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How to run: python solution.py

Task 1:
Problem1Solver computes all the required items and draw several images. As it is asked, I am showing outputs for two images (00000048.png, 00000173.png).

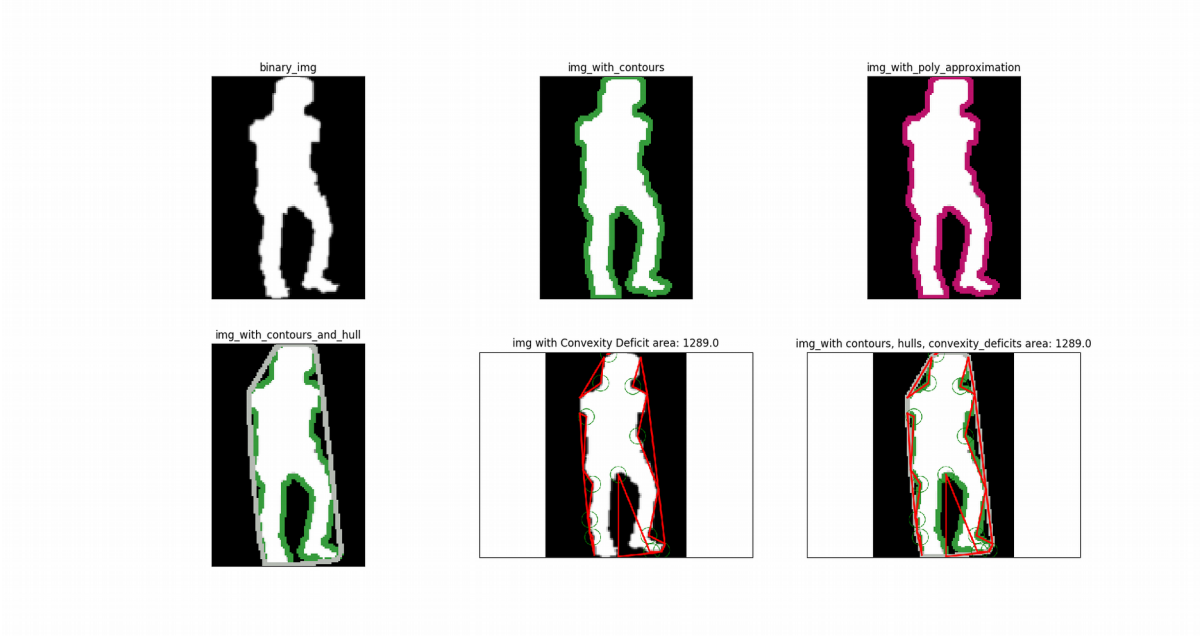

Illustration 1: Computed Features for 00000048.png

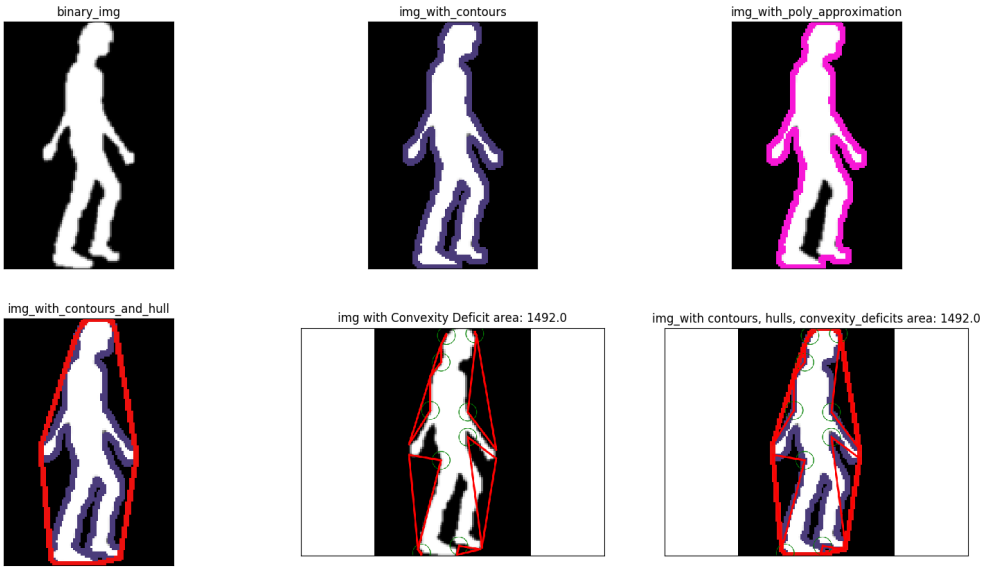

Illustration 2: Computed features for 00000173.png

For 1st image: 00000048.png
original_area=3912.0, original_perimeter=471.9
hull_area=5283.0, hull_perimeter=318.1
Moments for Original image:
 m00=3912.0, m10=175698.8, m01=245946.2, m20=8462461.2, m11=11257972.5, m02=20044319.5
Moments for Convex hulls:
 m00=5283.0, m10=243768.0, m01=355255.2, m20=12104704.8, m11=16779098.8, m02=30213544.0

For 2nd image: 00000173.png
original_area=3141.0, original_perimeter=427.4
hull_area=4734.0, hull_perimeter=304.0
Moments for Original image:
 m00=3141.0, m10=136383.5, m01=219155.2, m20=6174798.7, m11=9438432.7, m02=19120732.0
Moments for Convex hulls:
 m00=4734.0, m10=207666.0, m01=327103.5, m20=9767028.8, m11=14105829.9, m02=27723658.8

Task 2:
Computed features for 10 images:

