1.1 Focus

1.1.1 Calibrate Your Camera!

1.

image1.jpg

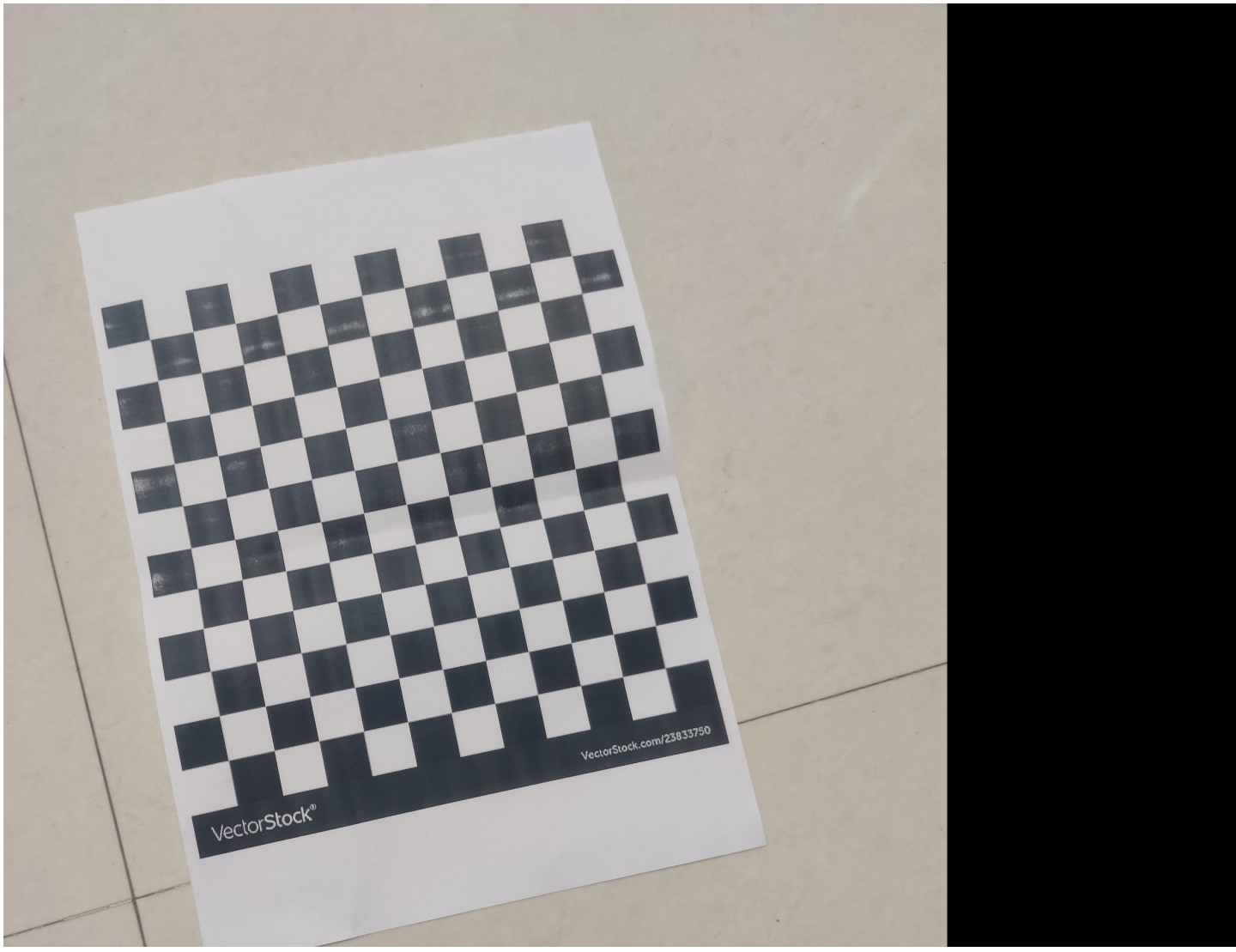


image2.jpg

