GEBZE TECHNICAL UNIVERSITY

CSE 463

HW1

REPORT

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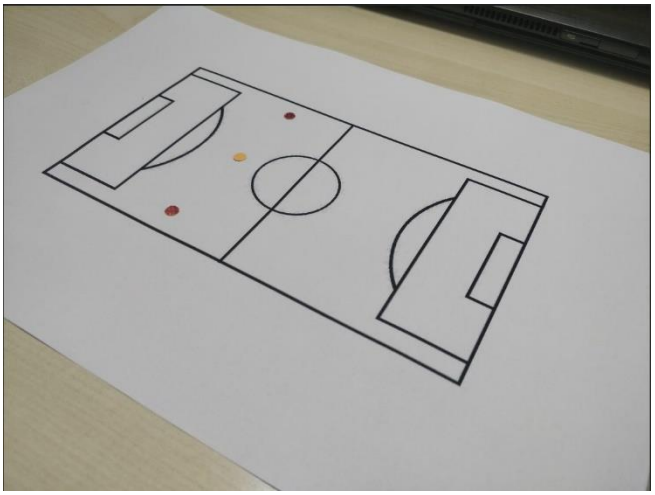
Usage

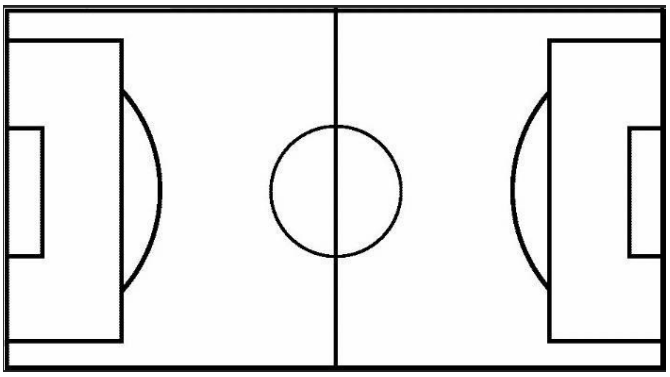
```
76  inputImg = cv2.imread('photo3.jpg')
77  modelImg = cv2.imread('photo.jpg')
```

In code there is a input image and model image. Input image is the image that we convert. Model image is our base soccer field for founding homography.

