

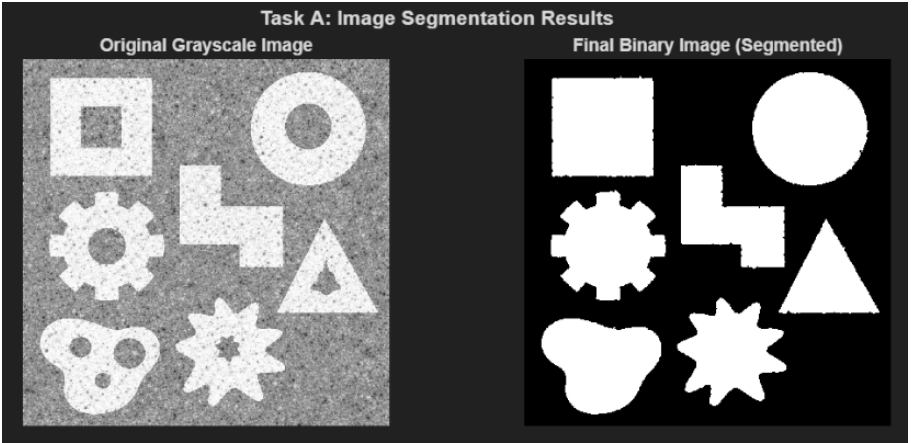
LAB 9

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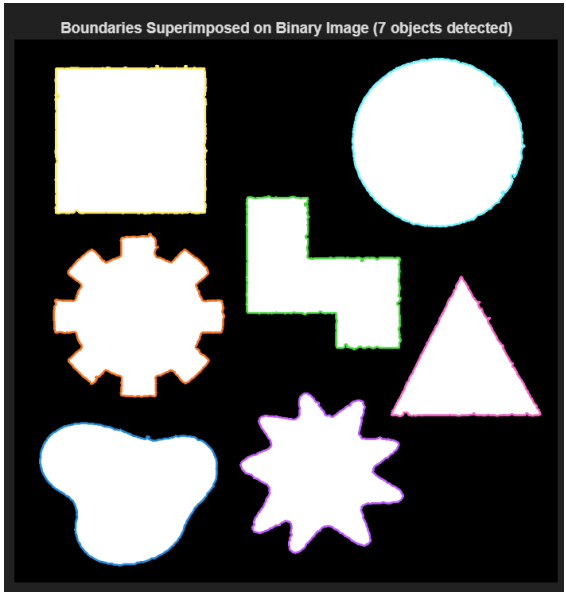
Image Representation & Description (MATLAB)**Task A: Image Segmentation**

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	
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	
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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.

