Assignment - 1

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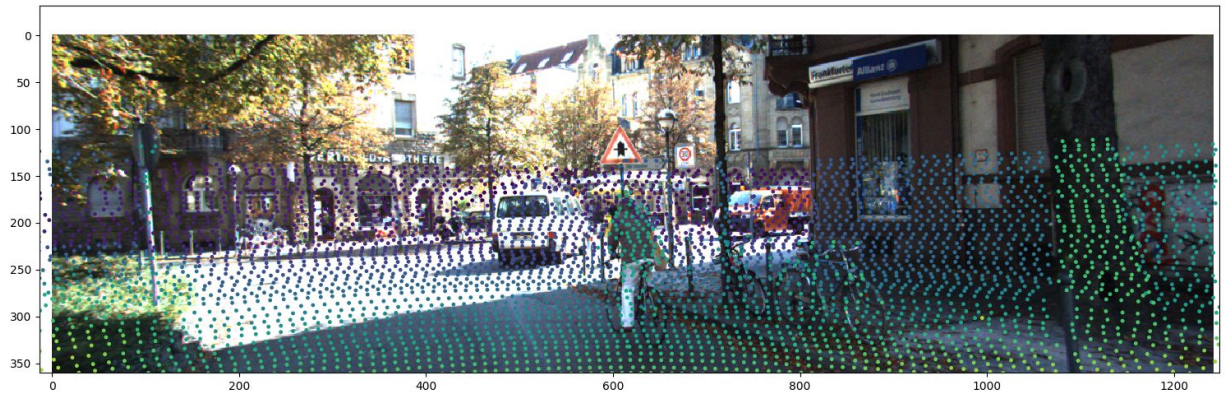
1. The main code for the question is

```
im = Image.open('image.png')
plt.imshow(im)
x,y,z = (points.T)
points = points.T
one = np.ones(len(x))
points = np.vstack([points,one])
P = K.dot(R)
sctr = P.dot(points)
x,y,z = sctr
x = x/z
y = y/z
plt.scatter(x,y,c=10000/z,s=6)
plt.show()
```

We have loaded the points of lidar and calculate the R matrix which comes out to be
R = [[0, -1, 0, 0.06], [0, 0, -1,-0.08], [1, 0, 0, -0.27]]
Where we have converted CM to M and also incorporate the transformation of axis.

Then we have multiplied K matrix with R to get the projection matrix and multiplied the points in lidar to get the points on image and finally plotted the image and points obtained by the Lidar along with gradient along Z axis.



The above is the final output of the code. This part of the code Completed by ANURAG SAHU

2. Steps to get to the result :

World

[0,0,0]

Image

[752, 260]

$\Rightarrow$ Image_C = P x World.

$$\Rightarrow \begin{bmatrix} 752 \\ 260 \\ 1 \end{bmatrix} = K \begin{bmatrix} R \mid t \end{bmatrix} \begin{bmatrix} 0 \\ 0 \\ 0 \\ 1 \end{bmatrix}$$

$$= K[R|t]\,[0,0,0,1]^T$$

$$= KR.T$$

R = I. because both the axis are aligned.

