

# **Exercise: Morphological operations**

**Image Processing & Analysis for Life Scientists**

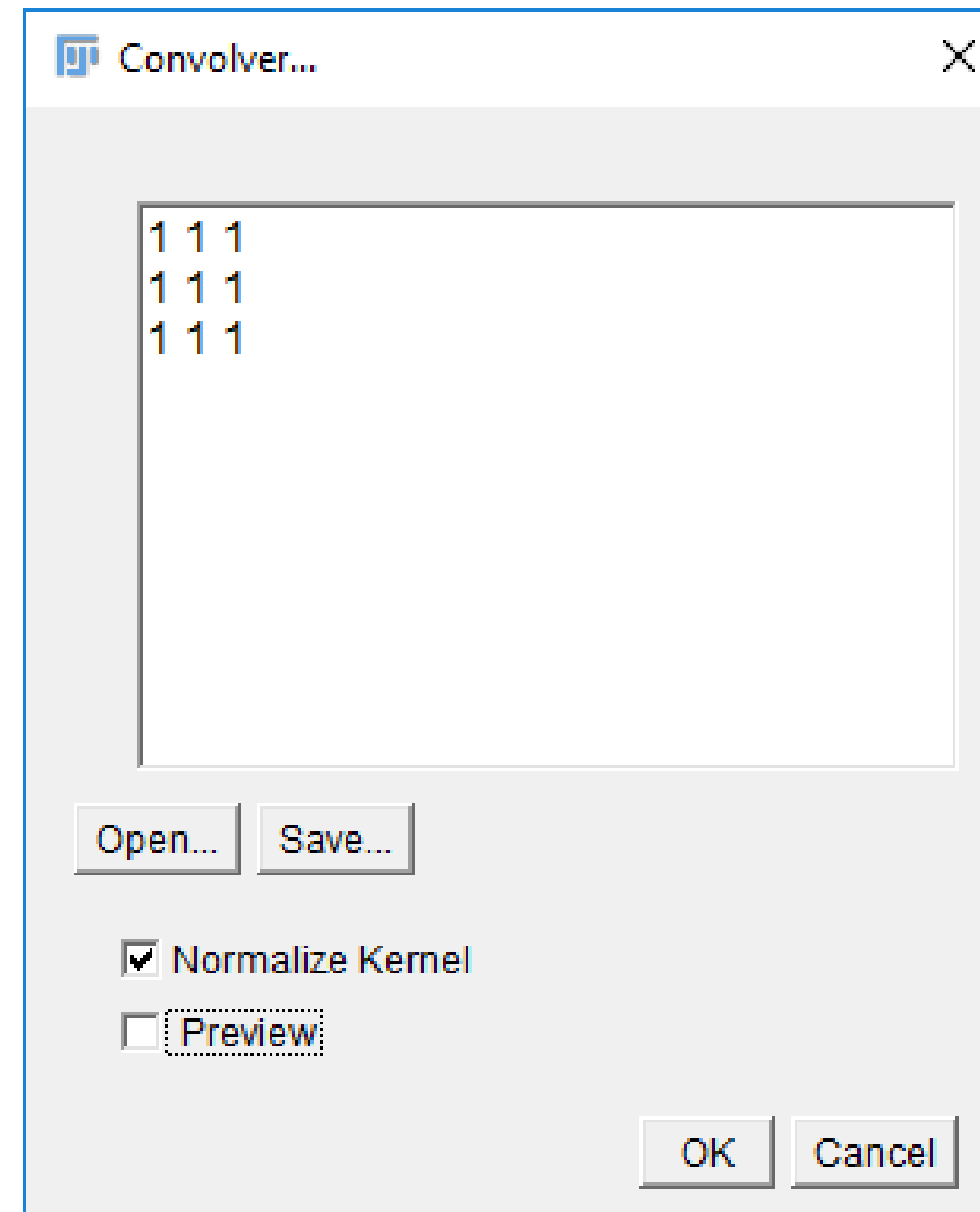
Olivier Burri, Romain Guiet & Arne Seitz

# Spatial Filtering: Convolution

1. Open *neuron\_bit.tif*  
Zoom in till you see pixels
2. Launch  
***Process → Filter → Convolve***  
Match the kernel to the  
examples and use 'preview'

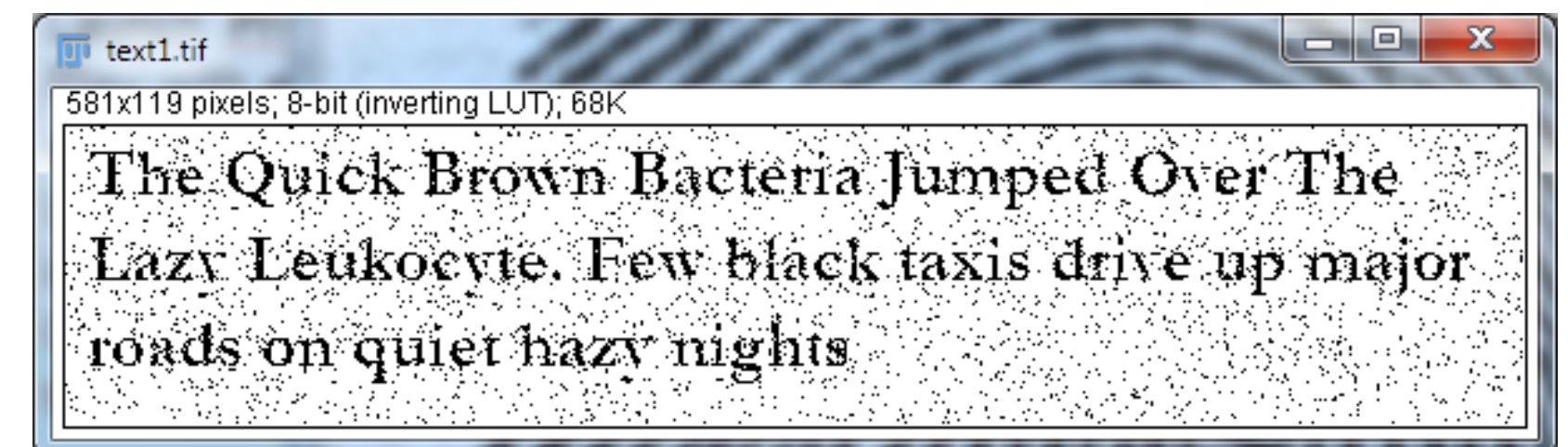
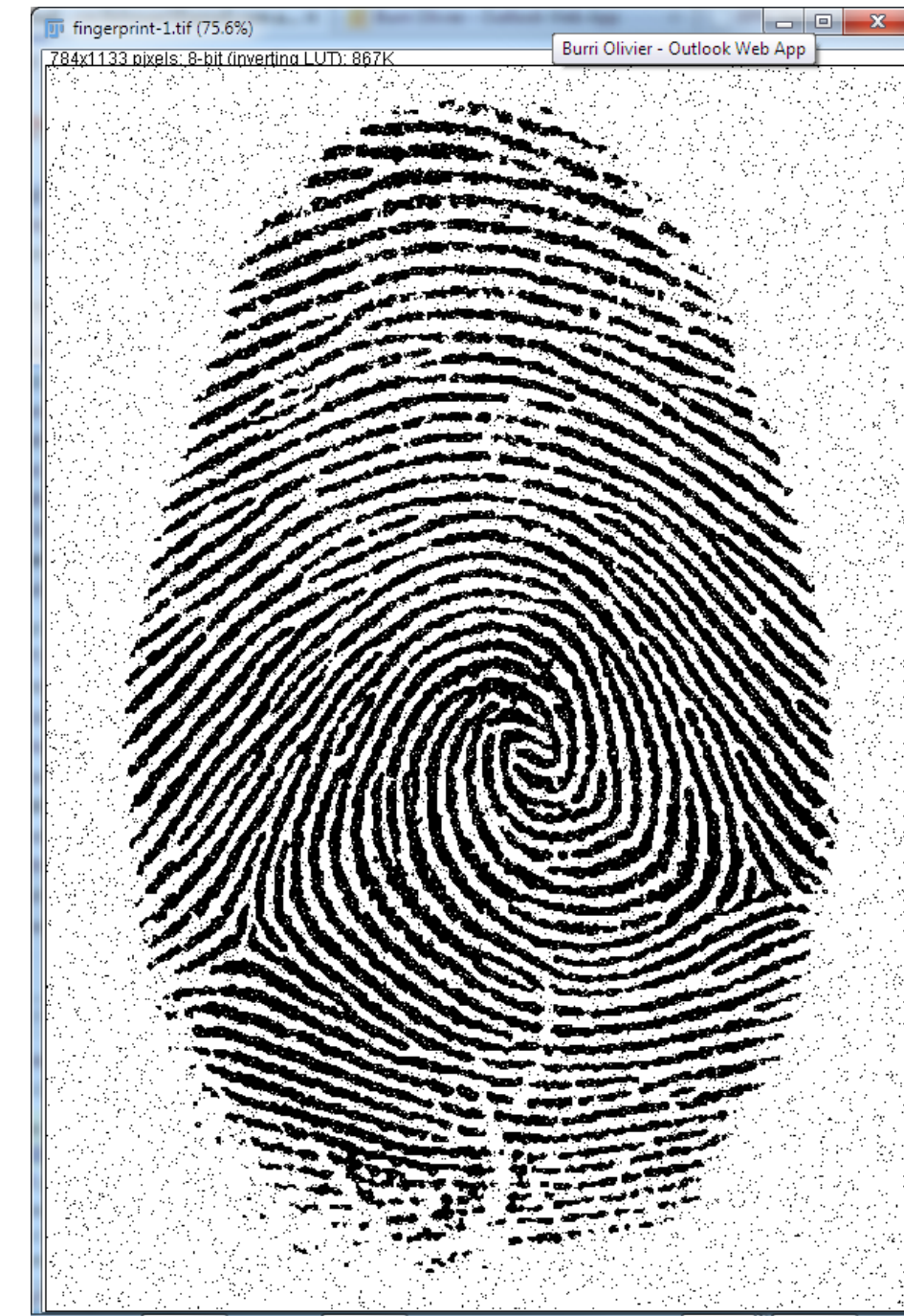
3x3

