CS419 HW3

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1 Results for Basic Shape Descriptors

Descriptor Set	Euclidean	Manhattan	Chi-squared	Mahalanobis
1 ('A')	0.18428571428571427	0.18428571428571427	0.18428571428571427	0.18428571428571427
2 ('P')	0.14	0.14	0.14	0.14
3 ('Co')	0.13142857142857142	0.13142857142857142	0.13142857142857142	0.13142857142857142
4 ('Ci')	0.10714285714285714	0.10714285714285714	0.10714285714285714	0.10714285714285714
5 ('R')	0.11571428571428571	0.11571428571428571	0.11571428571428571	0.11571428571428571
6 ('E')	0.16142857142857142	0.16142857142857142	0.16142857142857142	0.16142857142857142
7 ('A', 'P')	0.2914285714285714	0.2957142857142857	0.3342857142857143	0.03571428571428571
8 ('A', 'Co')	0.18428571428571427	0.18428571428571427	0.20714285714285716	0.17142857142857143
9 ('A', 'Ci')	0.18428571428571427	0.18428571428571427	0.21571428571428572	0.18142857142857144
10 ('A', 'R')	0.18428571428571427	0.18428571428571427	0.19714285714285715	0.18285714285714286
11 ('A', 'E')	0.18428571428571427	0.18428571428571427	0.21428571428571427	0.18
12 ('P', 'Co')	0.1442857142857143	0.15	0.21285714285714286	0.1442857142857143
13 ('P', 'Ci')	0.14285714285714285	0.1442857142857143	0.24428571428571427	0.14285714285714285
14 ('P', 'R')	0.1442857142857143	0.14714285714285713	0.20714285714285716	0.1442857142857143
15 ('P', 'E')	0.14142857142857143	0.14714285714285713	0.22428571428571428	0.14142857142857143
16 ('Co', 'Ci')	0.22714285714285715	0.22142857142857142	0.23142857142857143	0.22714285714285715
17 ('Co', 'R')	0.27	0.2671428571428571	0.2742857142857143	0.27
18 ('Co', 'E')	0.35428571428571426	0.37	0.36428571428571427	0.35428571428571426
19 ('Ci', 'R')	0.26857142857142857	0.26571428571428574	0.27	0.26857142857142857
20 ('Ci', 'E')	0.3385714285714286	0.35285714285714287	0.32142857142857145	0.3385714285714286
21 ('R', 'E')	0.35	0.3557142857142857	0.3457142857142857	0.35
22 ('A', 'P', 'Co')	0.2914285714285714	0.2957142857142857	0.3414285714285714	0.03571428571428571
23 ('A', 'P', 'Ci')	0.2914285714285714	0.2957142857142857	0.33285714285714285	0.041428571428571426
24 ('A', 'P', 'R')	0.2914285714285714	0.2957142857142857	0.3414285714285714	0.04
25 ('A', 'P', 'E')	0.2914285714285714	0.2957142857142857	0.3357142857142857	0.037142857142857144
26 ('A', 'Co', 'Ci')	0.18428571428571427	0.18571428571428572	0.22	0.17142857142857143
27 ('A', 'Co', 'R')	0.18428571428571427	0.18428571428571427	0.21428571428571427	0.16857142857142857
28 ('A', 'Co', 'E')	0.18428571428571427	0.18428571428571427	0.22428571428571428	0.17285714285714285
29 ('A', 'Ci', 'R')	0.18428571428571427	0.18428571428571427	0.22142857142857142	0.18
30 ('A', 'Ci', 'E')	0.18428571428571427	0.18571428571428572	0.23285714285714285	0.18142857142857144
31 ('A', 'R', 'E')	0.18428571428571427	0.18428571428571427	0.21857142857142858	0.18
32 ('P', 'Co', 'Ci')	0.1457142857142857	0.15714285714285714	0.27285714285714285	0.1457142857142857
33 ('P', 'Co', 'R')	0.1457142857142857	0.15571428571428572	0.24	0.1457142857142857
34 ('P', 'Co', 'E')	0.1457142857142857	0.15285714285714286	0.2814285714285714	0.1457142857142857
35 ('P', 'Ci', 'R')	0.1442857142857143	0.15285714285714286	0.28	0.1442857142857143
36 ('P', 'Ci', 'E')	0.1442857142857143	0.15285714285714286	0.29285714285714287	0.1442857142857143
37 ('P', 'R', 'E')	0.1442857142857143	0.15285714285714286	0.2742857142857143	0.1442857142857143
38 ('Co', 'Ci', 'R')	0.38857142857142857	0.39285714285714285	0.38142857142857145	0.38857142857142857
39 ('Co', 'Ci', 'E')	0.47	0.4785714285714286	0.48857142857142855	0.47
40 ('Co', 'R', 'E')	0.4757142857142857	0.4785714285714286	0.4742857142857143	0.4757142857142857
41 ('Ci', 'R', 'E')	0.48857142857142855	0.49	0.48	0.48857142857142855