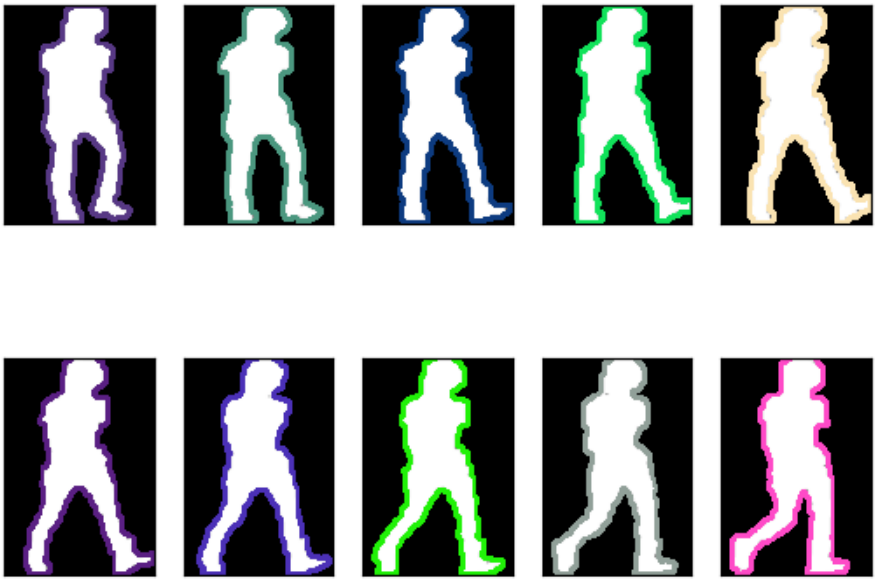

Illustration 3: Computed contours for 10 images

Illustration 4: Polygonal approximation for 10 images

Illustration 4: Computed convex hulls for 10 images

Illustration 5: Computed convexity deficits with areas

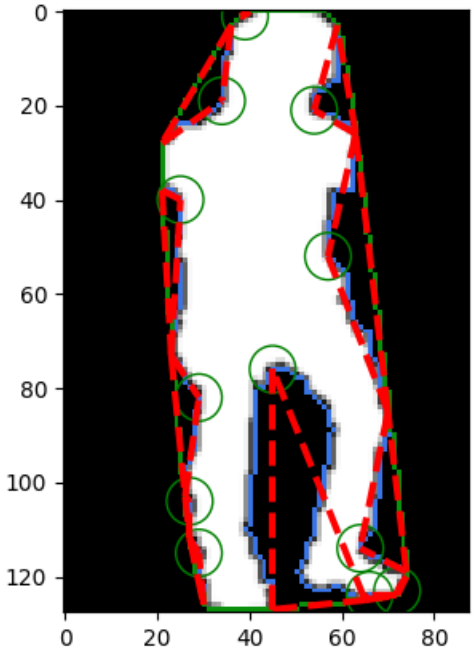

Illustration 6: Sample Convexity deficits for 00000048.png

Task 3:

To solve this problem, I have used window size from 3 to 11. Output for each window size consists of four images:

1. Boundaries
2. Curvatures in respect with x and y coordinate values
3. Curvature hot map
4. Given image with curvature hot map

