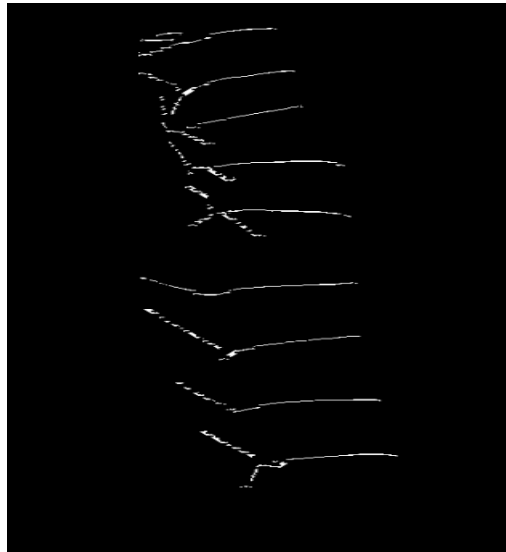


Assignment 1

Approach

No of Sutures – I have found out the skeleton of the sutures using thinning. This procedure erodes away the boundaries of foreground objects as much as possible but does not affect pixels at the ends of lines. The resulting image produced is shown below. It has just preserved the structure of the stitch and removed everything else. I used a 3*3 rectangle structuring element for this.



Dilating – After this I dilated the output, so that the gaps left in the image are filled. I used a 3*3 ellipse kernel for this.

Structuring Element

We manually created a structuring elements in the previous example. So for this purpose, OpenCV has elliptical/circular shaped kernels. So for this purpose, OpenCV has kernel, you get the desired kernel.

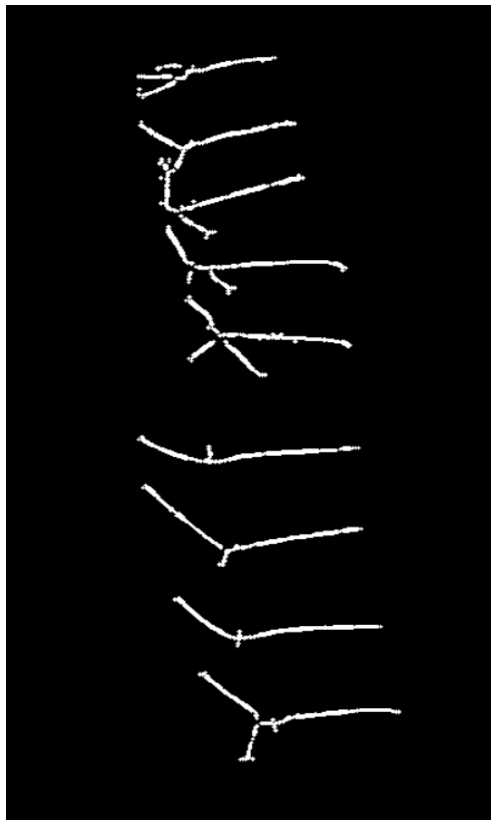
```
# Rectangular Kernel
>>> cv.getStructuringElement(cv.MORPH_RECT,(5,5))
array([[1, 1, 1, 1, 1],
       [1, 1, 1, 1, 1],
       [1, 1, 1, 1, 1],
       [1, 1, 1, 1, 1],
       [1, 1, 1, 1, 1]], dtype=uint8)

# Elliptical Kernel
>>> cv.getStructuringElement(cv.MORPH_ELLIPSE,(5,5))
array([[0, 0, 1, 0, 0],
       [1, 1, 1, 1, 1],
       [1, 1, 1, 1, 1],
       [1, 1, 1, 1, 1],
       [0, 0, 1, 0, 0]], dtype=uint8)

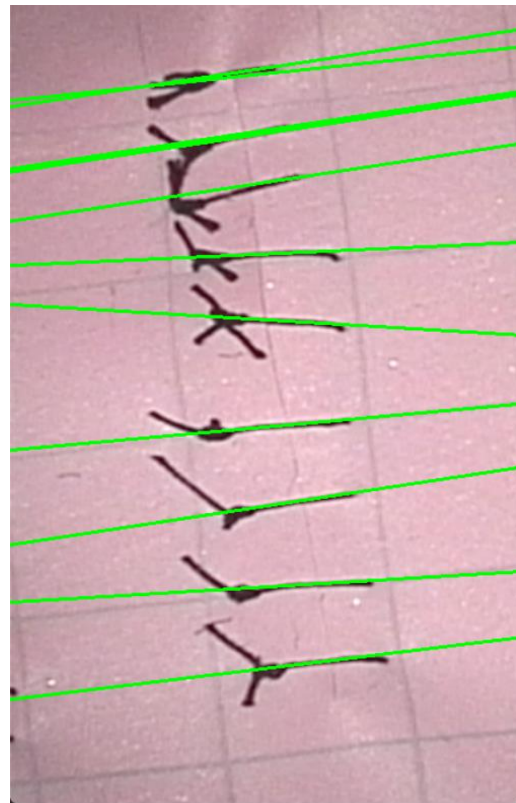
# Cross-shaped Kernel
>>> cv.getStructuringElement(cv.MORPH_CROSS,(5,5))
array([[0, 0, 1, 0, 0],
       [0, 0, 1, 0, 0],
       [1, 1, 1, 1, 1],
       [0, 0, 1, 0, 0],
       [0, 0, 1, 0, 0]], dtype=uint8)
```

Hough Transform – As the problem was to find no of sutures, distance between sutures and angle between sutures. I used a restricted Hough transform on angle range of 80 – 100 degrees. This filter was applied in the algorithm itself which increased its speed as well. In the AIMS dataset mostly, sutures were 1-2 pixel wide and minimum length of suture was not less than 35 pixels. I took a 7-pixel threshold among sutures of their average y values distance, so two lines with avg y value less than 7 pixels were not included together. I also had a filter to include at least 38 points accumulated in Hough transform to further filter the lines formed on image points which were not actually sutures.

Results were as shown in image below.



Dilated skeleton image



After Hough Transform

Calculations

No of sutures – No. of lines Hough transform detects.

Inter suture distance - Difference between average y values of lines found through Hough transform.

Angle among sutures – Since polar coordinates give angle between perpendicular line on the nearest point on suture. I calculated 90-Angle.