Example Input

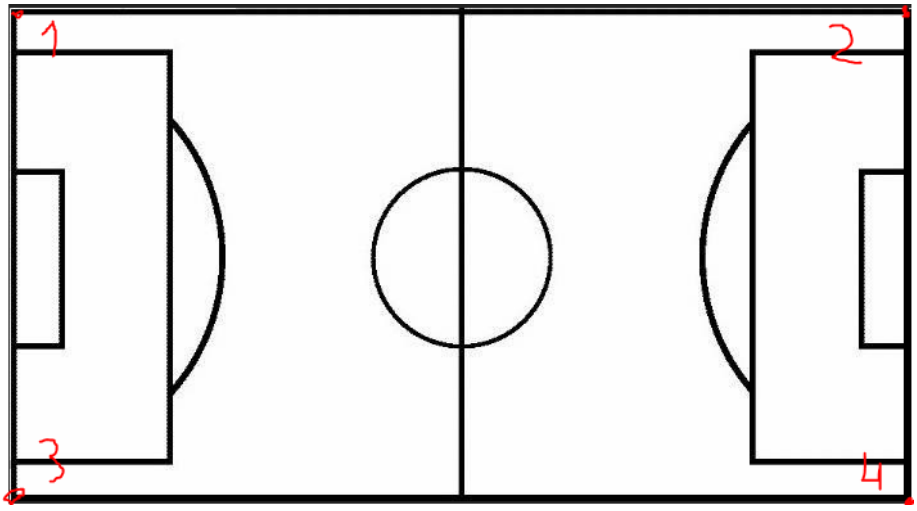


Constant Model

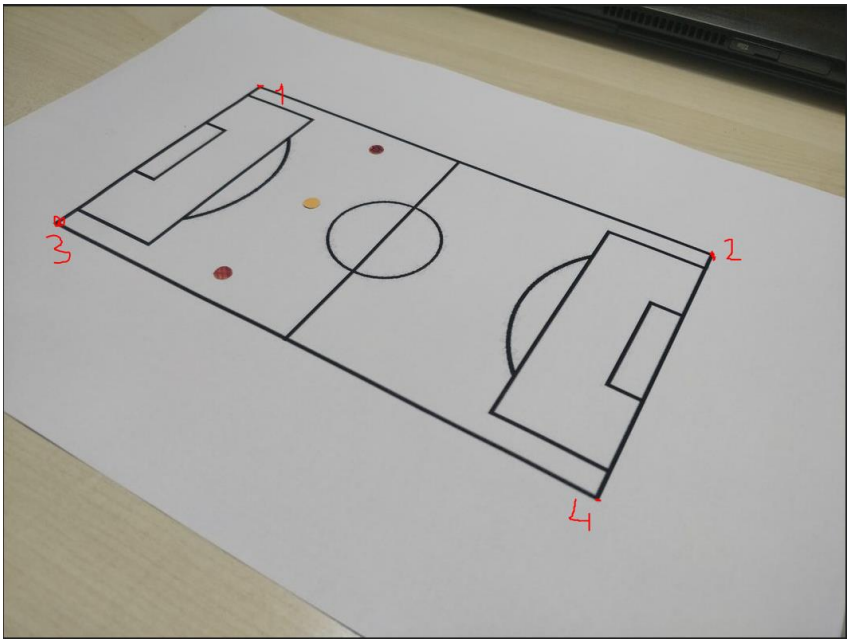


We need 4 points from each image. Since our model never changes i pick its corners as 4 point that i should take. For calculating homography matrix matching same points is important. For correct results user should pick points with same order.