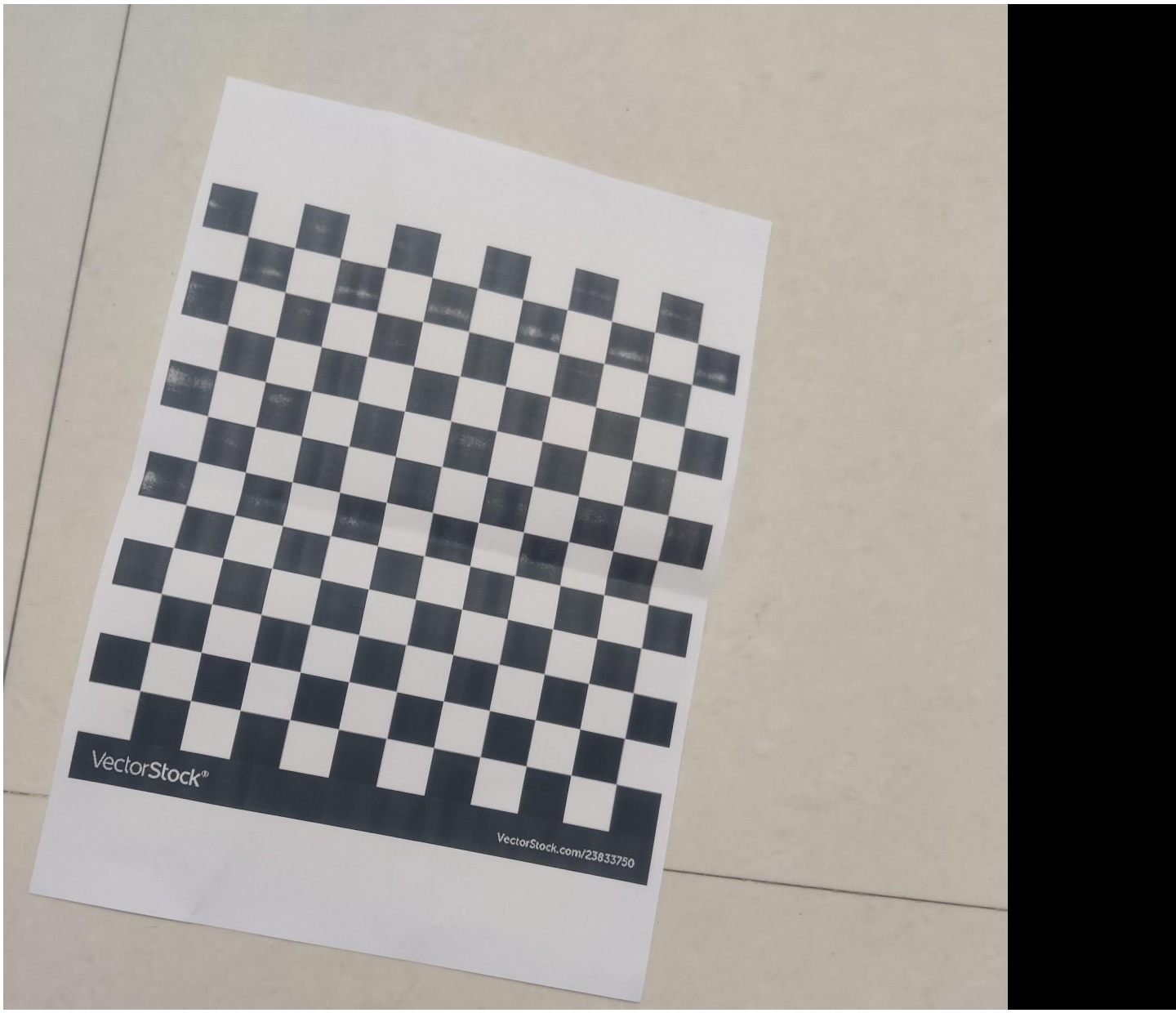
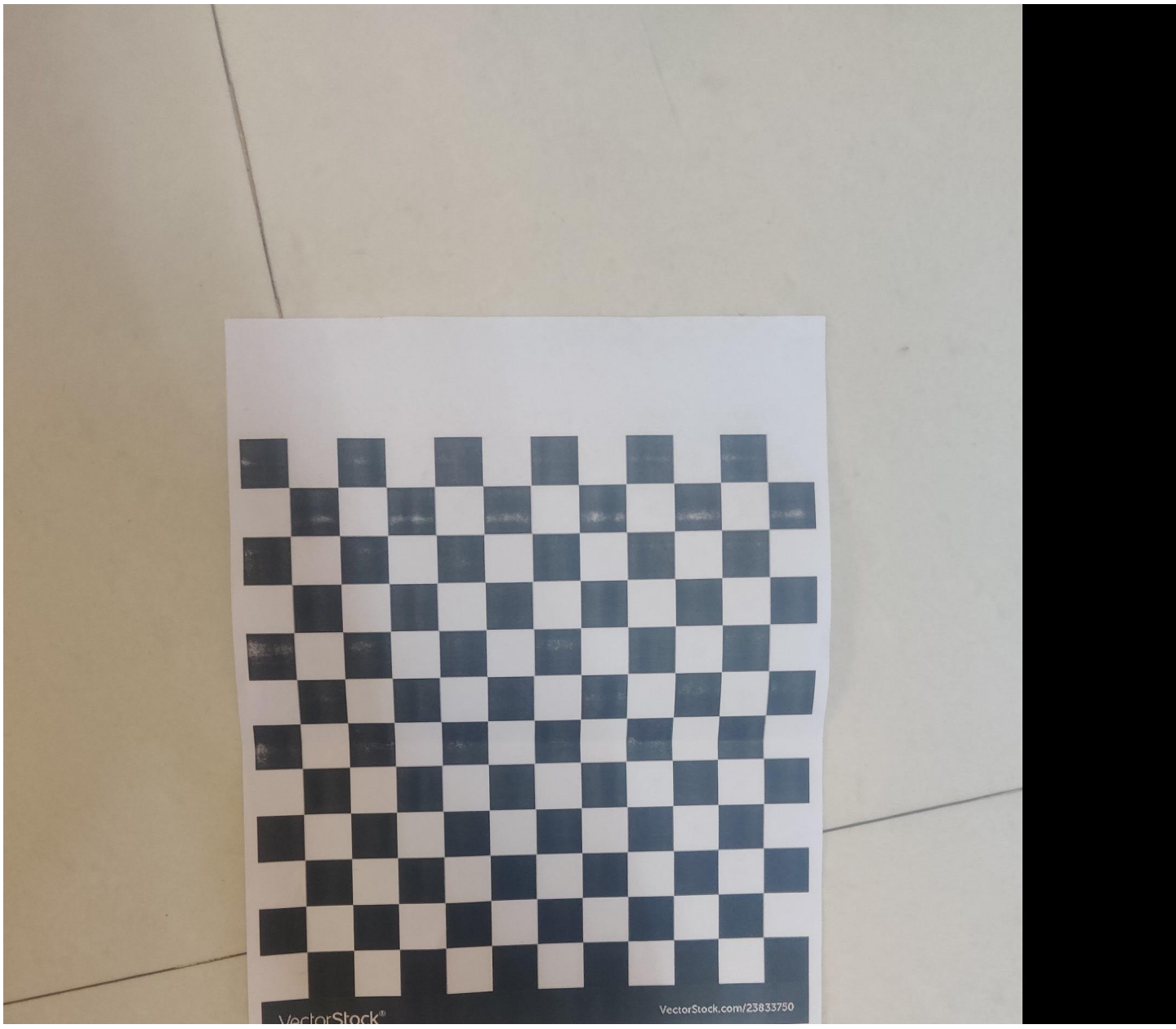


