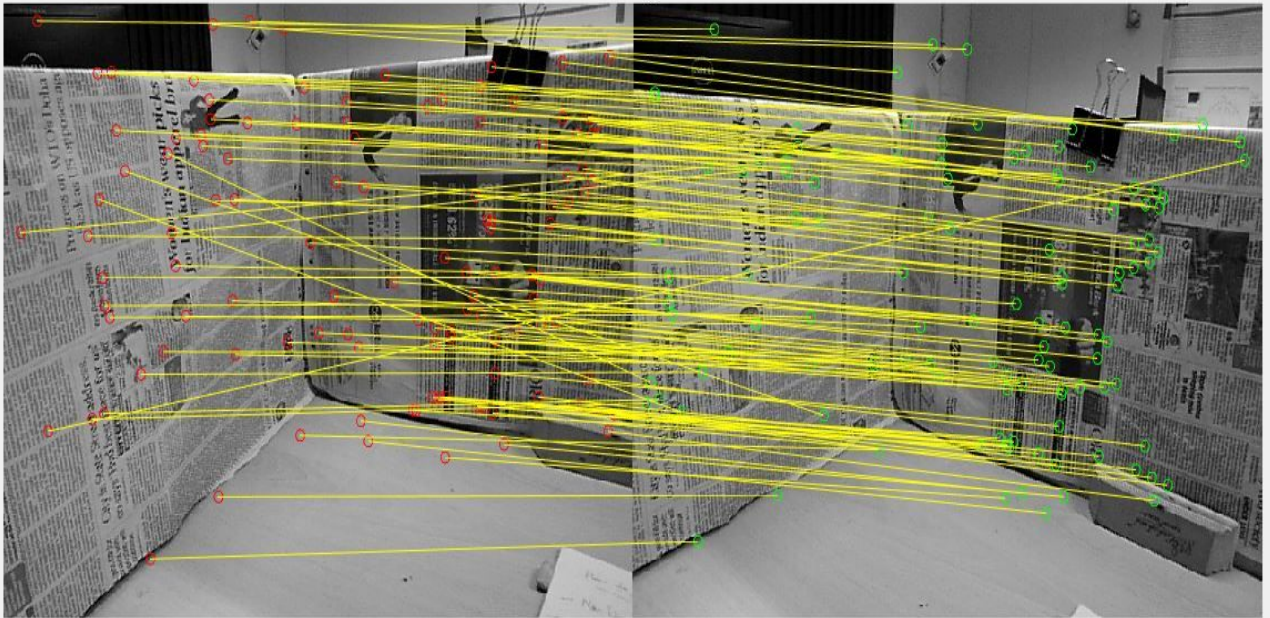
Where $ProjMat_1 = K * [eye(3,3) \ 0 \ 0 \ 0]^T$ and $ProjMat_2 = K * [R \ t]$ are projection matrices corresponding to image1 and image2.

4) Then the obtained world points corresponding to different projection matrices(4 as shown in code) are plotted in a 3D plot and camera frustum is plotted using given code. The position (pose,orientation) of camera after moving is thereby estimated.



Matching points (Montage mapping)