1	1	1
1	1	1
1	1	1



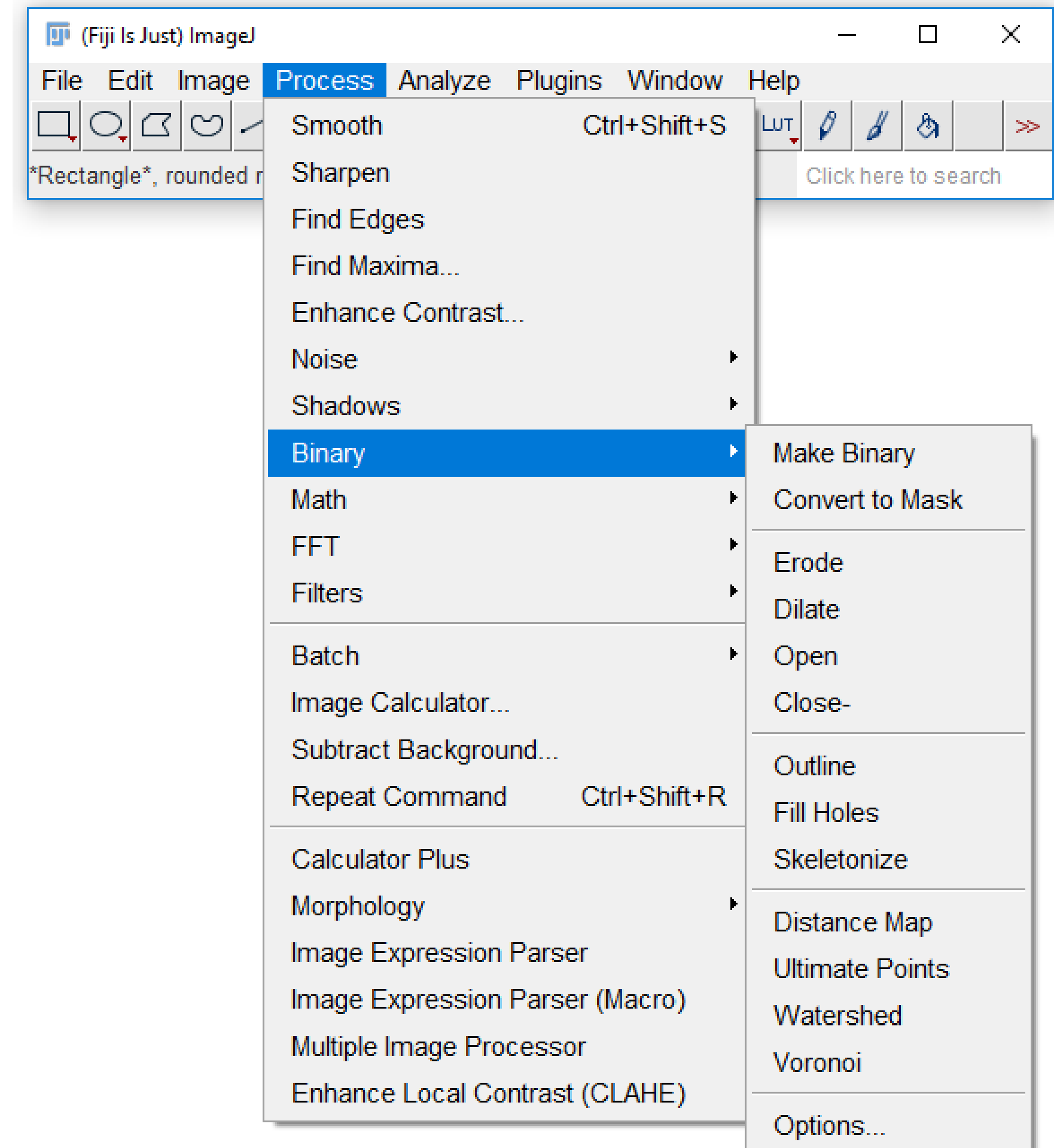
# Morphological Operations

1. Open *fingerprint.tif* and *text1.tif*
2. Launch **Process** → **Binary** → **Options**  
Play with **erosion** and **dilation** operations with different iterations using 'preview'
3. Use **openings** and **closings** on the image to see how they affect it.
4. Can you find the best parameters to recover the text?



# Fill Holes, Skeletonize, Outline

1. Open fingerprint.tif, text1.tif and text2.tif
2. Use openings and closings to remove unwanted artifacts if any.
3. Use Outline, Fill Holes and Skeletonize on the images and see the results