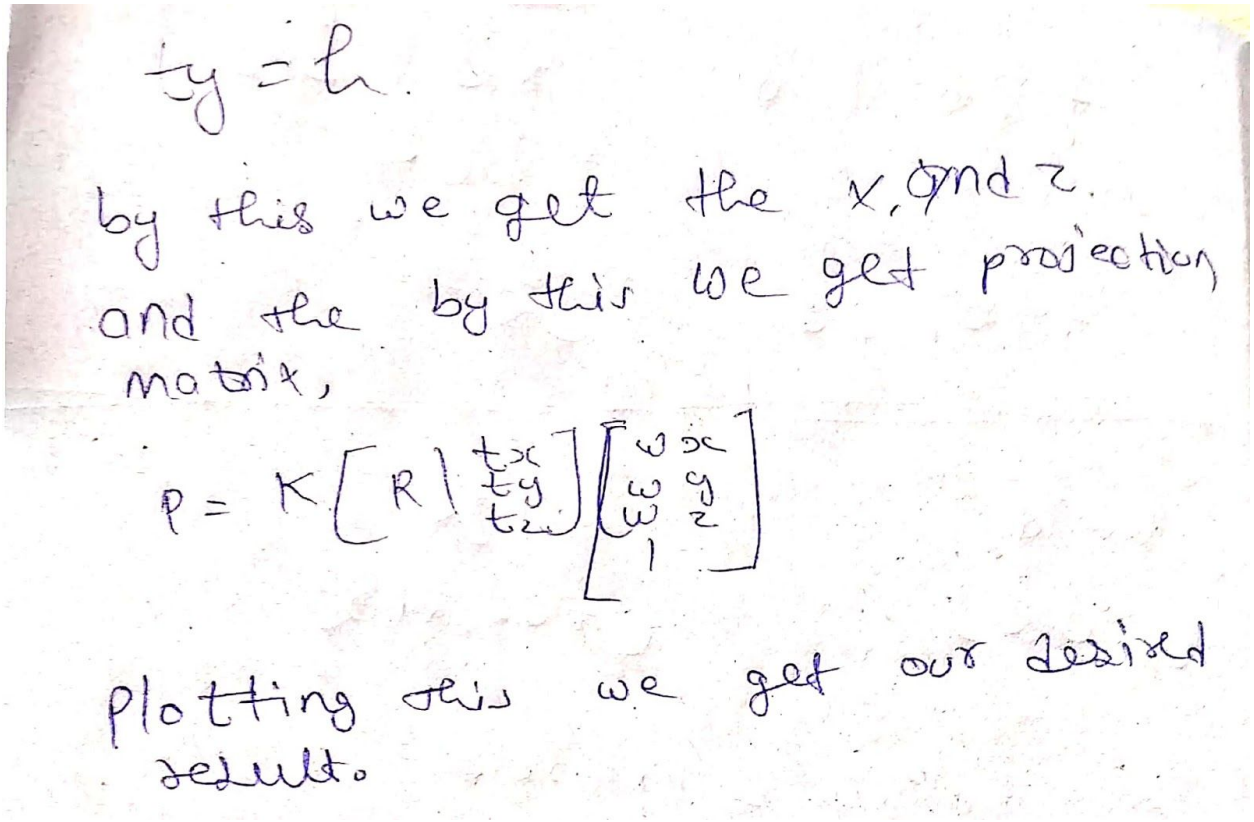
$$= KT$$

$$\Rightarrow T = K^{-1} * \text{Image-C}$$

$$\Rightarrow [tx, ty, tz] = K^{-1} * \text{Image-C}$$

$$\Rightarrow tx = (tx/ty) * h$$

$$tz = (tz/ty) * h$$



We take one point as the world origin in the picture
Then taking that point

- Plot the Lines according to the Points.

The Output of the code is

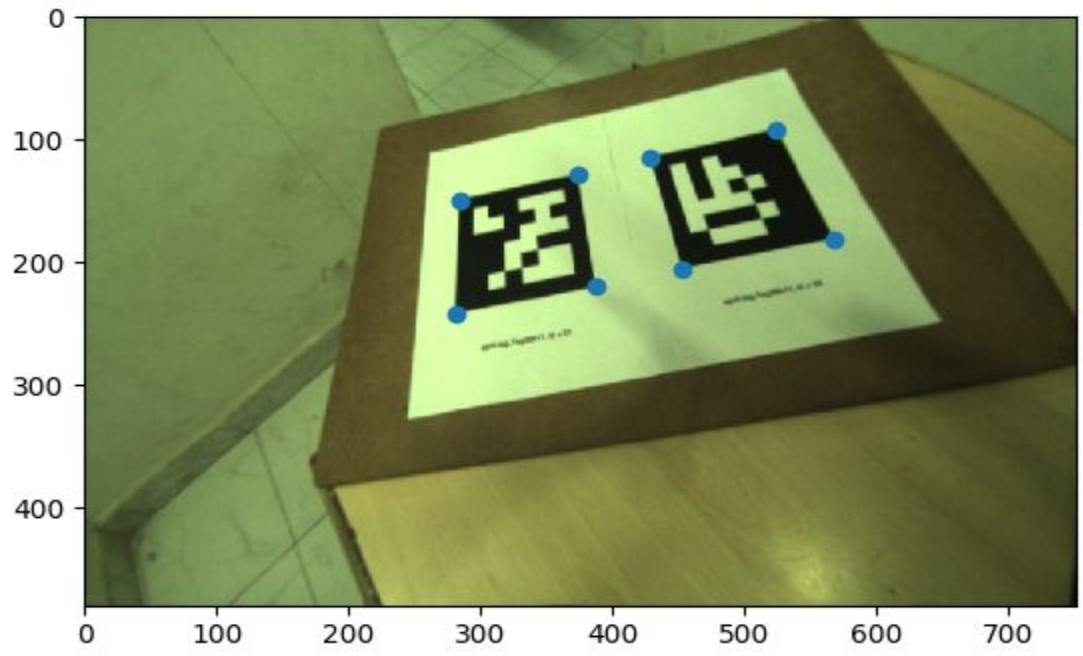
This part of the code Completed by ANURAG SAHU.

3. The Steps to do this question

- Get the u,v and also calculate the corresponding the world coordinate values of the points
- After removing the z axis part of the data perform the DLT

- After that reshape the last eigon vector
- The Obtained 3 X 3 matrix is the homography matrix
- Multiply the homography matrix with the points
- Plot the image and the Points

The Output of the above steps:



The R and T matrix comes out to be:

```
The R Matrix :
[[-0.57941796  0.79498721 -0.17963897]
 [-0.81139463 -0.58344346  0.0351067 ]
 [-0.07689981  0.16609955  0.98310598]]
The t Matrix :
[-0.07689981  0.16609955  0.98310598]
```

This part of the code Completed by ANURAG SAHU.