montage



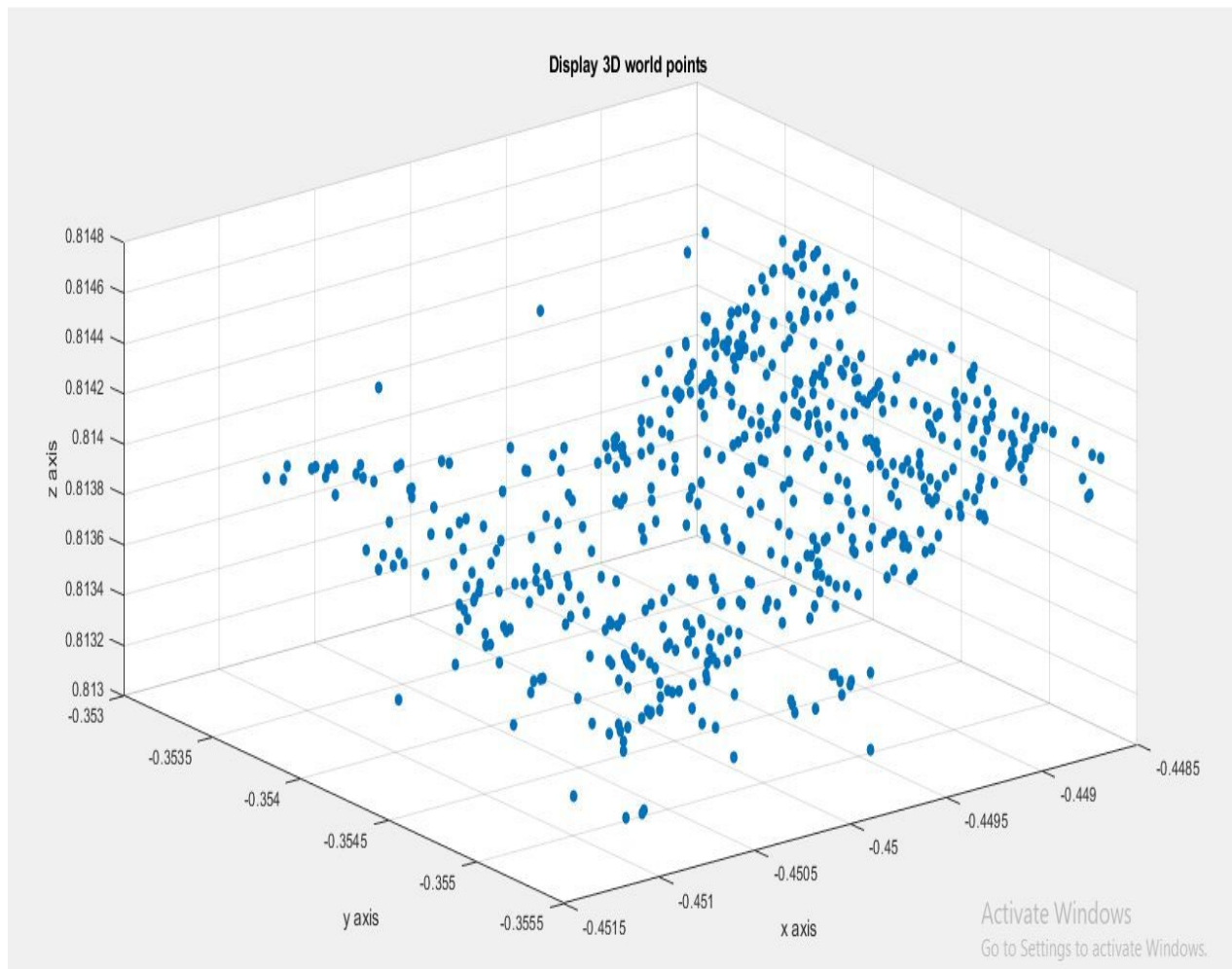
```
=====Fundamental Matrix=====
    0.0000    0.0000   -0.0022
   -0.0000    0.0000    0.0032
    0.0019   -0.0032   -0.0448

=====Rotation matrix=====
