

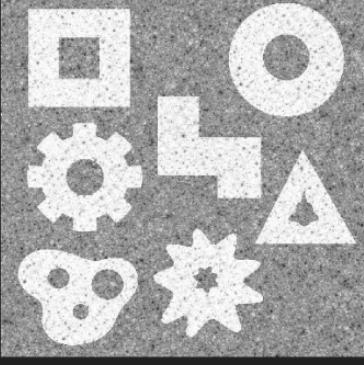
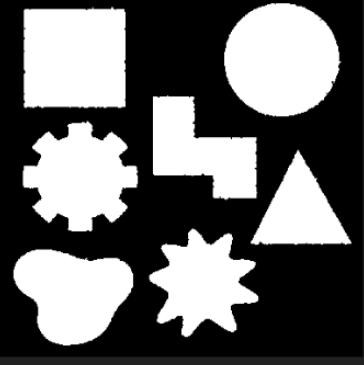
**LAB 9**

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Group: A4CDCS2306A

**Image Representation & Description (MATLAB)****Task A: Image Segmentation**

Results in table format:	Image Result:								
<table border="1"> <thead> <tr> <th>Parameter</th><th>Value</th></tr> </thead> <tbody> <tr> <td>Threshold Level (Otsu)</td><td>0.7529</td></tr> <tr> <td>Foreground Pixels</td><td>424,890</td></tr> <tr> <td>Background Pixels</td><td>623,686</td></tr> </tbody> </table>	Parameter	Value	Threshold Level (Otsu)	0.7529	Foreground Pixels	424,890	Background Pixels	623,686	<p style="text-align: center;"><b>Task A: Image Segmentation Results</b></p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Original Grayscale Image</p>  </div> <div style="text-align: center;"> <p>Final Binary Image (Segmented)</p>  </div> </div>
Parameter	Value								
Threshold Level (Otsu)	0.7529								
Foreground Pixels	424,890								
Background Pixels	623,686								

**Discussion**

The Otsu thresholding method automatically determined the optimal threshold (0.7529) to separate foreground objects from the background. Hole filling ensured complete object regions, while small object removal eliminated noise artifacts, resulting in a clean binary image with 40.52% foreground coverage.

**Task B: Boundary-Based Representation**

Results in table format:	Image Result:																
<table border="1"> <thead> <tr> <th>Object</th><th>Boundary Points</th></tr> </thead> <tbody> <tr> <td>1</td><td>896</td></tr> <tr> <td>2</td><td>1215</td></tr> <tr> <td>3</td><td>1127</td></tr> <tr> <td>4</td><td>1205</td></tr> <tr> <td>5</td><td>1164</td></tr> <tr> <td>6</td><td>952</td></tr> <tr> <td>7</td><td>831</td></tr> </tbody> </table>	Object	Boundary Points	1	896	2	1215	3	1127	4	1205	5	1164	6	952	7	831	<p style="text-align: center;">Boundaries Superimposed on Binary Image (7 objects detected)</p> 
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**Discussion**

The *bwboundaries* function successfully traced the perimeter of 7 segmented objects. Object 2 had the longest boundary with 1215 points, while Object 7 had the shortest with 831 points.

### Task C: Region-Based Descriptors

Results in table format:					Image Result:																																								
<table border="1"> <thead> <tr> <th>Object</th><th>Area</th><th>Perimeter</th><th>Eccentricity</th><th>Compactness</th></tr> </thead> <tbody> <tr><td>1</td><td>62,291</td><td>991.21</td><td>0.5711</td><td>15.77</td></tr> <tr><td>2</td><td>63,691</td><td>1362.35</td><td>0.3104</td><td>29.14</td></tr> <tr><td>3</td><td>77,132</td><td>1146.04</td><td>0.2461</td><td>17.03</td></tr> <tr><td>4</td><td>53,090</td><td>1345.06</td><td>0.1436</td><td>34.08</td></tr> <tr><td>5</td><td>51,088</td><td>1200.49</td><td>0.8627</td><td>28.21</td></tr> <tr><td>6</td><td>79,907</td><td>1055.03</td><td>0.1700</td><td>13.93</td></tr> <tr><td>7</td><td>37,691</td><td>911.76</td><td>0.3714</td><td>22.06</td></tr> </tbody> </table>					Object	Area	Perimeter	Eccentricity	Compactness	1	62,291	991.21	0.5711	15.77	2	63,691	1362.35	0.3104	29.14	3	77,132	1146.04	0.2461	17.03	4	53,090	1345.06	0.1436	34.08	5	51,088	1200.49	0.8627	28.21	6	79,907	1055.03	0.1700	13.93	7	37,691	911.76	0.3714	22.06	<p style="text-align: center;">Objects Labeled with Region Numbers</p>
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### Discussion