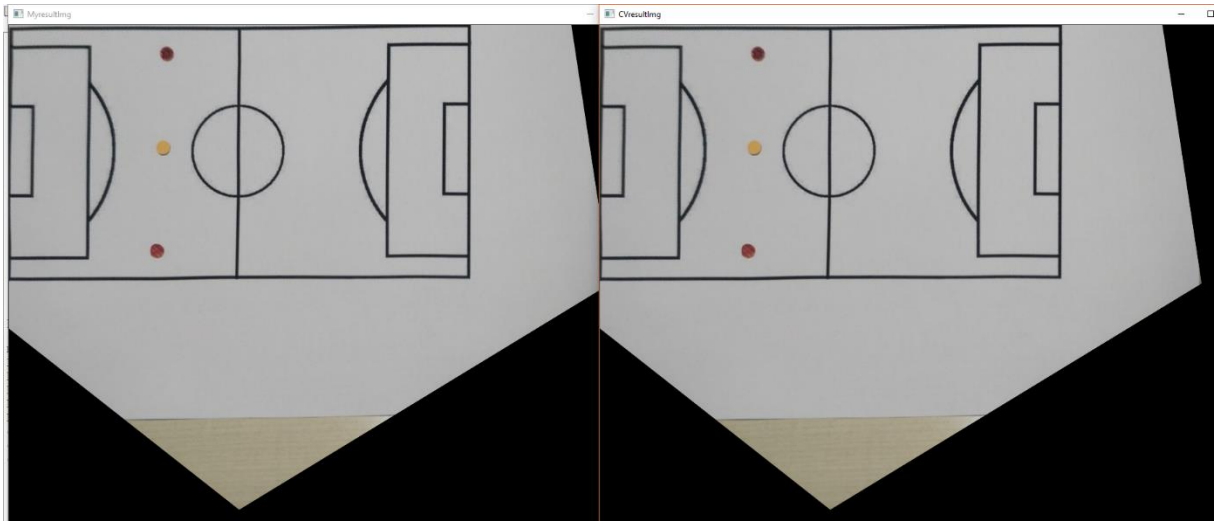
Order Of Automatically Selected Points



Example Selection From Input Image



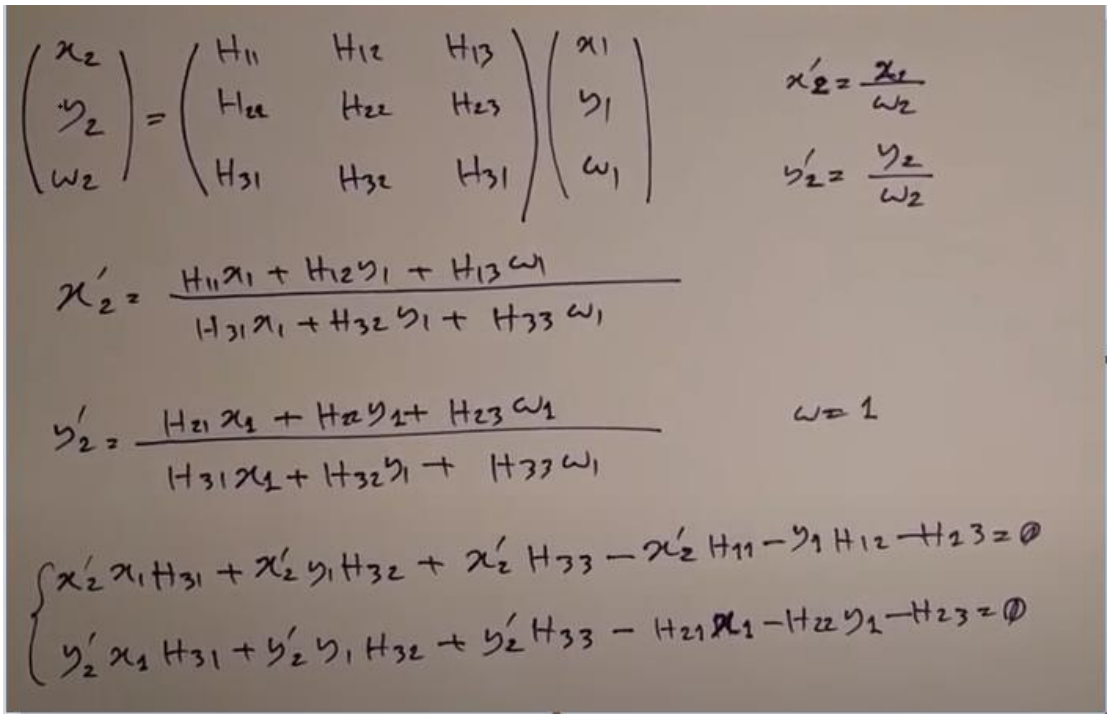
When selection complated press ESC and two result screen show up.