42 ('A', 'P', 'Co', 'Ci')	0.2914285714285714	0.2957142857142857	0.3414285714285714	0.04285714285714286
43 ('A', 'P', 'Co', 'R')	0.2914285714285714	0.2957142857142857	0.3414285714285714	0.03857142857142857
44 ('A', 'P', 'Co', 'E')	0.2914285714285714	0.2957142857142857	0.3414285714285714	0.03571428571428571
45 ('A', 'P', 'Ci', 'R')	0.2914285714285714	0.2957142857142857	0.3414285714285714	0.03571428571428571
46 ('A', 'P', 'Ci', 'E')	0.2914285714285714	0.2957142857142857	0.3357142857142857	0.03571428571428571
47 ('A', 'P', 'R', 'E')	0.2914285714285714	0.2957142857142857	0.3414285714285714	0.04
48 ('A', 'Co', 'Ci', 'R')	0.18428571428571427	0.18571428571428572	0.2257142857142857	0.16857142857142857
49 ('A', 'Co', 'Ci', 'E')	0.18428571428571427	0.18571428571428572	0.2357142857142857	0.16285714285714287
50 ('A', 'Co', 'R', 'E')	0.18428571428571427	0.18571428571428572	0.23285714285714285	0.16857142857142857
51 ('A', 'Ci', 'R', 'E')	0.18428571428571427	0.18571428571428572	0.2342857142857143	0.18
52 ('P', 'Co', 'Ci', 'R')	0.1457142857142857	0.15857142857142856	0.29285714285714287	0.1457142857142857
53 ('P', 'Co', 'Ci', 'E')	0.1457142857142857	0.16142857142857142	0.3171428571428571	0.1457142857142857
54 ('P', 'Co', 'R', 'E')	0.1457142857142857	0.16	0.3	0.1457142857142857
55 ('P', 'Ci', 'R', 'E')	0.1442857142857143	0.15857142857142856	0.32142857142857145	0.1442857142857143
56 ('Co', 'Ci', 'R', 'E')	0.5414285714285715	0.5442857142857143	0.5557142857142857	0.5414285714285715
57 ('A', 'P', 'Co', 'Ci', 'R')	0.2914285714285714	0.2957142857142857	0.3414285714285714	0.03428571428571429
58 ('A', 'P', 'Co', 'Ci', 'E')	0.2914285714285714	0.2957142857142857	0.3414285714285714	0.03857142857142857
59 ('A', 'P', 'Co', 'R', 'E')	0.2914285714285714	0.2957142857142857	0.3414285714285714	0.03857142857142857
60 ('A', 'P', 'Ci', 'R', 'E')	0.2914285714285714	0.2957142857142857	0.3414285714285714	0.03571428571428571
61 ('A', 'Co', 'Ci', 'R', 'E')	0.18428571428571427	0.18714285714285714	0.24428571428571427	0.1657142857142857
62 ('P', 'Co', 'Ci', 'R', 'E')	0.1457142857142857	0.16	0.33714285714285713	0.1457142857142857
63 ('A', 'P', 'Co', 'Ci', 'R', 'E')	0.2914285714285714	0.2957142857142857	0.3414285714285714	0.03571428571428571