Object 6 is the largest (Area: 79,907) and most circular (Compactness: 13.93, closest to 12.57). Object 5 is the most elongated (Eccentricity: 0.8627). Object 4 has the most complex shape (Compactness: 34.08).

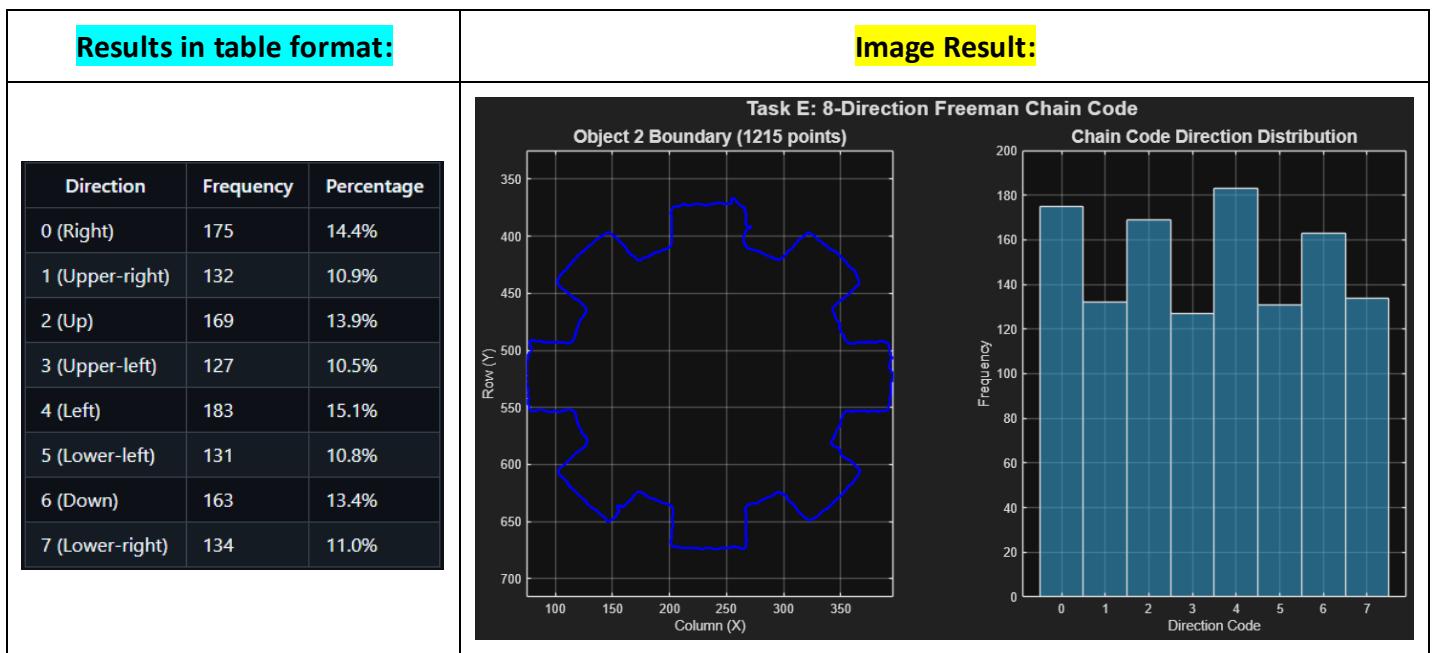
### Task D: Topological Descriptors

Results in table format:		Image Result:							
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Descriptor	Value								
Connected Components (C)	7								
Euler Number (E)	7								
Number of Holes (H)	0								

### Discussion

The image contains 7 distinct objects with no internal holes, resulting in an Euler number of 7. This confirms the segmentation process successfully filled any potential holes within the objects.