    0.9881   -0.1016   -0.1152
    0.1052    0.9941    0.0253
    0.1119   -0.0371    0.9930

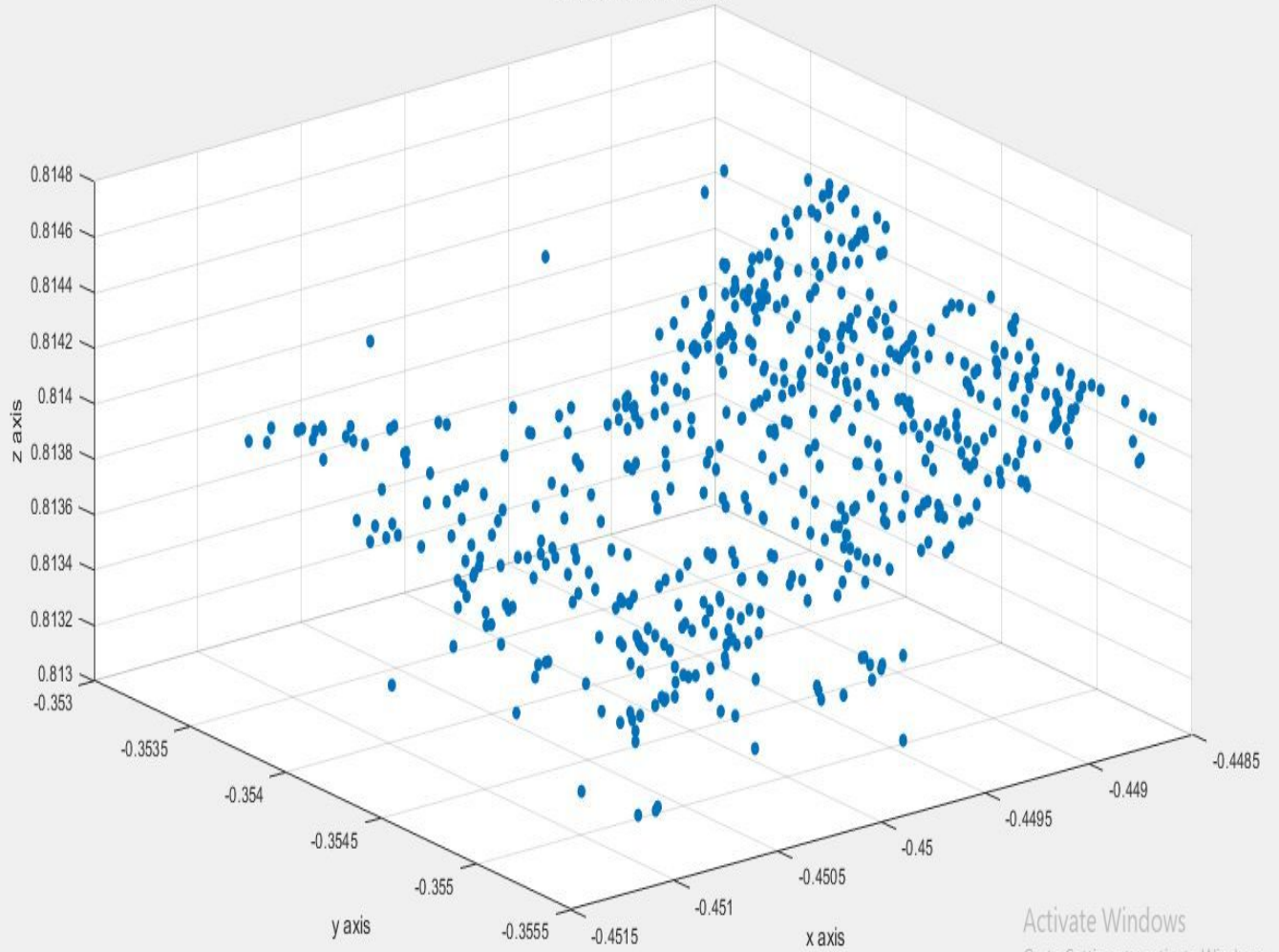
=====Translation matrix=====
    0.1795
    0.1020
    0.9785
```