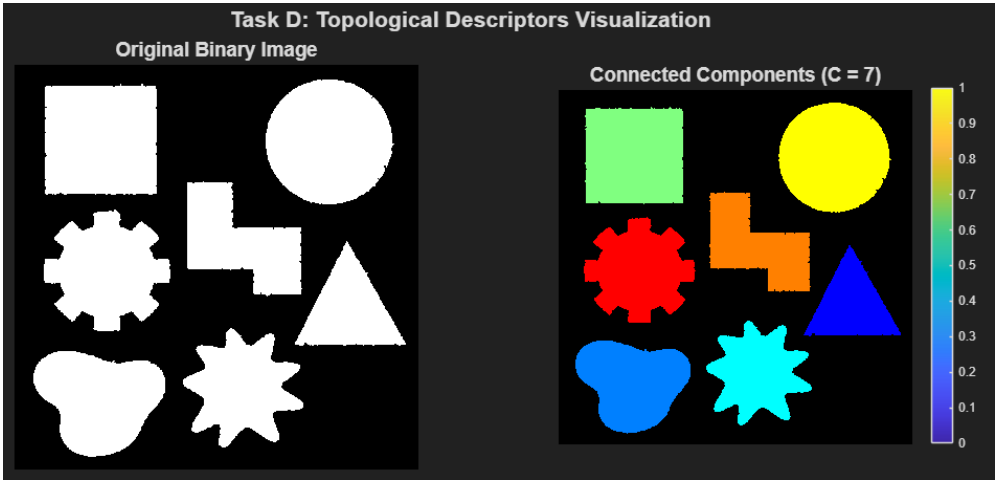
Task C: Region-Based Descriptors

Results in table format:				
				</

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:								
<table><tr><th>Descriptor</th><th>Value</th></tr><tr><td>Connected Components (C)</td><td>7</td></tr><tr><td>Euler Number (E)</td><td>7</td></tr><tr><td>Number of Holes (H)</td><td>0</td></tr></table> <p>Connected Components = Number of separate objects</p> <p>Euler Number = Topological invariant</p> <p>Number of Holes (H) = Enclosed background regions</p>	Descriptor	Value	Connected Components (C)	7	Euler Number (E)	7	Number of Holes (H)	0	 <p>The image displays two side-by-side visualizations. The left visualization, titled 'Original Binary Image', shows the same seven white shapes on a black background as in Task C. The right visualization, titled 'Connected Components (C = 7)', shows the same shapes colored differently to represent their connectivity. A color bar on the right indicates values from 0 to 1. The shapes are colored: 1. Blue, 2. Red, 3. Green, 4. Cyan, 5. Orange, 6. Yellow, 7. Dark Blue.</p>
Descriptor	Value								
Connected Components (C)	7								
Euler Number (E)	7								
Number of Holes (H)	0								

Discussion

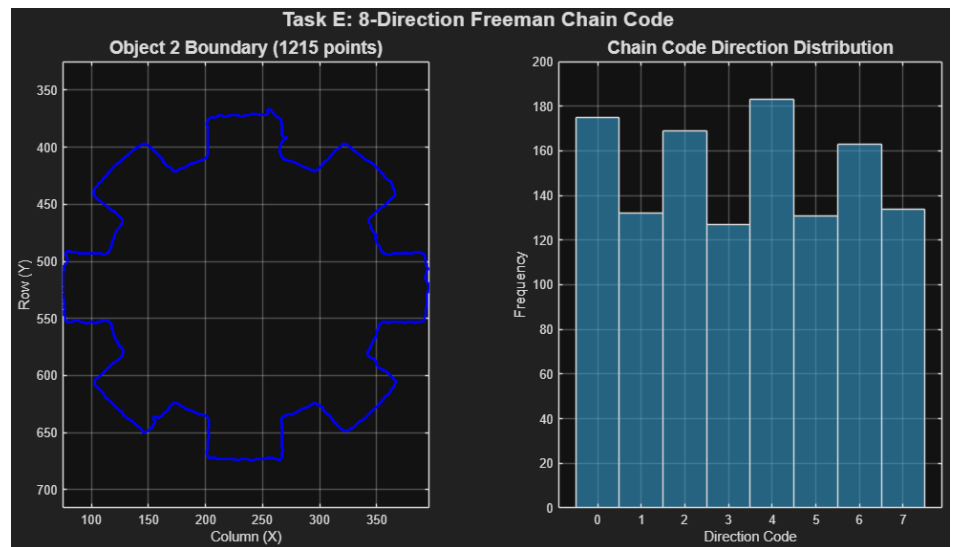
The image contains 7 distinct objects with no internal holes, resulting in an Euler number of 7. This confirms the segmentation process successfully filled any potential holes within the objects.