Table 1: Results of All Possible Combinations of Basic Shape Descriptors

Distance Metric	**Euclidean**	**Manhattan**	**Chi-squared**	**Mahalanobis**
Average Accuracy	0.231904761904762	0.23612244897959186	0.2841269841269842	0.16507936507936513

Table 2: Avrage Accuracies

In our experiments, we observed that the best accuracy achieved was 0.5557142857142857, and this was obtained using the Chi-squared Distance metric. The corresponding descriptor set that resulted in this optimal performance was ['Convexity', 'Circularity', 'Rectangularity', 'Eccentricity']. These findings are summarized in Table 1, which provides a comprehensive overview of the average accuracies across different distance metrics.

And also as we can see in Table 2, the distance metric that showed highest performance is Chi-squared distance metric.

2 Results for Fourier Descriptors

Experiment (Coefficient)	**Euclidean**	**Manhattan**	**Chi-squared**	**Mahalanobis**
Experiment 1 (5)	0.3442857142857143	0.3585714285714286	0.4085714285714286	0.09714285714285714
Experiment 2 (20)	0.35714285714285715	0.3942857142857143	0.4142857142857143	0.09571428571428571
Experiment 3 (50)	0.35714285714285715	0.40285714285714286	0.4328571428571429	0.08285714285714285
Experiment 4 (70)	0.37142857142857144	0.43	0.44142857142857145	0.09285714285714286

Table 3: Experiment Results with Coefficients

Distance Metric	Euclidean	Manhattan	Chi-squared	Mahalanobis
Average Accuracy	0.35750000000000004	0.3964285714285714	0.4242857142857143	0.09214285714285714

Table 4: Average Accuracies

In the experiments conducted, the best accuracy achieved was 0.44142857142857145, and it was obtained using the Chi-squared distance metric with a coefficient of 70. These results are detailed in Table 3.

And also as we can see in Table 4, the distance metric that showed highest performance is Chi-squared distance metric.

3 Results for Shape Histogram Descriptors

Experiment (Length)	Euclidean	Manhattan	Chi-squared	Mahalanobis
Experiment 1 (5)	0.5057142857142857	0.49714285714285716	0.4928571428571429	0.5057142857142857
Experiment 2 (10)	0.5885714285714285	0.5957142857142858	0.6085714285714285	0.5885714285714285
Experiment 3 (20)	0.5714285714285714	0.59	0.6028571428571429	0.5714285714285714
Experiment 4 (30)	0.5528571428571428	0.5971428571428572	0.6057142857142858	0.5528571428571428

Table 5: Experiment Results with Different Lengths

Metric	Value
Average Accuracy (Euclidean Distance)	0.5546428571428571
Average Accuracy (Manhattan Distance)	0.5700000000000001
Average Accuracy (Chi-squared Distance)	0.5775
Average Accuracy (Mahalanobis Distance)	0.5546428571428571
Best Accuracy	0.6085714285714285
Best Distance	Chi-squared Distance
Best Length	10

Table 6: Average and Best Accuracies

In the conducted experiments, the highest accuracy achieved was 0.6085714285714285, and it was obtained for experiments with a length of 10 using the Chi-squared distance metric. These results are detailed in Table 5.

Additionally, when considering the average accuracies presented in Table 6, the Chi-squared distance metric consistently demonstrated the best performance among the evaluated metrics.