Fundamental matrix ,Rotation matrix and Translation matrix found.

**World points corresponding to features given,
For 4 different projection matrices(P_2 guessed),**

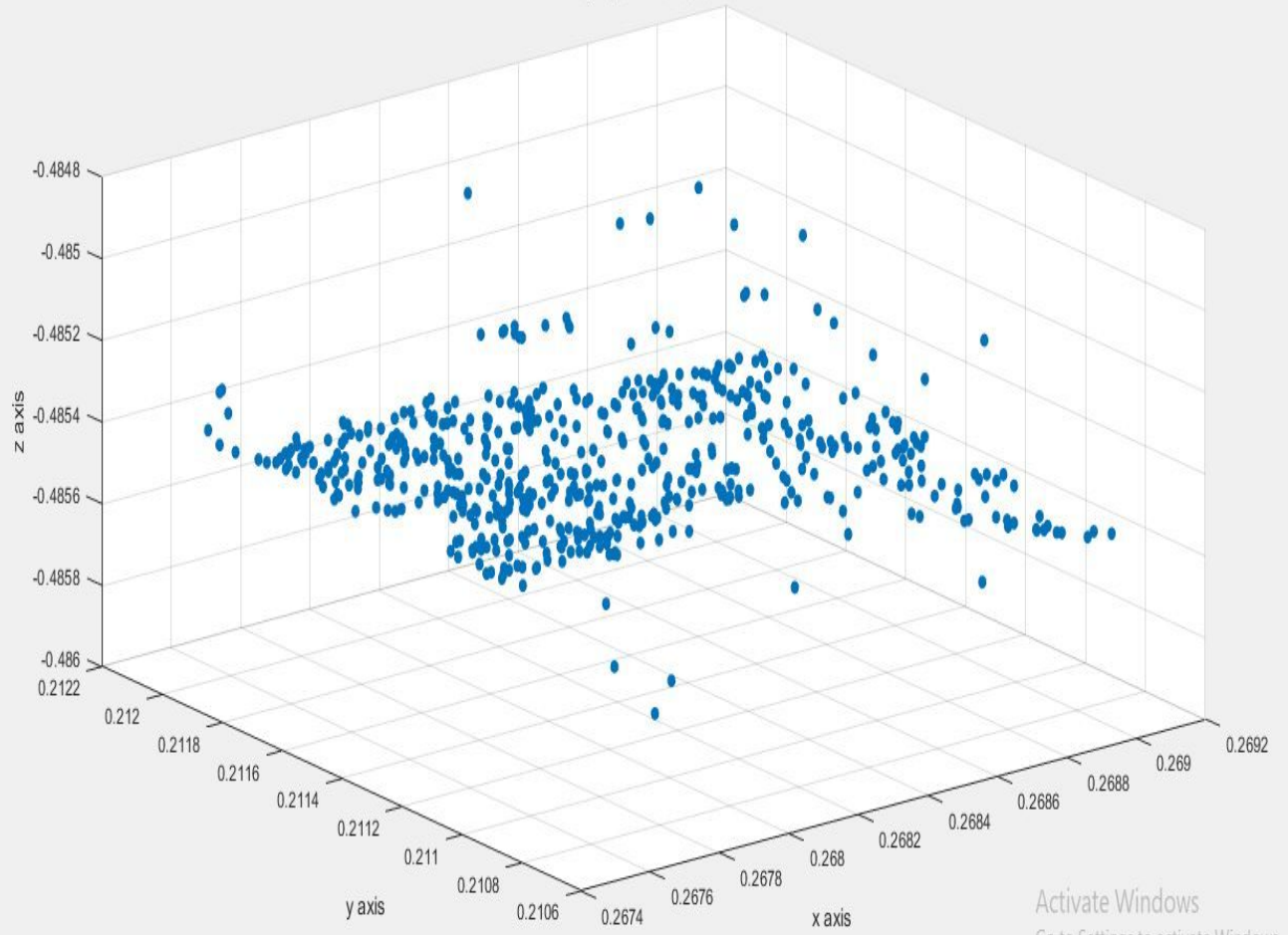


Display 3D world points



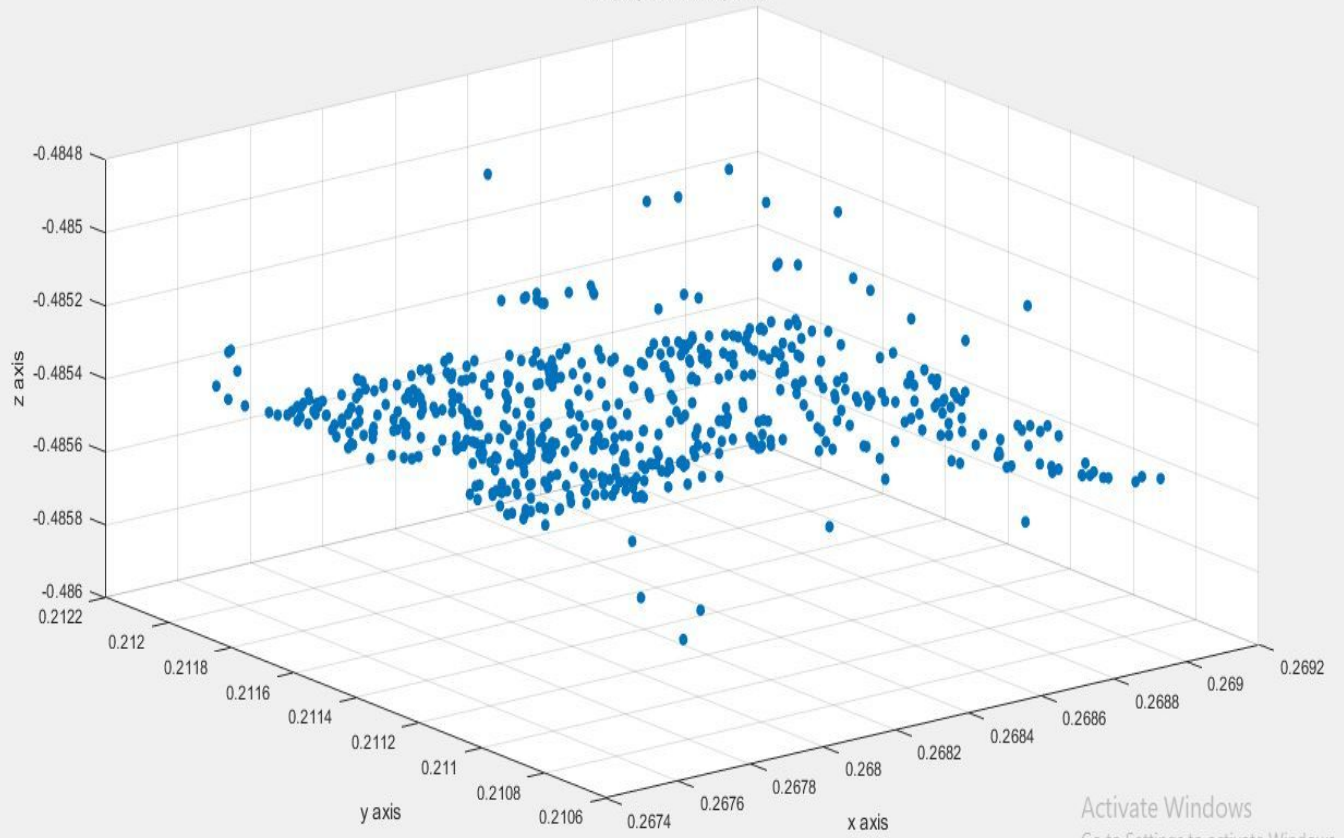
Activate Windows
Go to Settings to activate Windows.