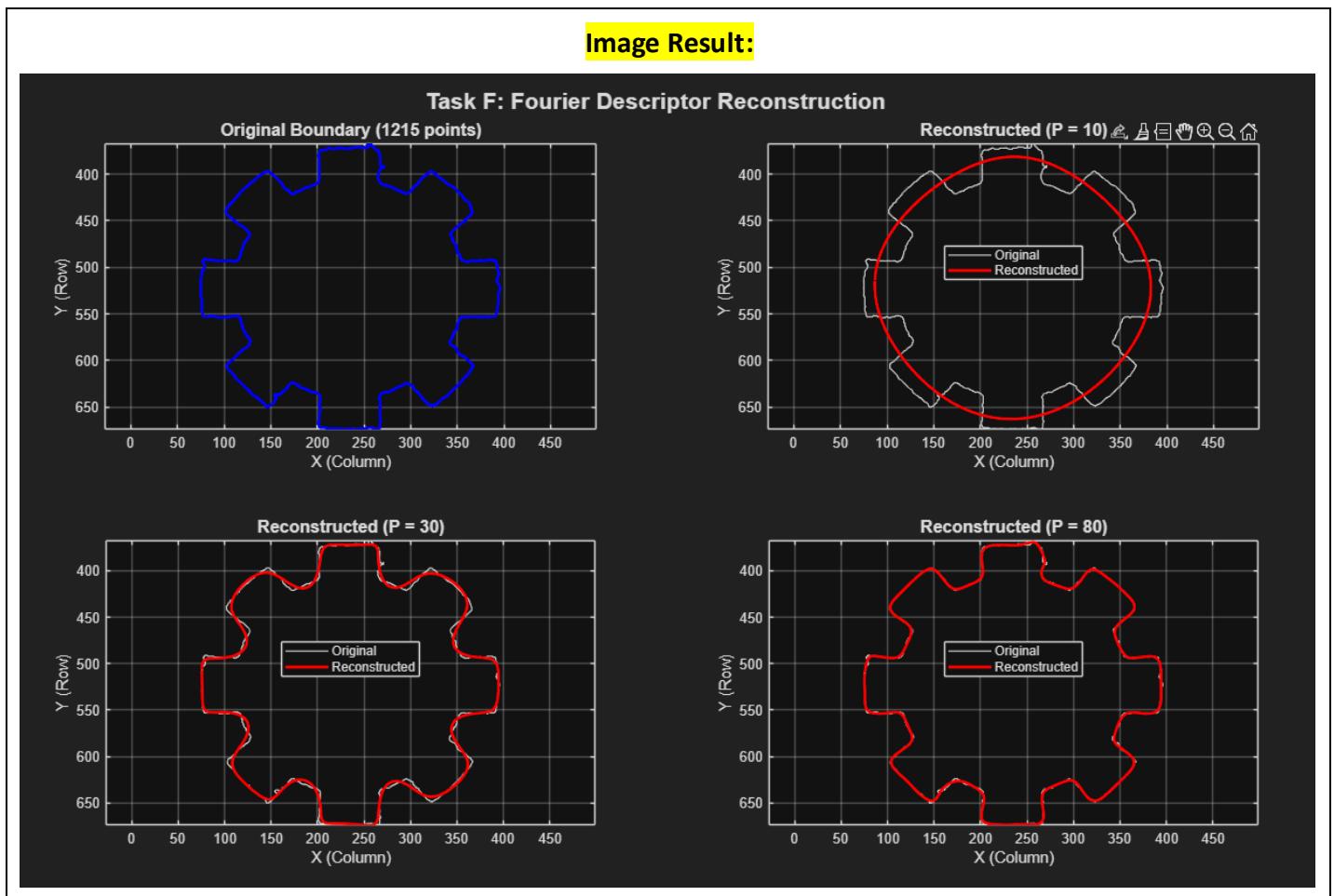
## Task E: Chain Code Representation



### Discussion

Chain code for Object 2 shows relatively balanced distribution of directions, with 'Left' (Direction 4) being slightly more frequent (15.1%). This suggests the object boundary is fairly regular without extreme directional bias.