4 Results for Moment Invariants Descriptors

Moment Set	Euclidean	Manhattan	Chi-squared	Mahalanobis
1 ('I1')	0.1442857142857143	0.1442857142857143	0.1442857142857143	0.1442857142857143
2 ('I2')	0.17857142857142858	0.17857142857142858	0.18	0.17857142857142858
3 ('I3')	0.11428571428571428	0.11428571428571428	0.11428571428571428	0.11428571428571428
4 ('I4')	0.10571428571428572	0.10571428571428572	0.10571428571428572	0.10571428571428572
5 ('I5')	0.12714285714285714	0.12714285714285714	0.024285714285714285	0.12714285714285714
6 ('I6')	0.1357142857142857	0.1357142857142857	0.02857142857142857	0.1357142857142857
7 ('I7')	0.11142857142857143	0.11142857142857143	0.018571428571428572	0.11142857142857143
8 ('I1', 'I2')	0.3342857142857143	0.3357142857142857	0.37285714285714283	0.3342857142857143
9 ('I1', 'I3')	0.2642857142857143	0.27	0.3157142857142857	0.2642857142857143
10 ('I1', 'I4')	0.21142857142857144	0.21571428571428572	0.32285714285714284	0.21142857142857144
11 ('I1', 'I5')	0.15571428571428572	0.15571428571428572	0.17142857142857143	0.15571428571428572
12 ('I1', 'I6')	0.17714285714285713	0.18285714285714286	0.1442857142857143	0.17714285714285713
13 ('I1', 'I7')	0.1457142857142857	0.1457142857142857	0.12857142857142856	0.1457142857142857
14 ('I2', 'I3')	0.29714285714285715	0.3	0.31142857142857144	0.29714285714285715
15 ('I2', 'I4')	0.24285714285714285	0.25285714285714284	0.2785714285714286	0.24285714285714285
16 ('I2', 'I5')	0.17857142857142858	0.18142857142857144	0.16	0.17857142857142858
17 ('I2', 'I6')	0.19428571428571428	0.2	0.10857142857142857	0.19428571428571428
18 ('I2', 'I7')	0.17857142857142858	0.18	0.12571428571428572	0.17857142857142858
19 ('I3', 'I4')	0.22857142857142856	0.22714285714285715	0.27285714285714285	0.22857142857142856
20 ('I3', 'I5')	0.11857142857142858	0.12	0.11	0.11857142857142858
21 ('I3', 'I6')	0.19428571428571428	0.20142857142857143	0.06285714285714286	0.19428571428571428
22 ('I3', 'I7')	0.11285714285714285	0.11285714285714285	0.09714285714285714	0.11285714285714285
23 ('I4', 'I5')	0.10571428571428572	0.10571428571428572	0.08	0.10571428571428572
24 ('I4', 'I6')	0.1957142857142857	0.18857142857142858	0.07142857142857142	0.1957142857142857
25 ('I4', 'I7')	0.10857142857142857	0.11	0.06428571428571428	0.10857142857142857
26 ('I5', 'I6')	0.14857142857142858	0.15428571428571428	0.037142857142857144	0.14857142857142858
27 ('I5', 'I7')	0.18857142857142858	0.19857142857142857	0.015714285714285715	0.18857142857142858
28 ('I6', 'I7')	0.1442857142857143	0.1457142857142857	0.017142857142857144	0.1442857142857143
29 ('I1', 'I2', 'I3')	0.4142857142857143	0.42142857142857143	0.4785714285714286	0.4142857142857143
30 ('I1', 'I2', 'I4')	0.35285714285714287	0.3657142857142857	0.4542857142857143	0.35285714285714287
31 ('I1', 'I2', 'I5')	0.3357142857142857	0.3385714285714286	0.38571428571428573	0.3357142857142857
32 ('I1', 'I2', 'I6')	0.3414285714285714	0.3485714285714286	0.3457142857142857	0.3414285714285714
33 ('I1', 'I2', 'I7')	0.3342857142857143	0.33714285714285713	0.36142857142857143	0.3342857142857143
34 ('I1', 'I3', 'I4')	0.27714285714285714	0.30428571428571427	0.42	0.27714285714285714
35 ('I1', 'I3', 'I5')	0.2642857142857143	0.2714285714285714	0.32428571428571443	0.2642857142857143
36 ('I1', 'I3', 'I6')	0.26571428571428574	0.2857142857142857	0.32285714285714284	0.26571428571428574
37 ('I1', 'I3', 'I7')	0.2642857142857143	0.27	0.31714285714285714	0.2642857142857143
38 ('I1', 'I4', 'I5')	0.21142857142857144	0.21571428571428572	0.32	0.21142857142857144
39 ('I1', 'I4', 'I6')	0.21428571428571427	0.22142857142857142	0.2557142857142857	0.21428571428571427
40 ('I1', 'I4', 'I7')	0.21142857142857144	0.21571428571428572	0.32428571428571443	0.21142857142857144
41 ('I1', 'I5', 'I6')	0.17714285714285713	0.18285714285714286	0.15142857142857144	0.17714285714285713
42 ('I1', 'I5', 'I7')	0.15571428571428572	0.15571428571428572	0.15857142857142856	0.15571428571428572
43 ('I1', 'I6', 'I7')	0.17714285714285713	0.18285714285714286	0.13857142857142857	0.17714285714285713
44 ('I2', 'I3', 'I4')	0.33714285714285713	0.3485714285714286	0.4085714285714286	0.33714285714285713
45 ('I2', 'I3', 'I5')	0.29714285714285715	0.30142857142857143	0.31571428571428571	0.29714285714285715
46 ('I2', 'I3', 'I6')	0.3	0.31	0.27142857142857143	0.3
47 ('I2', 'I3', 'I7')	0.29714285714285715	0.3	0.31428571428571432	0.29714285714285715
48 ('I2', 'I4', 'I5')	0.24285714285714285	0.25142857142857145	0.27142857142857143	0.24285714285714285
49 ('I2', 'I4', 'I6')	0.24142857142857144	0.25857142857142856	0.19	0.24142857142857144
50 ('I2', 'I4', 'I7')	0.24285714285714285	0.25285714285714284	0.27285714285714285	0.24285714285714285
51 ('I2', 'I5', 'I6')	0.19428571428571428	0.20142857142857143	0.10428571428571429	0.19428571428571428
52 ('I2', 'I5', 'I7')	0.17857142857142858	0.18142857142857144	0.13142857142857142	0.17857142857142858
53 ('I2', 'I6', 'I7')	0.19428571428571428	0.2	0.09571428571428571	0.19428571428571428
54 ('I3', 'I4', 'I5')	0.2342857142857143	0.22714285714285715	0.25142857142857145	0.2342857142857143