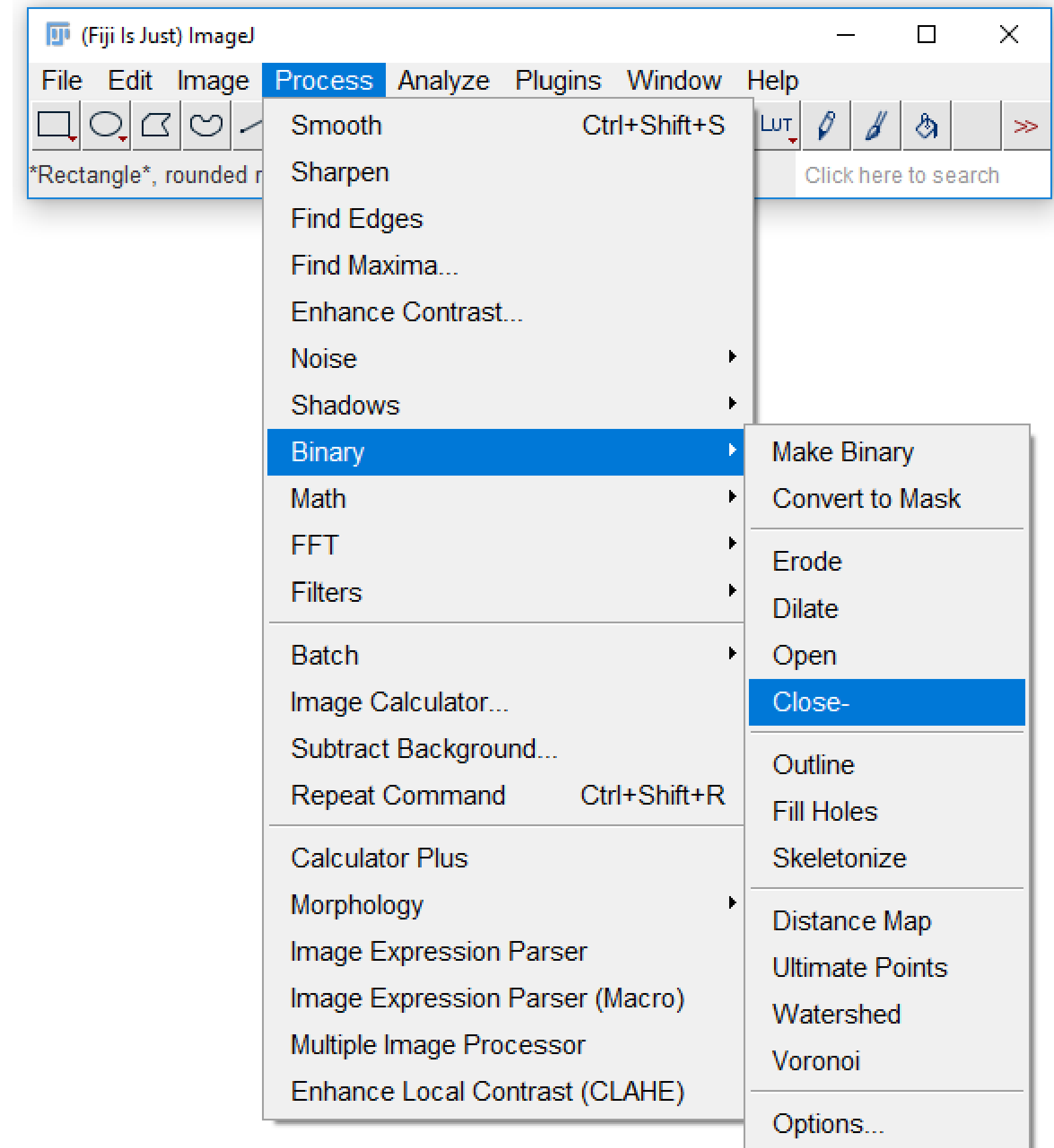


# Fill Holes, Skeletonize, Outline

1. Open fingerprint.tif, text1.tif and text2.tif
2. Use openings and closings to remove unwanted artifacts if any.
3. Use Outline, Fill Holes and Skeletonize on the images and see the results

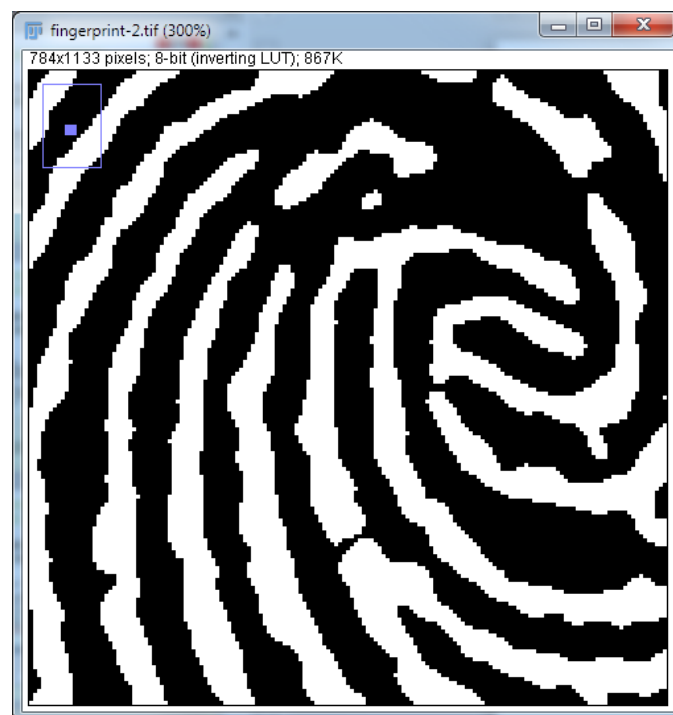


Closing  
Iterations: 3  
Count: 3

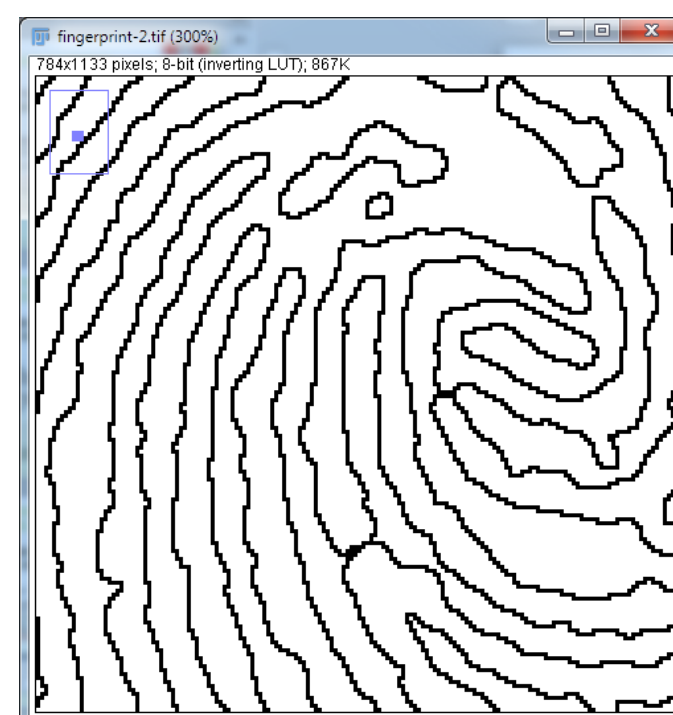


# Fill Holes, Skeletonize, Outline

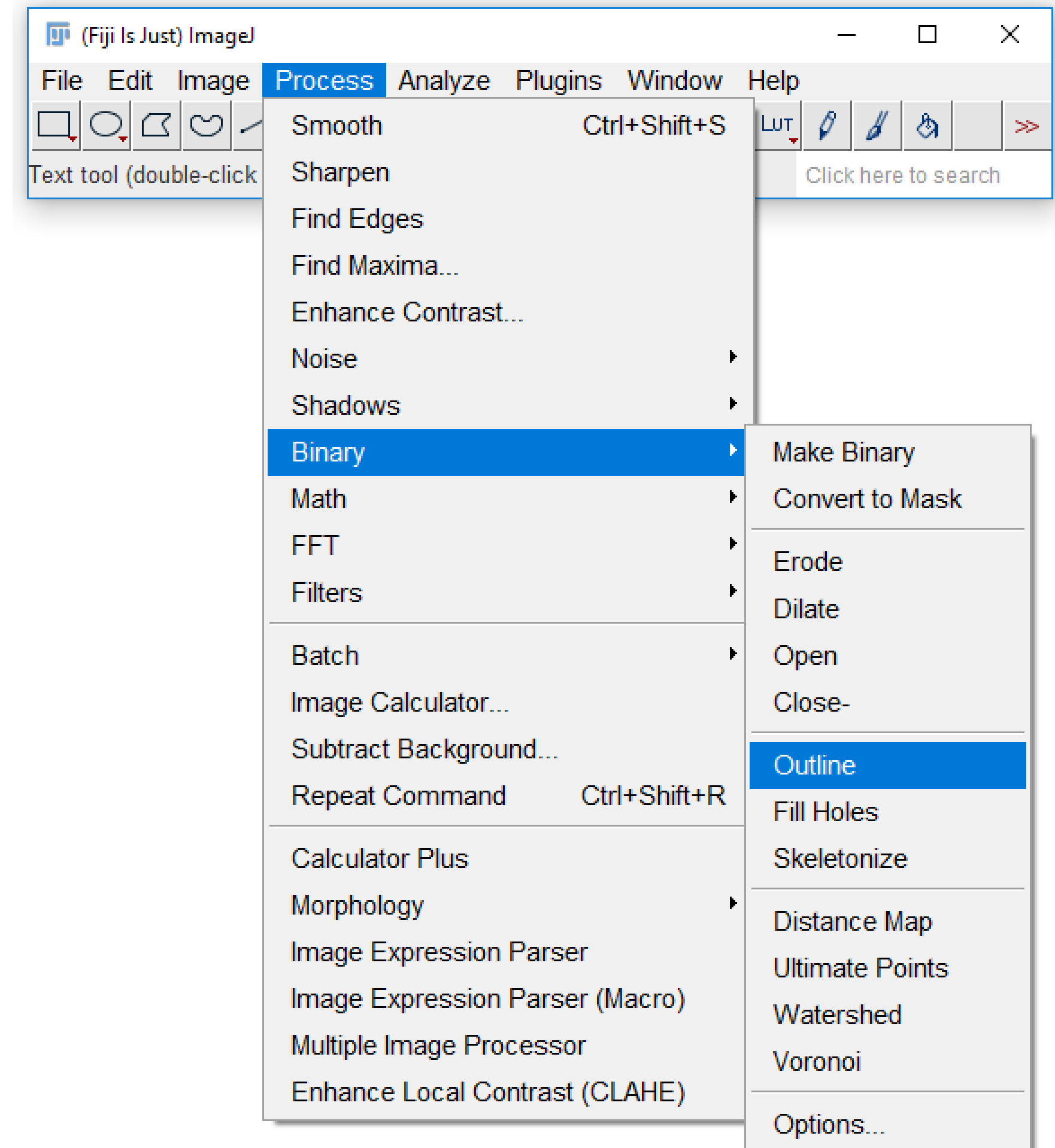
1. Open fingerprint.tif, text1.tif and text2.tif
2. Use openings and closings to remove unwanted artifacts if any.
3. Use Outline, Fill Holes and Skeletonize on the images and see the results