## Task F: Fourier Descriptors



Results in table format:		Coefficients (P)	Mean Error	Max Error
		10	13.96	24.05
		30	2.54	6.76
		80	0.86	2.95

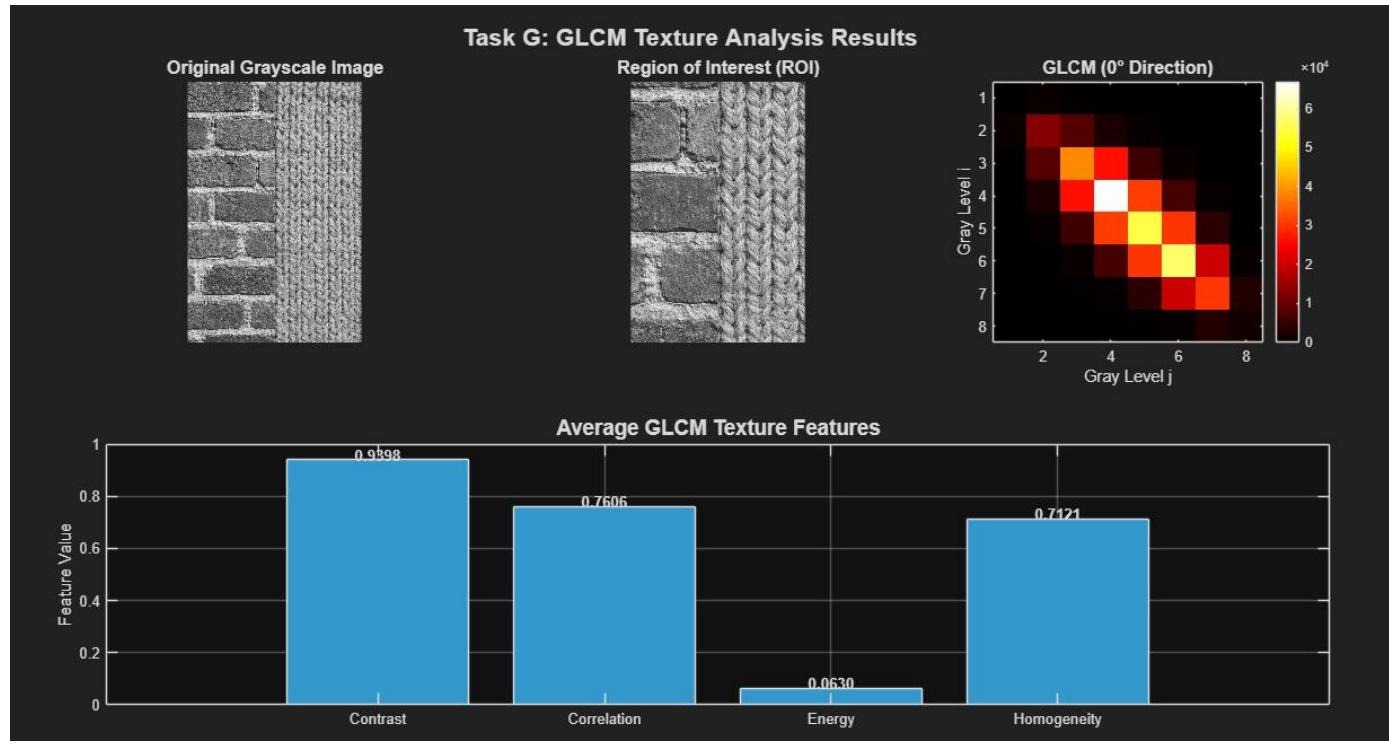
## Discussion

As the number of coefficients (P) increases, the reconstruction error decreases significantly. P=10 gives a rough approximation, while P=80 provides a highly accurate reconstruction (Mean Error < 1 pixel), demonstrating that the shape's essential information is concentrated in the lower-frequency coefficients.

## Task G: Texture Description (GLCM)

Results in table format:	Feature	Value	Interpretation
	Contrast	0.9398	Moderate local intensity variation
	Correlation	0.7606	High linear dependency between pixels
	Energy	0.0630	Low uniformity (heterogeneous texture)
	Homogeneity	0.7121	Relatively smooth texture

## Image Result:



## Discussion

The texture analysis reveals a heterogeneous texture (low Energy) with moderate contrast. The high correlation (0.76) and homogeneity (0.71) suggest the texture has a repetitive pattern with gradual transitions, consistent with the visual appearance of the brick/fabric texture.