55 ('I3', 'I4', 'I6')	0.2671428571428571	0.27714285714285714	0.16428571428571428	0.2671428571428571
56 ('I3', 'I4', 'I7')	0.23142857142857143	0.22714285714285715	0.26142857142857145	0.23142857142857143
57 ('I3', 'I5', 'I6')	0.19428571428571428	0.19857142857142857	0.06428571428571428	0.19428571428571428
58 ('I3', 'I5', 'I7')	0.11714285714285715	0.12	0.1	0.11714285714285715
59 ('I3', 'I6', 'I7')	0.19428571428571428	0.2	0.05857142857142857	0.19428571428571428
60 ('I4', 'I5', 'I6')	0.1957142857142857	0.19	0.07	0.1957142857142857
61 ('I4', 'I5', 'I7')	0.10857142857142857	0.11	0.055714285714285716	0.10857142857142857
62 ('I4', 'I6', 'I7')	0.1957142857142857	0.19142857142857142	0.06142857142857143	0.1957142857142857
63 ('I5', 'I6', 'I7')	0.15285714285714286	0.15571428571428572	0.02	0.15285714285714286
64 ('I1', 'I2', 'I3', 'I4')	0.4228571428571429	0.4342857142857143	0.5242857142857142	0.4228571428571429
65 ('I1', 'I2', 'I3', 'I5')	0.4142857142857143	0.42142857142857143	0.48	0.4142857142857143
66 ('I1', 'I2', 'I3', 'I6')	0.4157142857142857	0.42428571428571427	0.46	0.4157142857142857
67 ('I1', 'I2', 'I3', 'I7')	0.4142857142857143	0.42142857142857143	0.4785714285714286	0.4142857142857143
68 ('I1', 'I2', 'I4', 'I5')	0.35285714285714287	0.3657142857142857	0.4542857142857143	0.35285714285714287
69 ('I1', 'I2', 'I4', 'I6')	0.35428571428571426	0.37	0.3985714285714286	0.35428571428571426
70 ('I1', 'I2', 'I4', 'I7')	0.35285714285714287	0.3657142857142857	0.4514285714285714	0.35285714285714287
71 ('I1', 'I2', 'I5', 'I6')	0.3414285714285714	0.3485714285714286	0.3457142857142857	0.3414285714285714
72 ('I1', 'I2', 'I5', 'I7')	0.3357142857142857	0.3385714285714286	0.38142857142857145	0.3357142857142857
73 ('I1', 'I2', 'I6', 'I7')	0.3414285714285714	0.3485714285714286	0.3457142857142857	0.3414285714285714
74 ('I1', 'I3', 'I4', 'I5')	0.27714285714285714	0.30428571428571427	0.42	0.27714285714285714
75 ('I1', 'I3', 'I4', 'I6')	0.28	0.31	0.37	0.28
76 ('I1', 'I3', 'I4', 'I7')	0.27714285714285714	0.30428571428571427	0.42428571428571427	0.27714285714285714
77 ('I1', 'I3', 'I5', 'I6')	0.2642857142857143	0.2857142857142857	0.32142857142857145	0.2642857142857143
78 ('I1', 'I3', 'I5', 'I7')	0.2642857142857143	0.2714285714285714	0.32285714285714284	0.2642857142857143
79 ('I1', 'I3', 'I6', 'I7')	0.26571428571428574	0.2857142857142857	0.32142857142857145	0.26571428571428574
80 ('I1', 'I4', 'I5', 'I6')	0.21428571428571427	0.22142857142857142	0.2542857142857143	0.21428571428571427
81 ('I1', 'I4', 'I5', 'I7')	0.21142857142857144	0.21714285714285714	0.3271428571428571	0.21142857142857144
82 ('I1', 'I4', 'I6', 'I7')	0.21428571428571427	0.22142857142857142	0.2557142857142857	0.21428571428571427
83 ('I1', 'I5', 'I6', 'I7')	0.17714285714285713	0.18285714285714286	0.1457142857142857	0.17714285714285713
84 ('I2', 'I3', 'I4', 'I5')	0.33714285714285713	0.3485714285714286	0.4085714285714286	0.33714285714285713