Closing  
Iterations: 2  
Count: 3



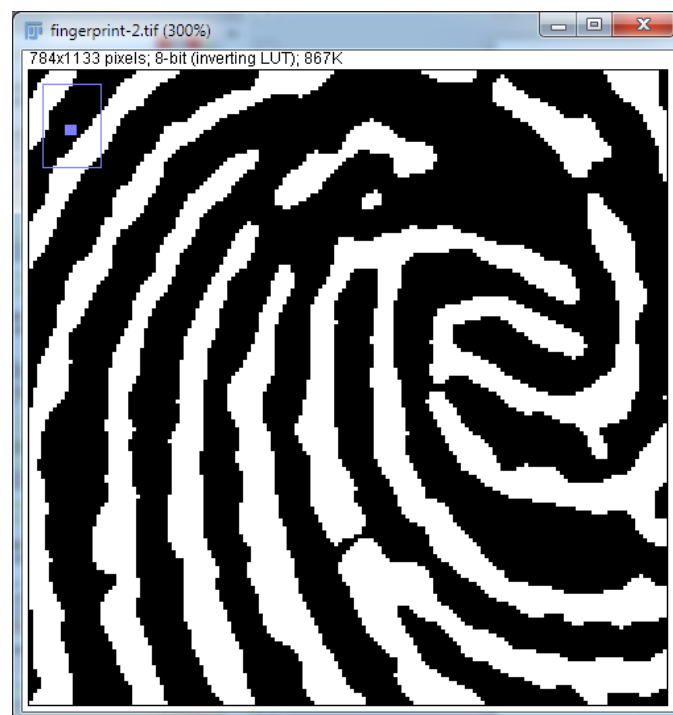
Outlines



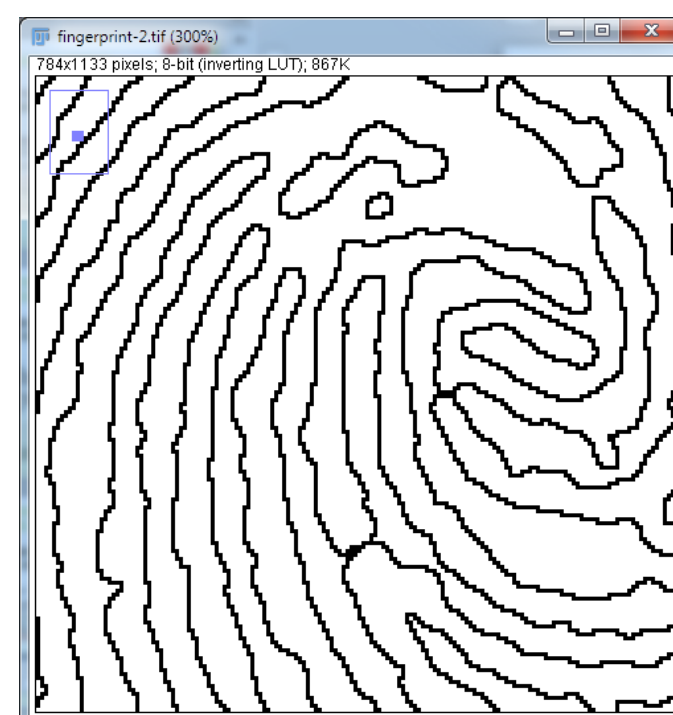


# Fill Holes, Skeletonize, Outline

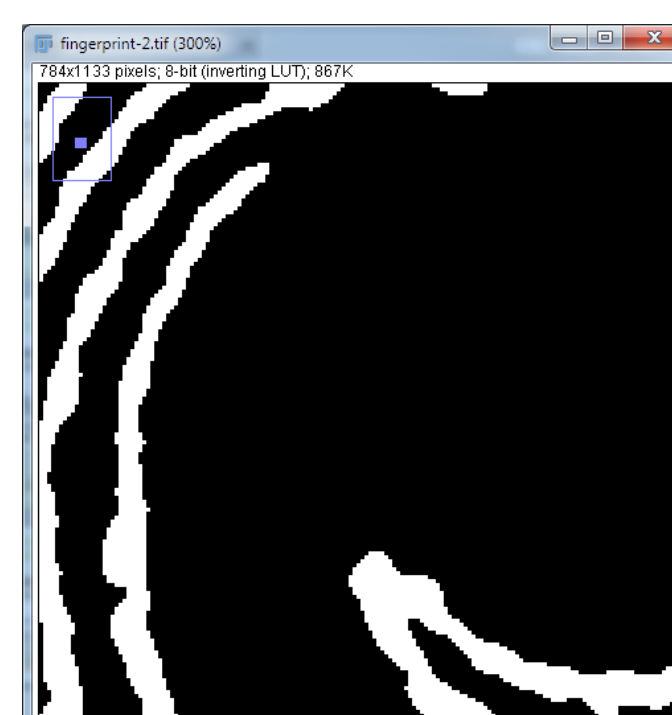
1. Open fingerprint.tif, text1.tif and text2.tif
2. Use openings and closings to remove unwanted artifacts if any.
3. Use Outline, Fill Holes and Skeletonize on the images and see the results