Task E: Chain Code Representation

Results in table format:

Direction	Frequency	Percentage
0 (Right)	175	14.4%
1 (Upper-right)	132	10.9%
2 (Up)	169	13.9%
3 (Upper-left)	127	10.5%
4 (Left)	183	15.1%
5 (Lower-left)	131	10.8%
6 (Down)	163	13.4%
7 (Lower-right)	134	11.0%

Image Result:

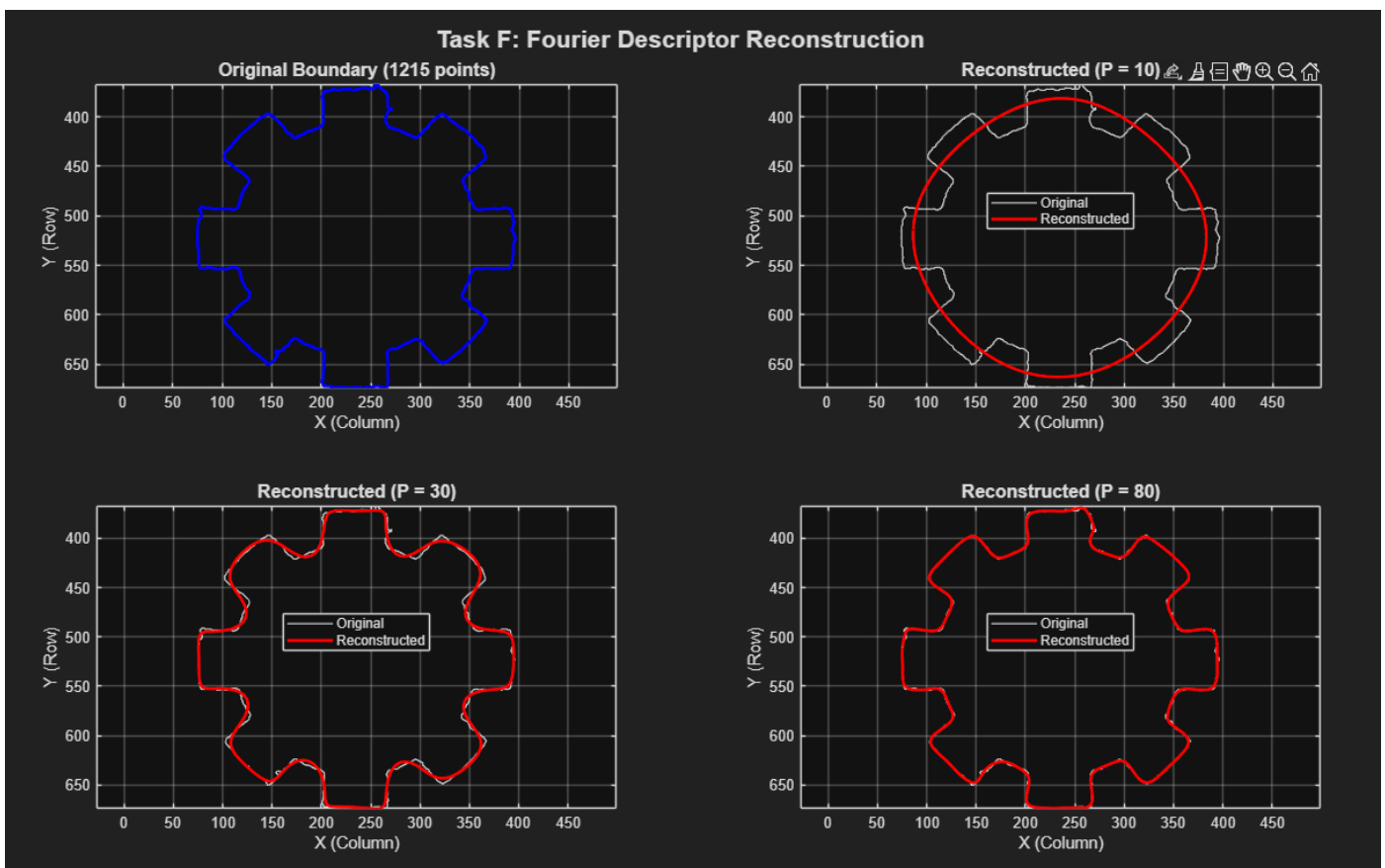


Discussion

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

Image Result:



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

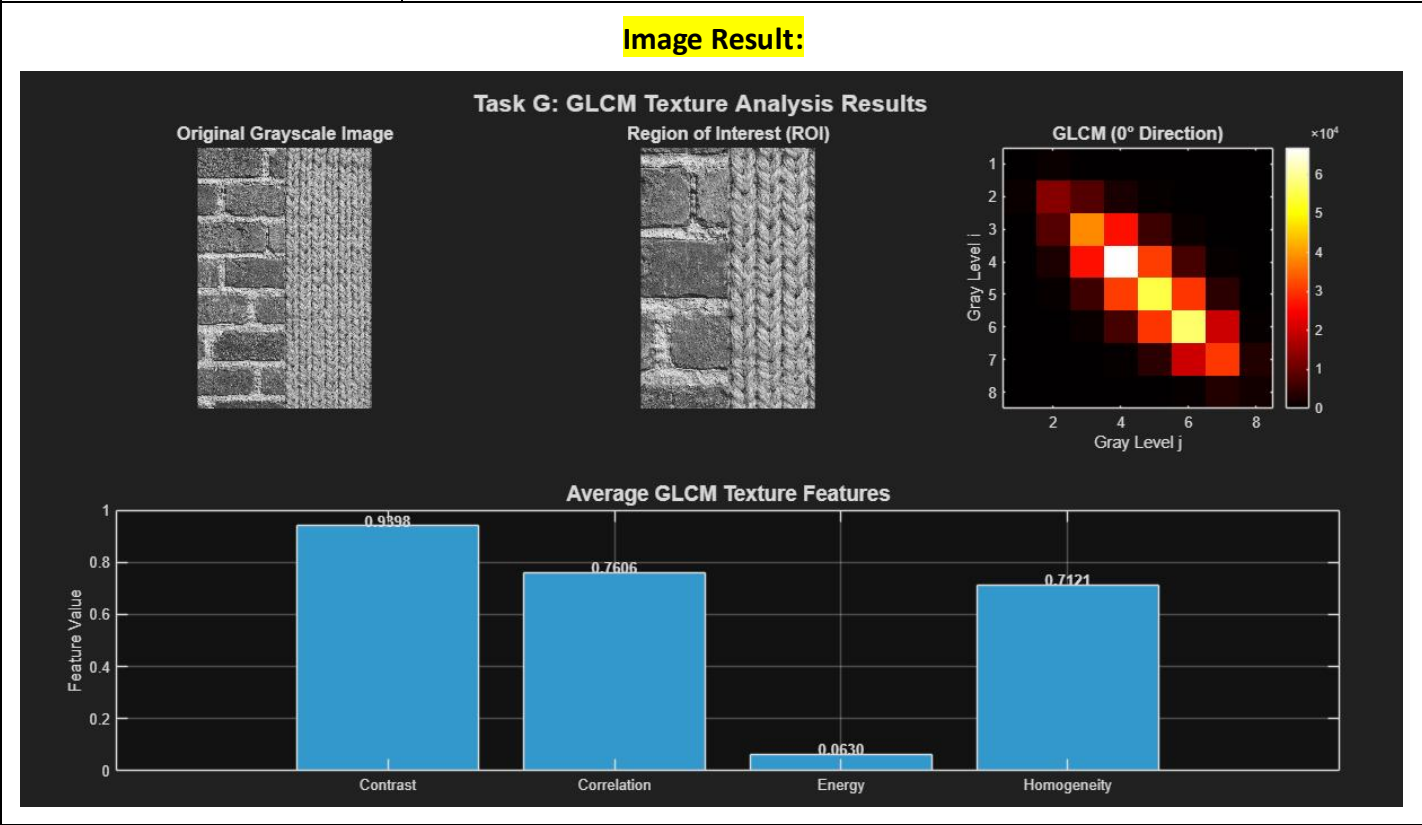
Discussion

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.