image3.jpg



true.jpg

2 and 3)

Object Points:
```
[[[ 0.  0.  0.]
  [17.  0.  0.]
  [34.  0.  0.]
  [ 0. 17.  0.]
  [17. 17.  0.]
  [34. 17.  0.]]
 [[ 0.  0.  0.]
  [17.  0.  0.]
  [34.  0.  0.]
  [ 0. 17.  0.]
  [17. 17.  0.]
  [34. 17.  0.]]]
```

Points for image 1:
```
[[1513.  730.]
 [1381.  753.]
 [1245.  779.]
 [1543.  851.]
 [1410.  876.]
 [1274.  906.]]
```

Points for image 2:
```
[[1686.  913.]
 [1552.  882.]
 [1420.  847.]
 [1712.  789.]
 [1577.  754.]
 [1447.  723.]]
```

Intrinsic Camera matrix is :
[[6.34870191e+03 0.00000000e+00 2.15168434e+03]
 [0.00000000e+00 7.92738128e+03 1.55219124e+03]
 [0.00000000e+00 0.00000000e+00 1.00000000e+00]]

Rotation vectors are :
[array([[0.36269183],
       [2.79656139],
       [-0.92394646]]), array([[0.13166407],
       [-0.90934491],
       [-2.82029257]])]

Translation vectors are :
[array([[-80.46066623],
       [-83.09052607],
       [799.71216772]]), array([[-58.30871144],
       [-64.04030653],
       [795.26797185]])]

While calling function cv2.calibrateCamera(). There is a parameter in this function which requires dimensions of image. We can change the dimension as whatever we may see appropropriate.

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The cv2.calibrateCamera() function returns
Reprojection error, camera matrix, distortion coefficients, rotation and translation vectors.
The intrinsic parameters are stored in camera matrix returned by cv2.calibrateCamera() function.

1.1.2

The focal length of the camera is : 4.7mm
The information regarding pixel size is available on this site : Link
Pixel size : 0.0008 mm

Run the script find_focal.py to generate the output:

Calibration Matrix :
[[5.73723022e+03 0.00000000e+00 2.44321643e+03]
 [0.00000000e+00 6.37053958e+03 1.50035406e+03]
 [0.00000000e+00 0.00000000e+00 1.00000000e+00]]

Focal Length :
fx in mm: 4.589784178965874
fy in mm : 5.0964316679911645
Focal length of camera in mm : 4.843107923478519

Average error: 0.4650070799721612

The focal length of the camera obtained is 4.84mm which very close to the real value 4.7mm

1.2.1 Tasks

1. The image for true.jpg is uploaded above in section 1.1.1

2. Increasing the number of images would lead to finding camera matrix with less error.

   Original points :
   [[1513. 730.]
    [1381. 753.]
    [1245. 779.]
    [1543. 851.]
    [1410. 876.]
    [1274. 906.]]

   Re projected points :
   [[1512.9286   728.53204]
    [1380.0955   753.91785]
    [1245.8999   779.564]
    [1543.8098   851.2643]
    [1409.524   877.5919]
    [1273.8441   904.19293]]

   Error: 0.5706905523935953

   This is the image for projected.jpg:


VectorStock®
VectorStock.com/23833750

1.3

After running the file reproject.py with appropriate parameters:

Output obtained:

Rearranged points for image 1:
[[498.0, 356.0], [443.0, 359.0], [390.0, 360.0], [498.0, 415.0], [444.0, 417.0], [392.0, 417.0]]

Rearranged points for image 2:
[[576.0, 329.0], [513.0, 330.0], [449.0, 331.0], [575.0, 396.0], [513.0, 396.0], [450.0, 397.0]]

Intrinsic Camera matrix is :
```
[[666.15775864   0.         459.73255518]
 [  0.         672.35517607 588.71569748]
 [  0.           0.           1.        ]]
```

Rotation vectors are :
```
[array([[ 0.01885828],
       [-2.89892147],
       [-0.33901475]]), array([[0.02265063],
       [3.11821315],
       [0.26494777]])]
```

Translation vectors are :
```
[array([[  2.02439555],
       [-12.18492143],
       [ 35.24644157]]), array([[  5.49962628],
       [-12.1432845 ],
       [ 31.47012792]])]
```

Average error: 0.16500191390514374

I have mentioned the image size as (1000,1000) for calculation.