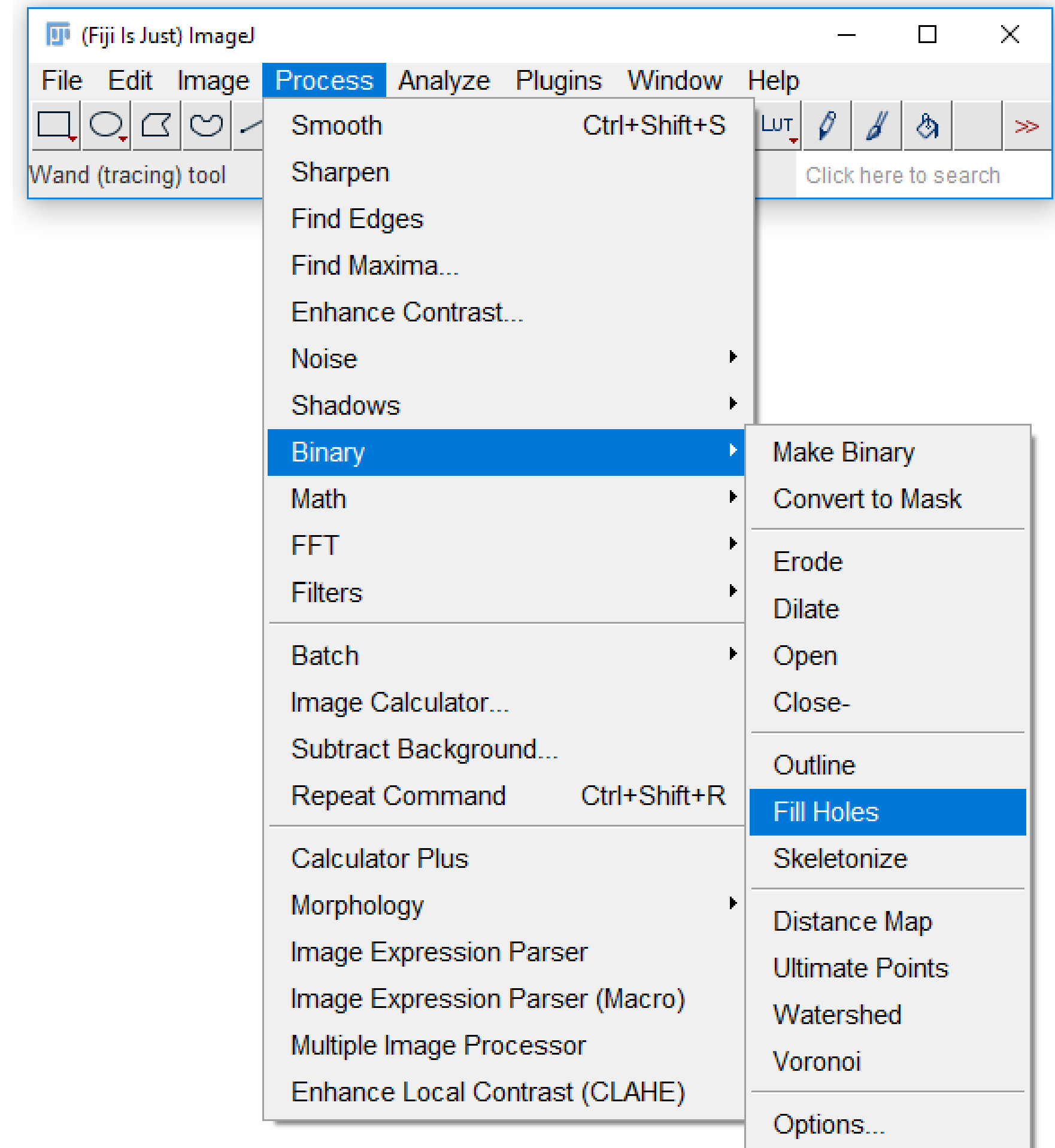
Closing  
Iterations: 2  
Count: 3



Outlines



Fill Holes

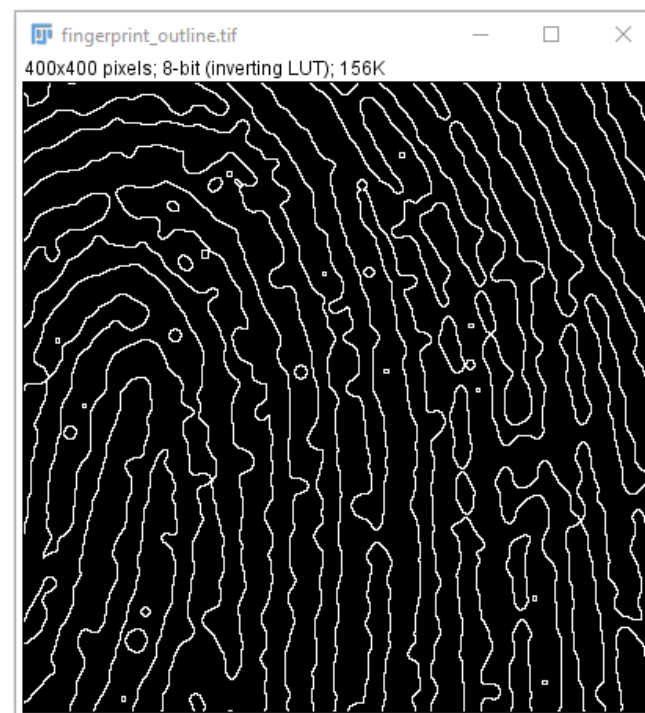


# Fill Holes, Skeletonize, Outline

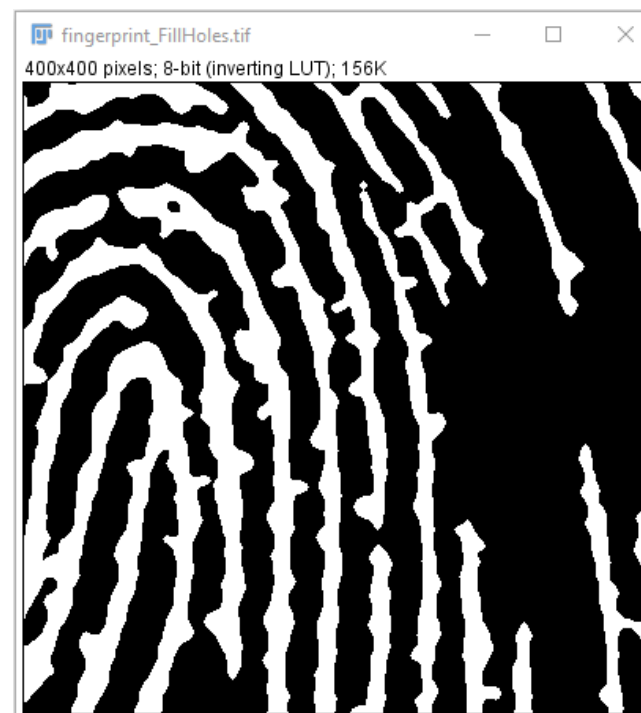
1. Open fingerprint.tif, text1.tif and text2.tif
2. Use openings and closings to remove unwanted artifacts if any.
3. Use Outline, Fill Holes and Skeletonize on the images and see the results