85 ('I2', 'I3', 'I4', 'I6')	0.33714285714285713	0.3457142857142857	0.34714285714285714	0.33714285714285713
86 ('I2', 'I3', 'I4', 'I7')	0.33714285714285713	0.3485714285714286	0.40714285714285714	0.33714285714285713
87 ('I2', 'I3', 'I5', 'I6')	0.3	0.31285714285714283	0.27	0.3
88 ('I2', 'I3', 'I5', 'I7')	0.29714285714285715	0.30142857142857143	0.3157142857142857	0.29714285714285715
89 ('I2', 'I3', 'I6', 'I7')	0.3	0.31	0.27	0.3
90 ('I2', 'I4', 'I5', 'I6')	0.24142857142857144	0.25857142857142856	0.19	0.24142857142857144
91 ('I2', 'I4', 'I5', 'I7')	0.24285714285714285	0.25142857142857145	0.26857142857142857	0.24285714285714285
92 ('I2', 'I4', 'I6', 'I7')	0.24142857142857144	0.25857142857142856	0.18857142857142858	0.24142857142857144
93 ('I2', 'I5', 'I6', 'I7')	0.19428571428571428	0.20285714285714285	0.09571428571428571	0.19428571428571428
94 ('I3', 'I4', 'I5', 'I6')	0.2671428571428571	0.27714285714285714	0.16428571428571428	0.2671428571428571
95 ('I3', 'I4', 'I5', 'I7')	0.2342857142857143	0.22714285714285715	0.24428571428571427	0.2342857142857143
96 ('I3', 'I4', 'I6', 'I7')	0.2671428571428571	0.27714285714285714	0.16142857142857142	0.2671428571428571
97 ('I3', 'I5', 'I6', 'I7')	0.19428571428571428	0.19857142857142857	0.06142857142857143	0.19428571428571428
98 ('I4', 'I5', 'I6', 'I7')	0.1957142857142857	0.19285714285714287	0.06	0.1957142857142857
99 ('I1', 'I2', 'I3', 'I4', 'I5')	0.4228571428571429	0.4342857142857143	0.5242857142857142	0.4228571428571429
100 ('I1', 'I2', 'I3', 'I4', 'I6')	0.4228571428571429	0.4357142857142857	0.4942857142857143	0.4228571428571429
101 ('I1', 'I2', 'I3', 'I4', 'I7')	0.4228571428571429	0.4342857142857143	0.5242857142857142	0.4228571428571429
102 ('I1', 'I2', 'I3', 'I5', 'I6')	0.4157142857142857	0.42428571428571427	0.46	0.4157142857142857
103 ('I1', 'I2', 'I3', 'I5', 'I7')	0.4142857142857143	0.42142857142857143	0.4785714285714286	0.4142857142857143
104 ('I1', 'I2', 'I3', 'I6', 'I7')	0.4157142857142857	0.42428571428571427	0.46	0.4157142857142857
105 ('I1', 'I2', 'I4', 'I5', 'I6')	0.35428571428571426	0.37	0.4	0.35428571428571426
106 ('I1', 'I2', 'I4', 'I5', 'I7')	0.35285714285714287	0.3657142857142857	0.45285714285714285	0.35285714285714287
107 ('I1', 'I2', 'I4', 'I6', 'I7')	0.35428571428571426	0.37	0.3985714285714286	0.35428571428571426
108 ('I1', 'I2', 'I5', 'I6', 'I7')	0.3414285714285714	0.3485714285714286	0.34714285714285714	0.3414285714285714
109 ('I1', 'I3', 'I4', 'I5', 'I6')	0.28	0.31	0.36857142857142855	0.28
110 ('I1', 'I3', 'I4', 'I5', 'I7')	0.27714285714285714	0.30428571428571427	0.42142857142857143	0.27714285714285714
111 ('I1', 'I3', 'I4', 'I6', 'I7')	0.28	0.31	0.37	0.28
112 ('I1', 'I3', 'I5', 'I6', 'I7')	0.26285714285714284	0.2857142857142857	0.32142857142857145	0.26285714285714284
113 ('I1', 'I4', 'I5', 'I6', 'I7')	0.21428571428571427	0.22142857142857142	0.2542857142857143	0.21428571428571427