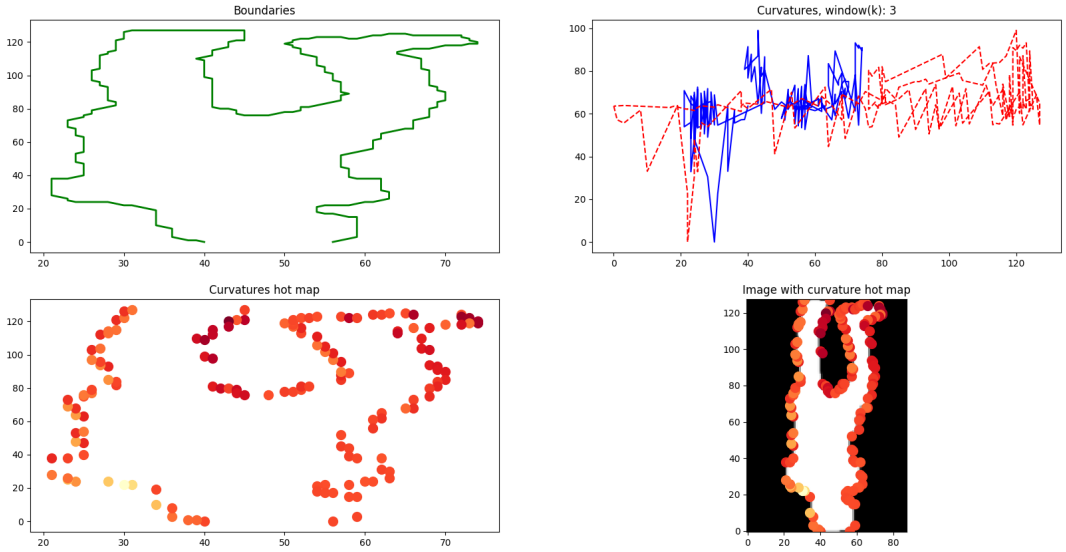

Illustration 7: Window size: 3

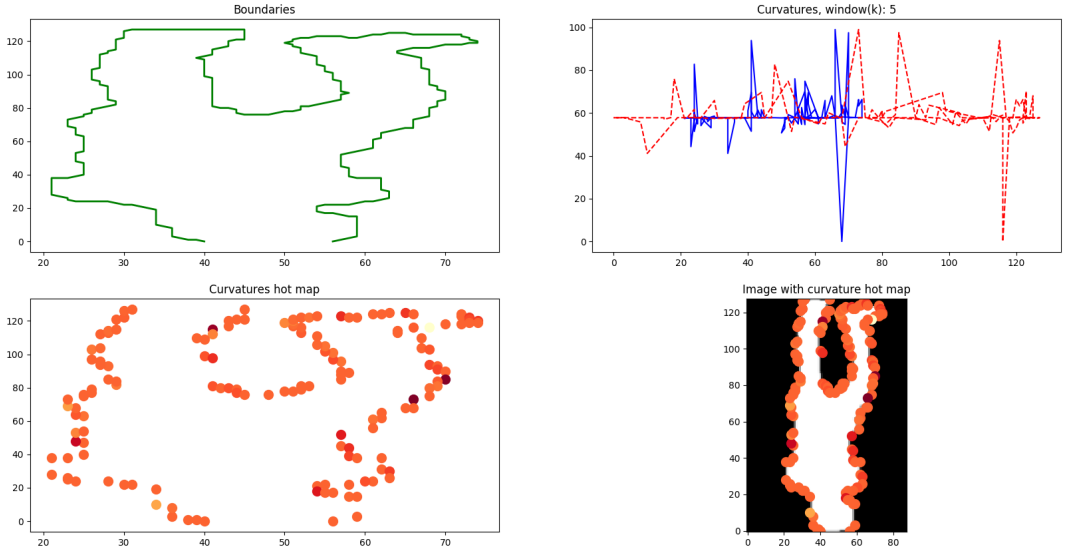