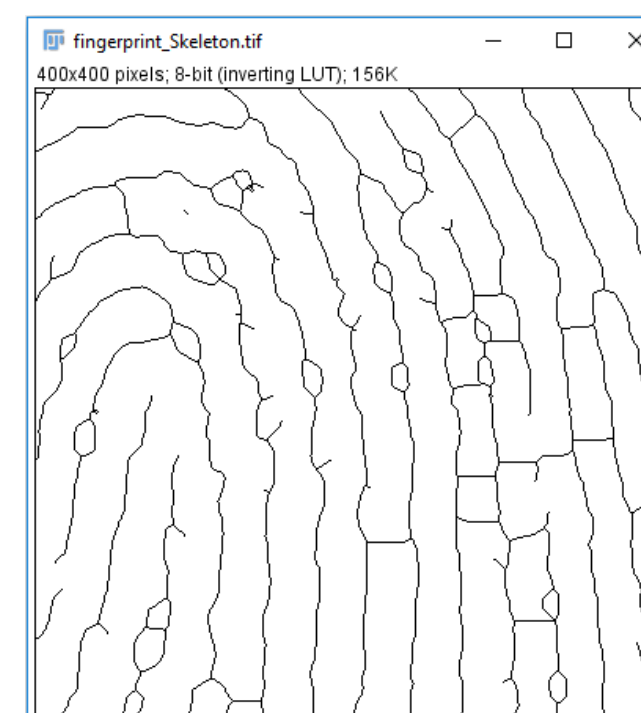
Closing  
Iterations: 2  
Count: 3



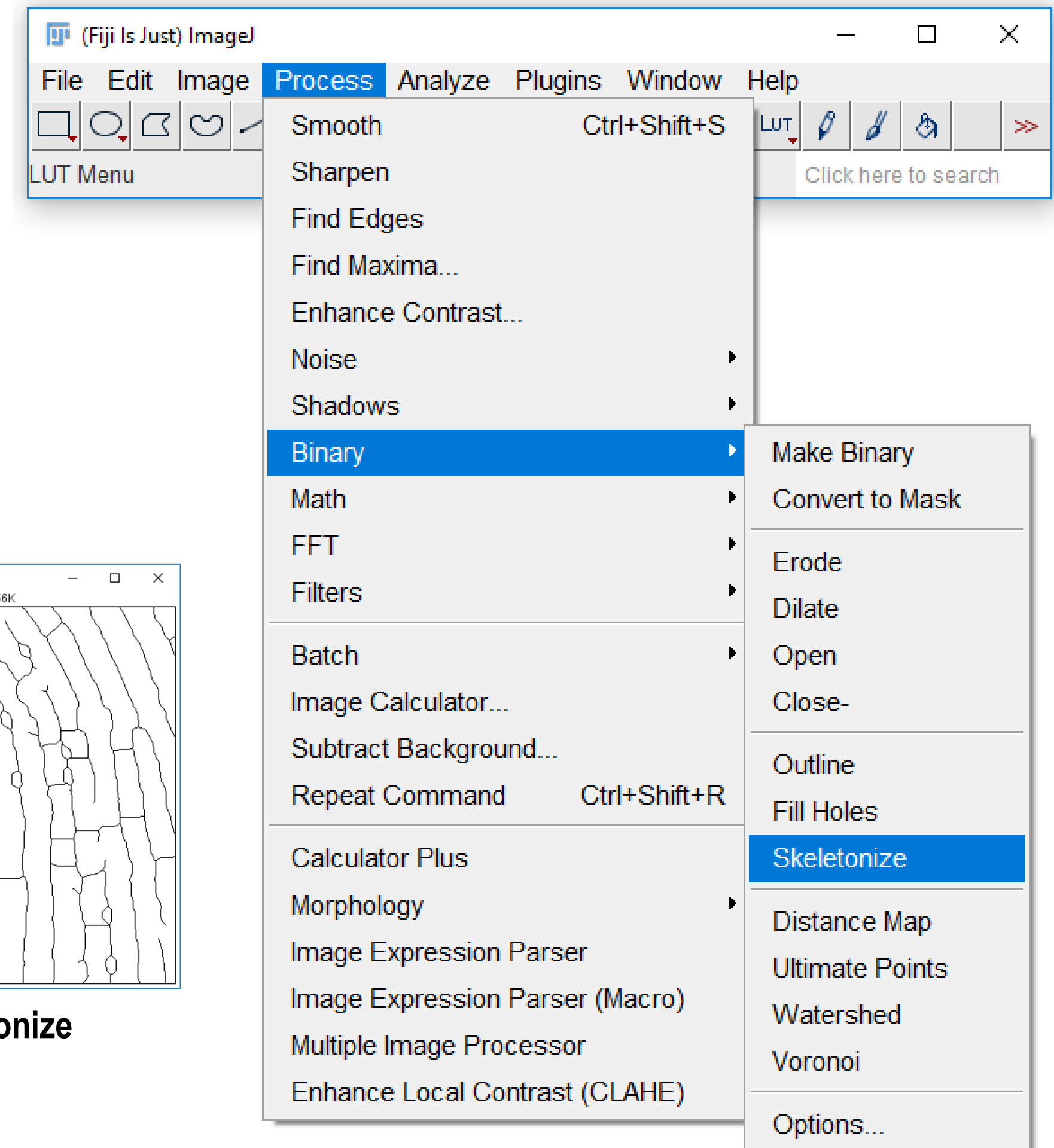
Outlines



Fill Holes



Skeletonize



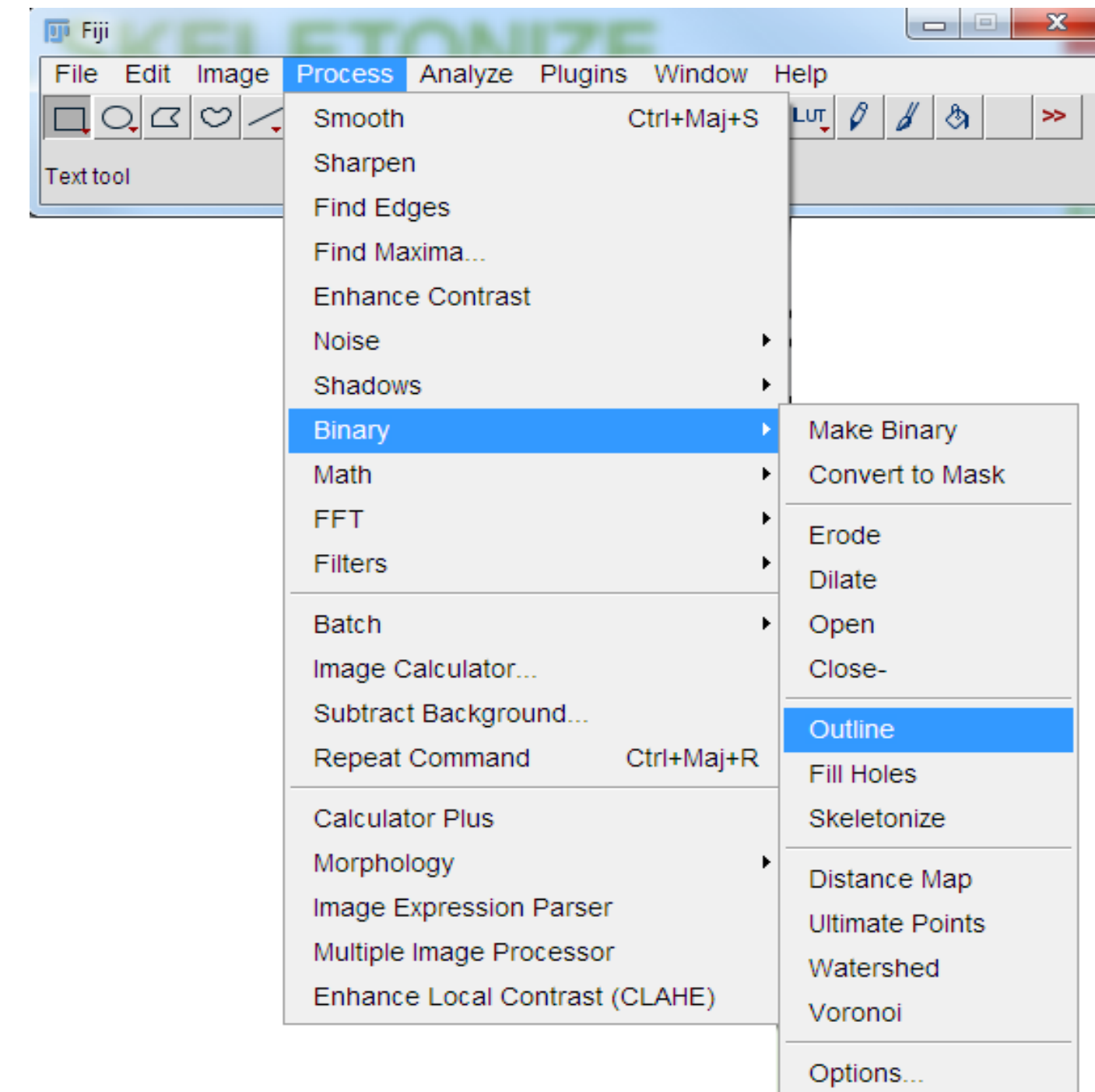


# Fill Holes, Skeletonize, Outline

- Goal: Understand and use morphological operations to extract features from an image

## Exercise:

1. Open **fingerprint.tif**, **text1.tif** and **text2.tif**
2. Use openings and closings to remove unwanted artifacts if any.
3. Use **Outline**, **Fill Holes** and **Skeletonize** on the images and see the results

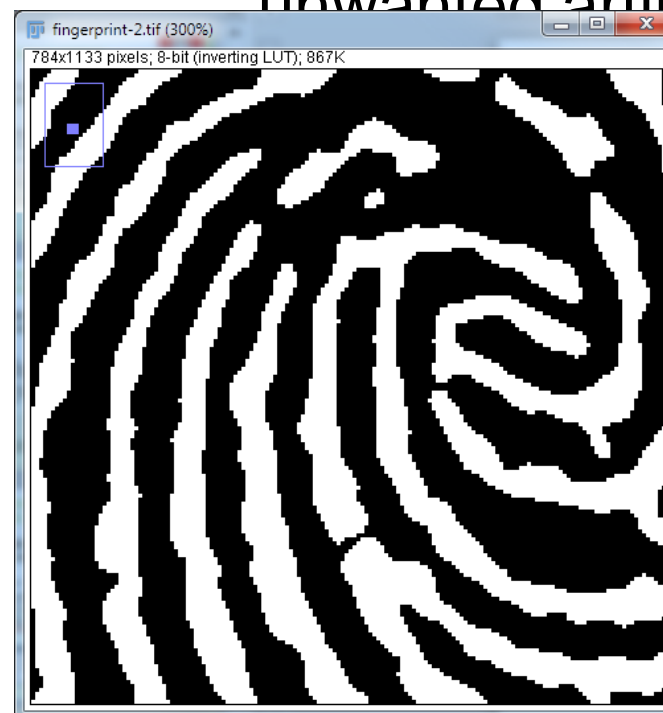


# Fill Holes, Skeletonize, Outline

- Goal: Understand and use morphological operations to extract features from an image

