Homework Assignment #4

Computer Vision for HCI - CSE 5524 Shailesh Tripathi (tripathi.52)

Note: Python libraries used are :numpy, skimage, matplotlib

Q1.

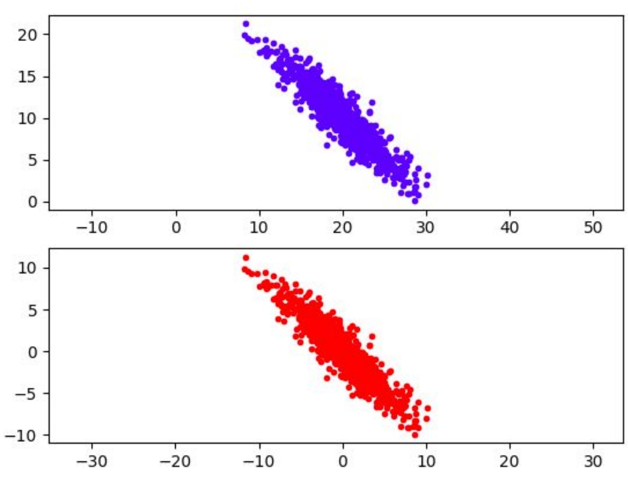
All 7 similitude moments were calculated [η_{02} η_{03} η_{11} η_{12} η_{20} η_{21} η_{30}]

boxIm#	Similitude Magnitudes
1	[0.0001653175573150067 , 0.0, 0.0, 0.0, 0.0006455256999919309, 0.0, 0.0]
2	[0.0001653175573150067 , 0.0, 0.0, 0.0, 0.0006455256999919309, 0.0, 0.0]
3	[0.00016576016576016575, 0.0, 0.0, 0.0, 0.0006435394670688788, 0.0, 0.0]
4	[0.0006455256999919309 , 0.0, 0.0, 0.0, 0.0001653175573150067, 0.0, 0.0]

Comparison:

- In all the images, the moments (0,3), (1,1), (1,2), (2,1) and (3,0) are zero. The reason being that the coordinates are subtracted by the centroid and when this is raised to an odd power, the moment of one half of the object will cancel out the other half's moment. Hence only those, moments who have both even powers in x and y direction (i.e, (0,2) and (2,0)) will have non-zero values.
- boxIm1 and boxIm2 have identical(exactly equal) shape but only shited. Since similitude moments are **translation (and scale) invariant,** the moments of the two are also equal.
- The boxes in image 1 and 3 have a very small width-to-height ratio(1.975 vs 1.969). Since the similitude moments are both **translation and scale invariant,** the values would have been exactly equal if their ratios were equal. Since the ratio differs by a very small amount, the moments also are very close if not equal.
- In boxIm4, the rectangle has same shape but rotated by 90-degrees. Hence the moments (0,2) and (2,0) are exchanged from boxIm1.

Q2.



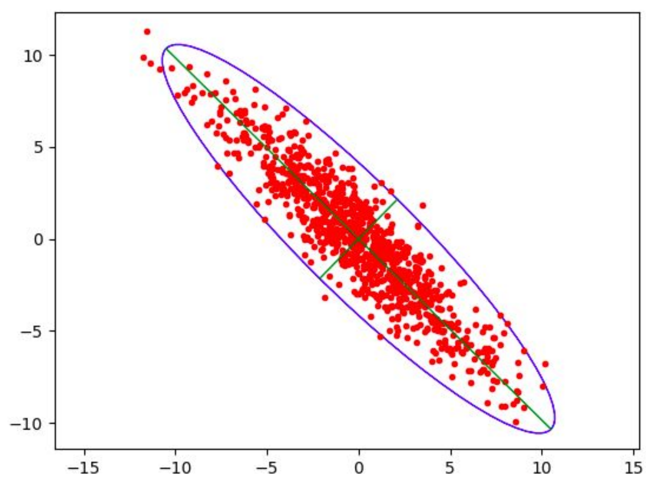
Q3.

Covariance matrix K = [[12.75660304 -11.56072237]
[-11.56072237 12.39609825]]

EigenVectors, U = [[0.71259733 0.70157327]
[-0.70157327 0.71259733]]

EigenValues, V = [24.13847816 1.01422313]

Since the 3*sigma length is required, the halflength = sqrt(9* eigenvalue)



Q4.

In order to rotate Y, we multiply it by U’ (because it acts as a rotation matrix)

Y_rotated = Y * U’