114 ('I2', 'I3', 'I4', 'I5', 'I6')	0.33714285714285713	0.3457142857142857	0.3457142857142857	0.33714285714285713
115 ('I2', 'I3', 'I4', 'I5', 'I7')	0.33714285714285713	0.3485714285714286	0.40714285714285714	0.33714285714285713
116 ('I2', 'I3', 'I4', 'I6', 'I7')	0.33714285714285713	0.3457142857142857	0.3442857142857143	0.33714285714285713
117 ('I2', 'I3', 'I5', 'I6', 'I7')	0.3	0.31285714285714283	0.26857142857142857	0.3
118 ('I2', 'I4', 'I5', 'I6', 'I7')	0.24142857142857144	0.25857142857142856	0.18571428571428572	0.24142857142857144
119 ('I3', 'I4', 'I5', 'I6', 'I7')	0.2671428571428571	0.27714285714285714	0.16	0.2671428571428571
120 ('I1', 'I2', 'I3', 'I4', 'I5', 'I6')	0.4228571428571429	0.4357142857142857	0.4942857142857143	0.4228571428571429
121 ('I1', 'I2', 'I3', 'I4', 'I5', 'I7')	0.4228571428571429	0.4342857142857143	0.5242857142857142	0.4228571428571429
122 ('I1', 'I2', 'I3', 'I4', 'I6', 'I7')	0.4228571428571429	0.4357142857142857	0.4942857142857143	0.4228571428571429
123 ('I1', 'I2', 'I3', 'I5', 'I6', 'I7')	0.4157142857142857	0.42428571428571427	0.46	0.4157142857142857
124 ('I1', 'I2', 'I4', 'I5', 'I6', 'I7')	0.35428571428571426	0.37	0.3985714285714286	0.35428571428571426
125 ('I1', 'I3', 'I4', 'I5', 'I6', 'I7')	0.28	0.31	0.36857142857142855	0.28
126 ('I2', 'I3', 'I4', 'I5', 'I6', 'I7')	0.33714285714285713	0.3457142857142857	0.34285714285714286	0.33714285714285713
127 ('I1', 'I2', 'I3', 'I4', 'I5', 'I6', 'I7')	0.4228571428571429	0.4357142857142857	0.4942857142857143	0.4228571428571429