Illustration 8: Window size: 5

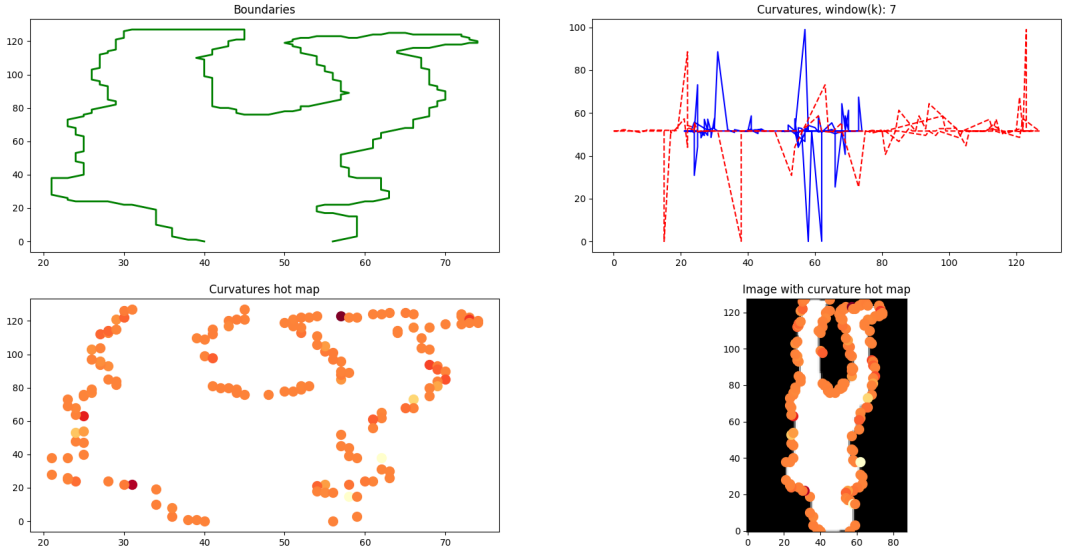

Illustration 9: Window size: 7

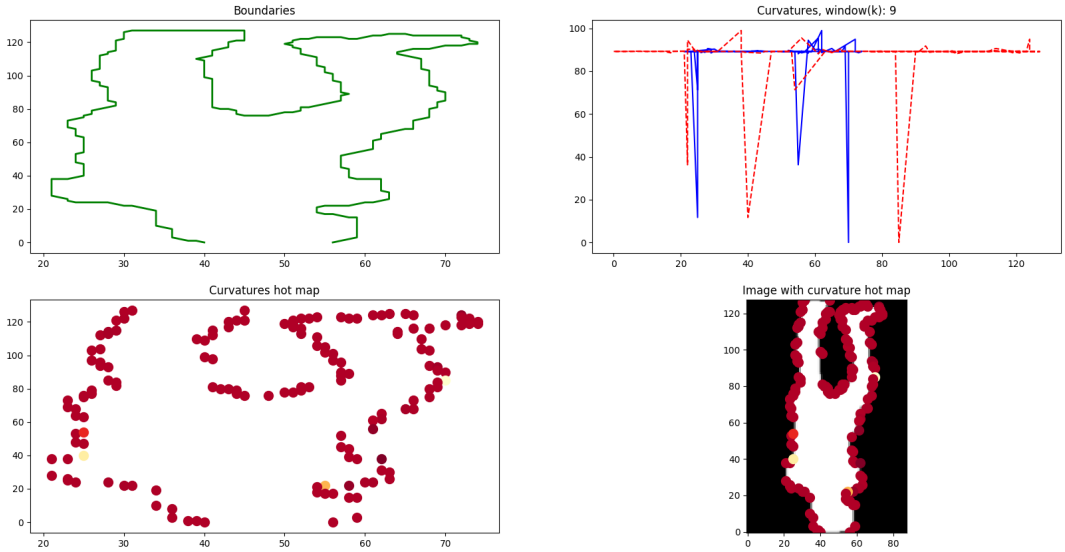