Display 3D world points



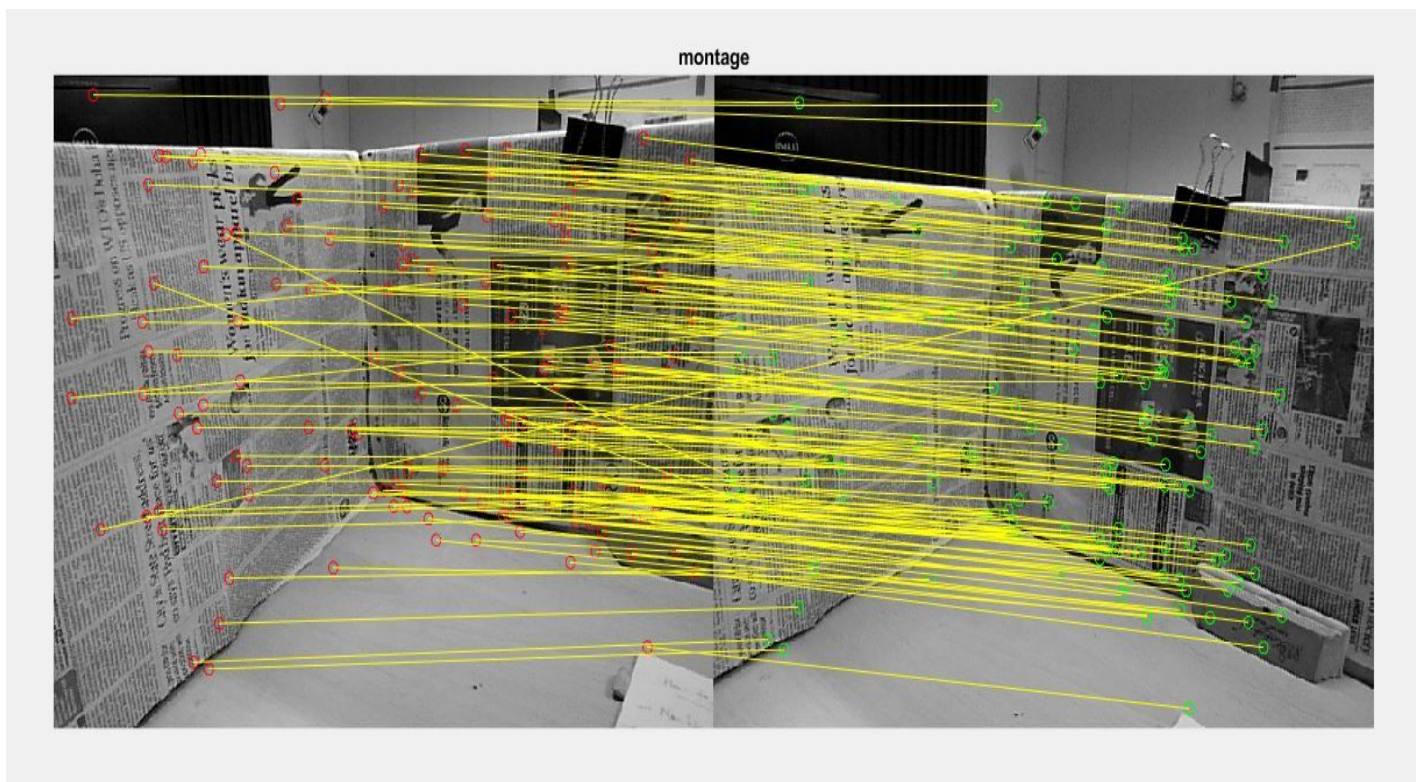
Activate Windows
Go to Settings to activate Windows.

Display 3D world points



Activate Windows
Go to Settings to activate Windows.

Set 2 : (2nd run)



```
=====Fundamental Matrix=====
  0.0000    0.0000   -0.0022
 -0.0000    0.0000    0.0032
  0.0019   -0.0032   -0.0448
```

```
=====Essential Matrix=====
  0.1660    2.2506   -0.1623
 -2.1901    0.2622    0.6707
  0.1978   -0.4402   -0.0401
```

```
=====Rotation matrix=====
  0.9881   -0.1016   -0.1152
  0.1052    0.9941    0.0253
  0.1119   -0.0371    0.9930
```

```
=====Translation matrix=====
  0.1795
  0.1020
  0.9785
```