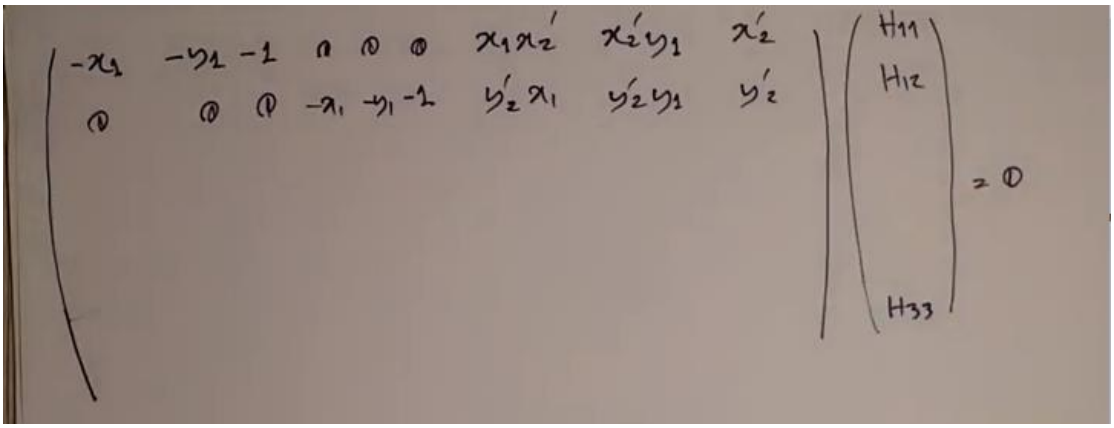


Window named “MyresultImg” uses the homography function that writed by me(homographyMy).Other window named “CvresultImg” uses OpenCV find homography function.

Homography Calculation

For one point we can write equation like this





I simply hardcoded the equation i find on paper for every point.

```
PH = np.array([
    [-x_1[0], -y_1[0], -1, 0, 0, 0, x_1[0]*x_1[1], y_1[0]*x_1[1], x_1[1]],
    [0, 0, 0, -x_1[0], -y_1[0], -1, x_1[0]*y_1[1], y_1[0]*y_1[1], y_1[1]],
    [-x_2[0], -y_2[0], -1, 0, 0, 0, x_2[0]*x_2[1], y_2[0]*x_2[1], x_2[1]],
    [0, 0, 0, -x_2[0], -y_2[0], -1, x_2[0]*y_2[1], y_2[0]*y_2[1], y_2[1]],
    [-x_3[0], -y_3[0], -1, 0, 0, 0, x_3[0]*x_3[1], y_3[0]*x_3[1], x_3[1]],
    [0, 0, 0, -x_3[0], -y_3[0], -1, x_3[0]*y_3[1], y_3[0]*y_3[1], y_3[1]],
    [-x_4[0], -y_4[0], -1, 0, 0, 0, x_4[0]*x_4[1], y_4[0]*x_4[1], x_4[1]],
    [0, 0, 0, -x_4[0], -y_4[0], -1, x_4[0]*y_4[1], y_4[0]*y_4[1], y_4[1]],
    ])
```

I use 4 point selected by user and 4 auto seleceted (corners of the model image) point to calculate homography matrix.

I tried the calculate intersection point of two paralel lines in infinity but failed.

For finding point at infinity first i represent my paralel lines in projective space. Then i cross product two lines but get a point at infinity. For resolving this I calculate homography matrix with seleceted points and corner points. Then i tried to convert lines with matrix i found. But couldnt do it.

Matrix Comparison

OpenCV Homography Matrix

```
OpenCV homography matrix:
 [[ 1.13749809e+00  1.67356041e+00 -5.30819368e+02]
 [-7.62561129e-01  2.03229735e+00  4.35846849e+01]
 [-8.38666223e-05  1.59234488e-03  1.00000000e+00]]
```

My Homography Matrix

```
My homography matrix:
 [[ 2.13568582e-03  3.14215845e-03 -9.96628835e-01]
 [-1.43173075e-03  3.81569751e-03  8.18315163e-02]
 [-1.57462028e-07  2.98967392e-06  1.87752915e-03]]
```

Even with different matrices output images are same for two of them.

Summary

Done-Not Done for steps in Assignment

1.Take a picture of the soccer field. Done

2.Ask the user to mark fourcorners of the soccer field. Done

3.To be able to find the homography, you need 4 points. For the 4thpoint use the intersection of the parallel lines of the soccer field. Not Done

4.Estimate a homography between the input image and the model soccer field.OpenCV functionsfindHomographyor getPerspectiveTransformwill be helpful. Half Done(Not with intersection of the parallel lines)

5.Derive formulas for estimatingthe homography yourself from these 4 points. Use your formulas to find the homograph and compare your results with the openCV results. Done

6.Using the new transform, transform the input image and display the output as shown above.You may use OpenCVfunction perspectiveTransform. Done