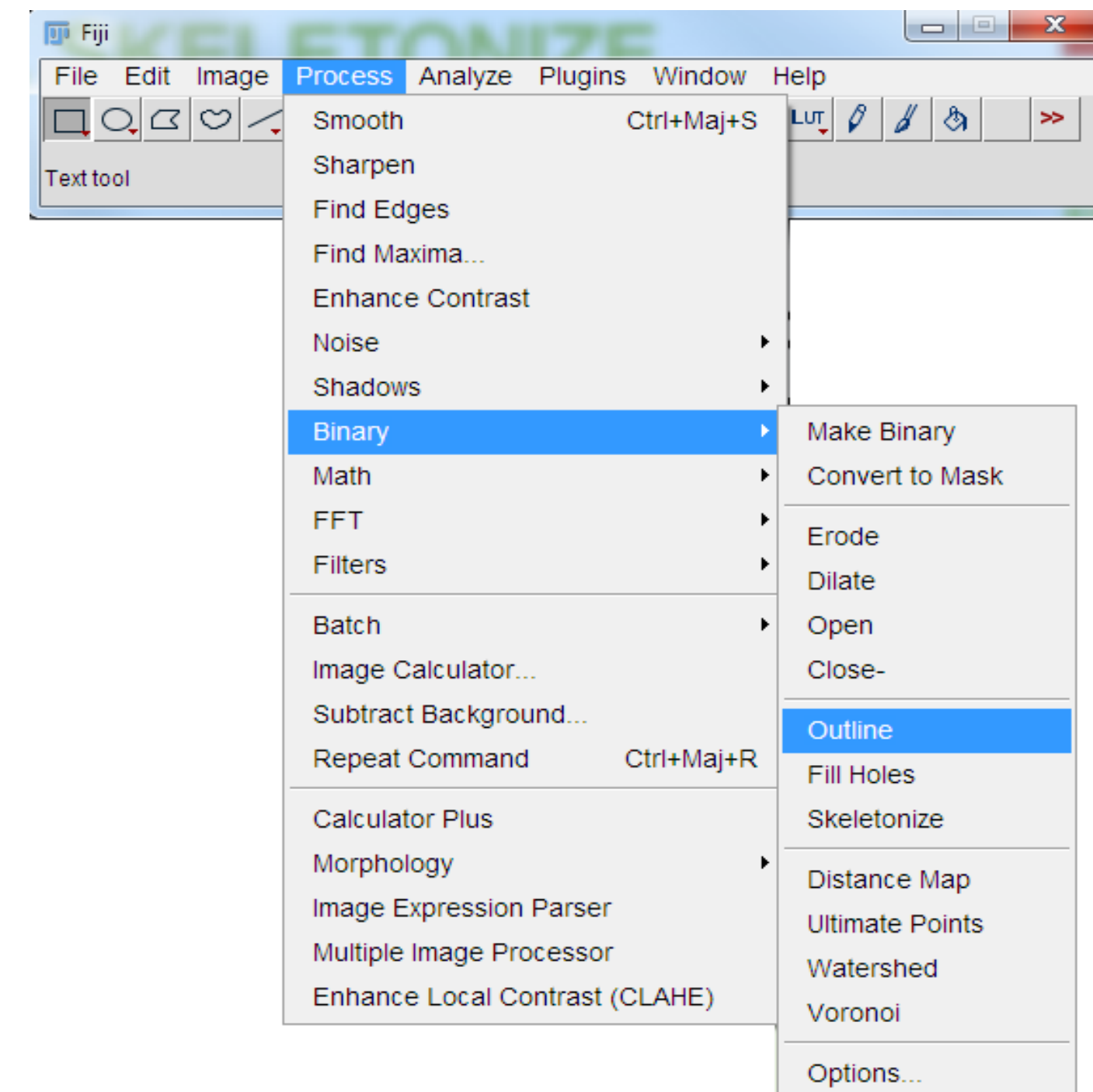
## Exercise:

1. Open **fingerprint.tif**, **text1.tif** and **text2.tif**
2. Use openings and closings to remove unwanted artifacts if any.



Closing  
Iterations: 2  
Count: 3

**Fill Holes and Skeletonize**  
and see the results

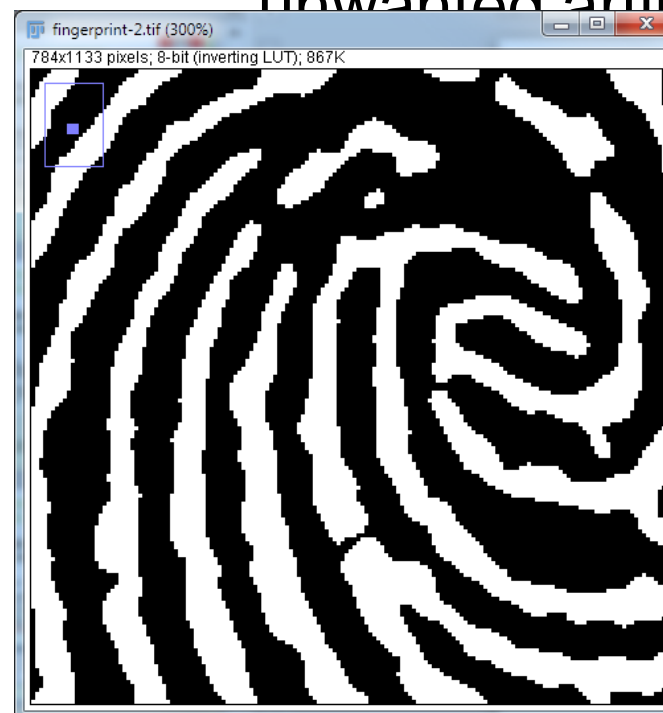


# Fill Holes, Skeletonize, Outline

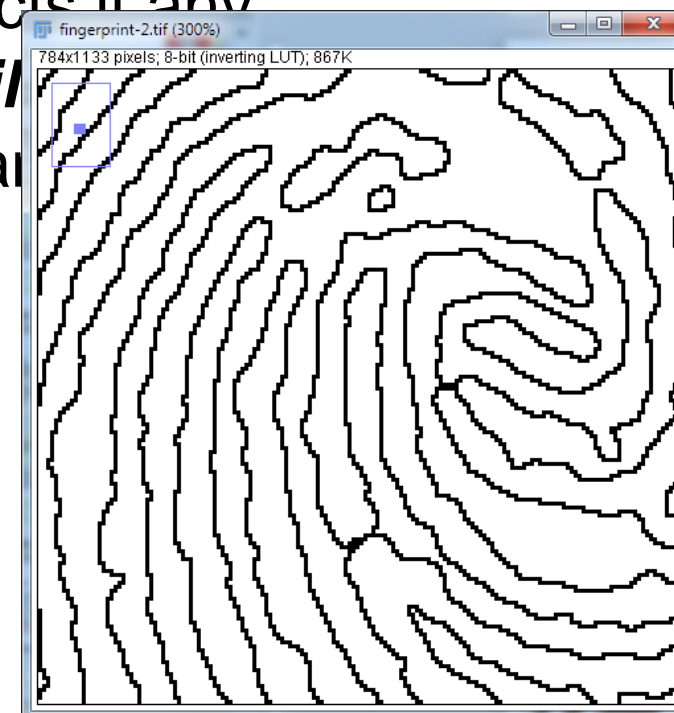
- Goal: Understand and use morphological operations to extract features from an image