Table 7: Experiment Results with Moment Set

Table 8: Avrage Accuracies

Metric	**Value**
Average Accuracy (Euclidean Distance)	0.2642969628796403
Average Accuracy (Manhattan Distance)	0.2725646794150732
Average Accuracy (Chi-squared Distance)	0.2726434195725535
Average Accuracy (Mahalanobis Distance)	0.2642969628796403
Best Accuracy	0.5242857142857142
Best Distance	Chi-squared Distance
Best Descriptor Set	$['I1', 'I2', 'I3', 'I4']$

In the conducted experiments Table 7, the best accuracy achieved is 0.5242857142857142, and this was obtained using the Chi-squared distance metric. The corresponding moment set for this best accuracy is ['I1', 'I2', 'I3', 'I4']. Additionally, the best distance metric overall, as indicated by the Table 8, is the Manhattan distance.

Table 9: Experiment with Arbitrary Combination Feature Vector

Descriptor Set	['Convexity', 'Circularity', 'Rectangularity', 'Eccentricity']
Fourier Descriptor Coefficient	70
Shape Histogram Descriptor Length	10
Moment Invariants Set	['I1', 'I2', 'I3', 'I4']
Accuracy (Euclidean Distance)	0.37142857142857144
Accuracy (Manhattan Distance)	0.43
Accuracy (Chi-squared Distance)	0.44142857142857145
Accuracy (Mahalanobis Distance)	0.10285714285714286

5 Results for Arbitrary Combinations of All Descriptors

In this arbitrary combination of all descriptors I used ['Convexity', 'Circularity', 'Rectangularity', 'Eccentricity'] set from the basic shape descriptors, Fourier Descriptor with coefficient 70, Shape Histogram Descriptor with length 10, and ['I1', 'I2', 'I3', 'I4'] set from Moment Invariants Descriptor.

As evident from the Table 9, the best accuracy achieved for the combined feature vector descriptor is 0.44142857142857145. This highest accuracy is obtained when utilizing the Chi-squared distance metric.