Illustration 10: Window size: 9

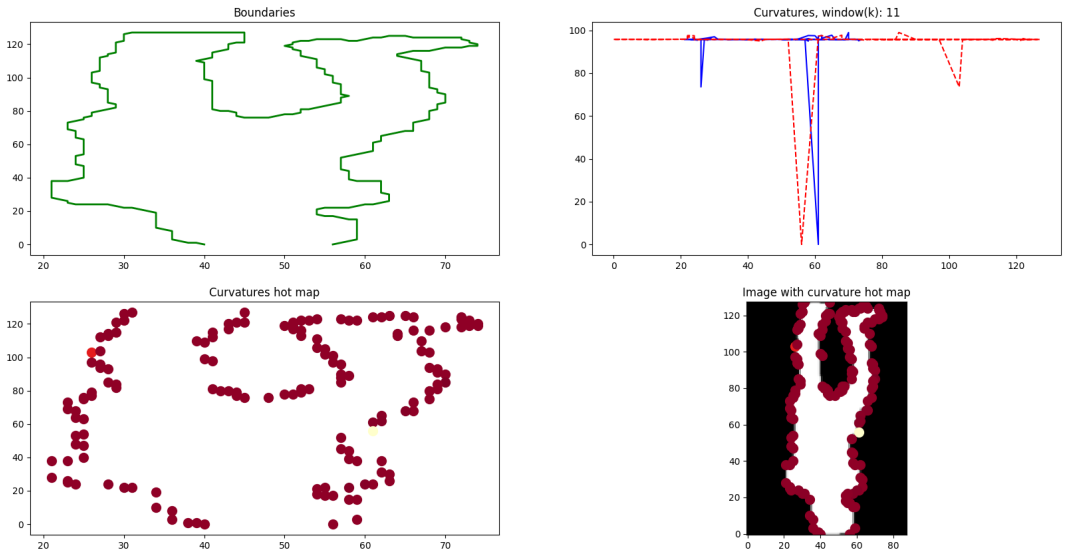

Illustration 11: Window size: 11

Task 4:

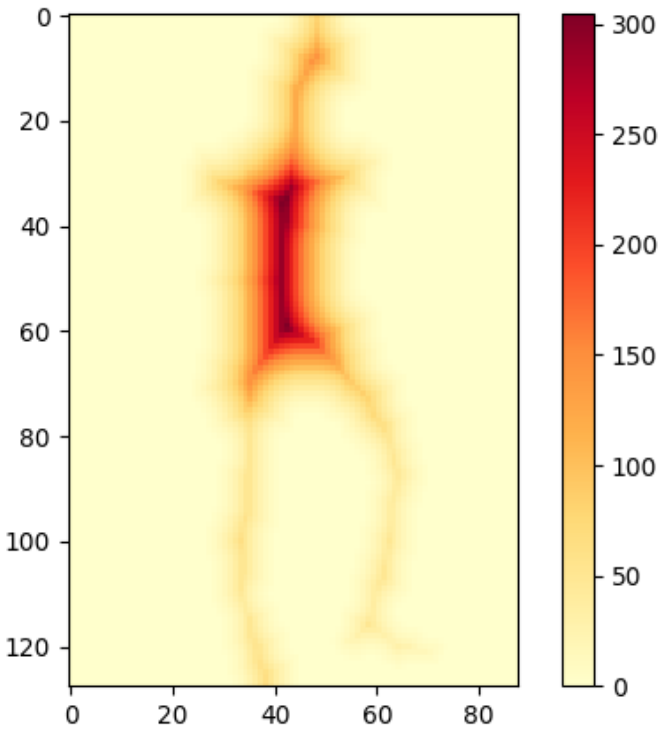

Illustration 12: Distance transformation for 00000048.png

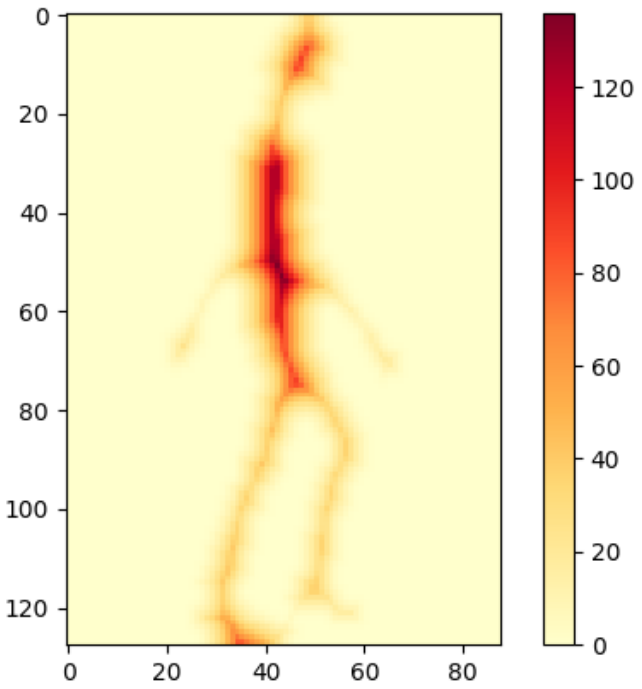

Illustration 13: Distance transformation for 00000173.png

Task 5: chamfer matching

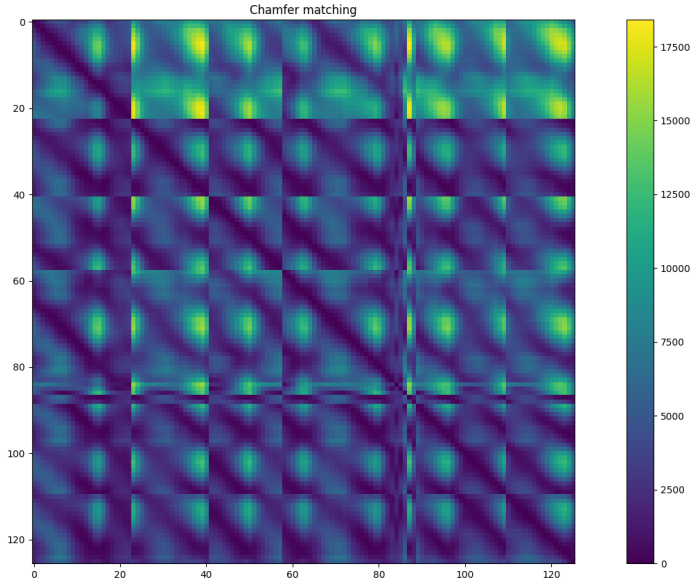

Illustration 14: Chamfer mathing

Task 6:

From chamfer matching and convexity deficits images we can see that there is a periodicity. The curvature shows where the high and low curvature exists. And the possible joints are circled in *Illustration 7*. We can result convexity deficits far point as joint point. From this point we can segment the image using nearest neighbor or recursive labeling algorithms.