## Exercise:

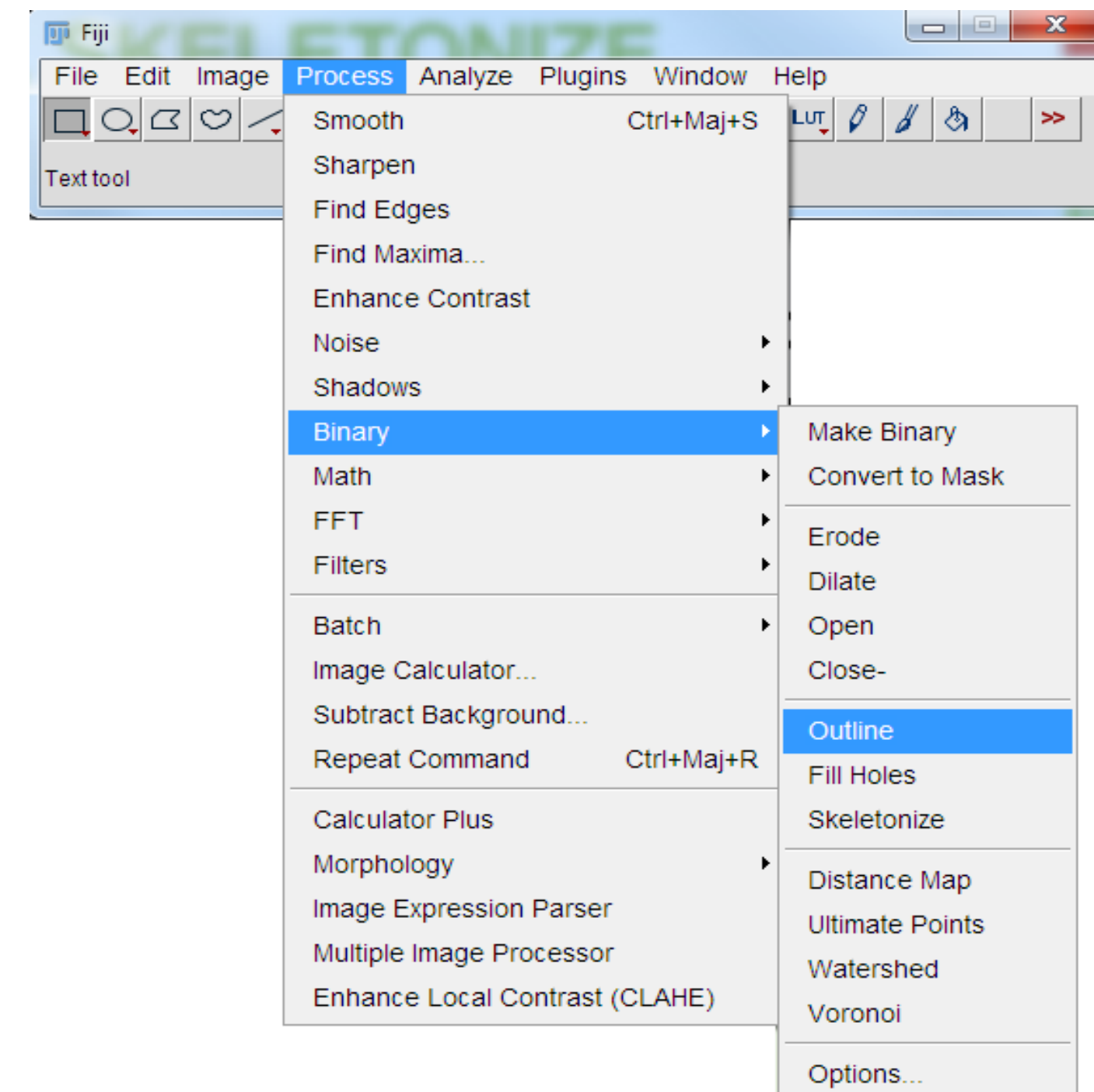
1. Open **fingerprint.tif**, **text1.tif** and **text2.tif**
2. Use openings and closings to remove unwanted artifacts if any



**Closing**  
Iterations: 2  
Count: 3



**Outlines**

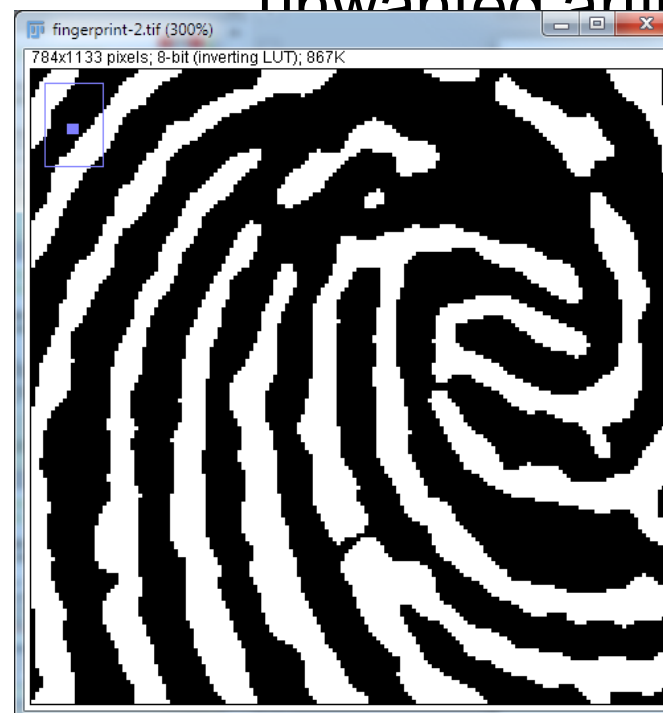


# Fill Holes, Skeletonize, Outline

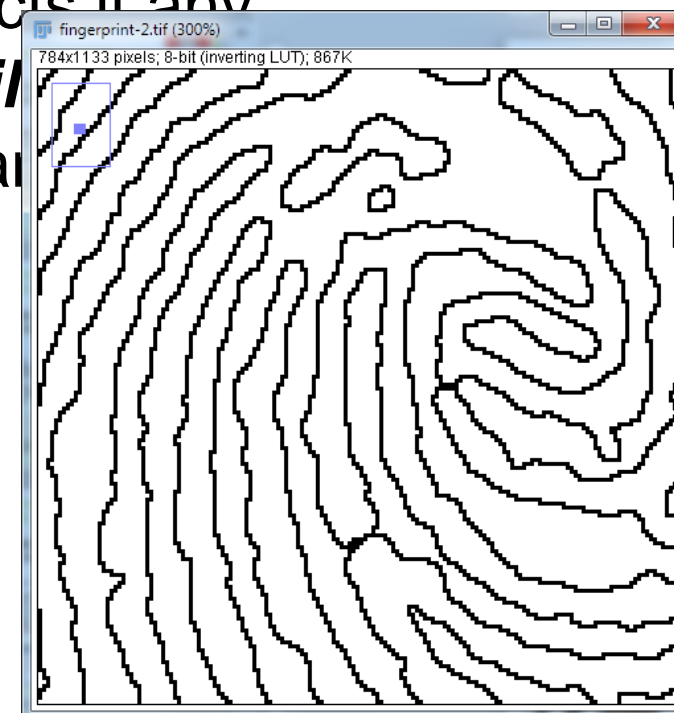
- Goal: Understand and use morphological operations to extract features from an image

## Exercise:

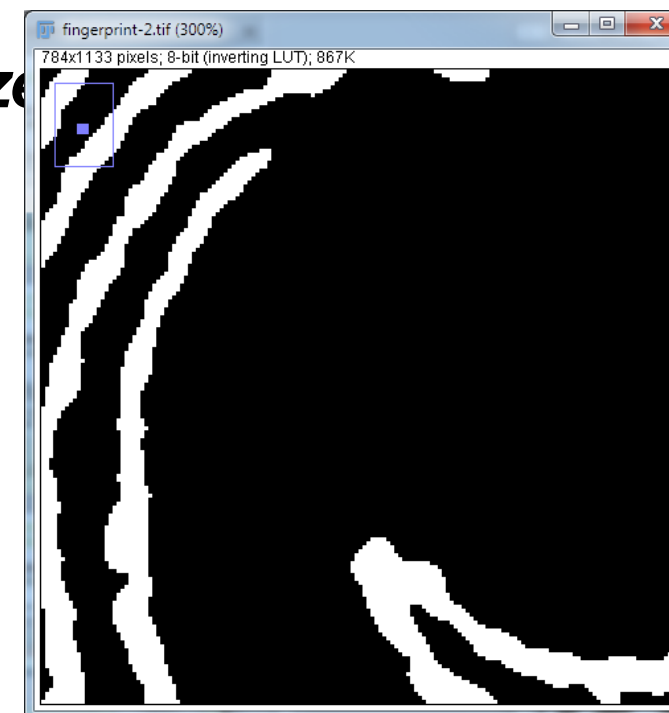
1. Open **fingerprint.tif**, **text1.tif** and **text2.tif**
2. Use openings and closings to remove unwanted artifacts if any



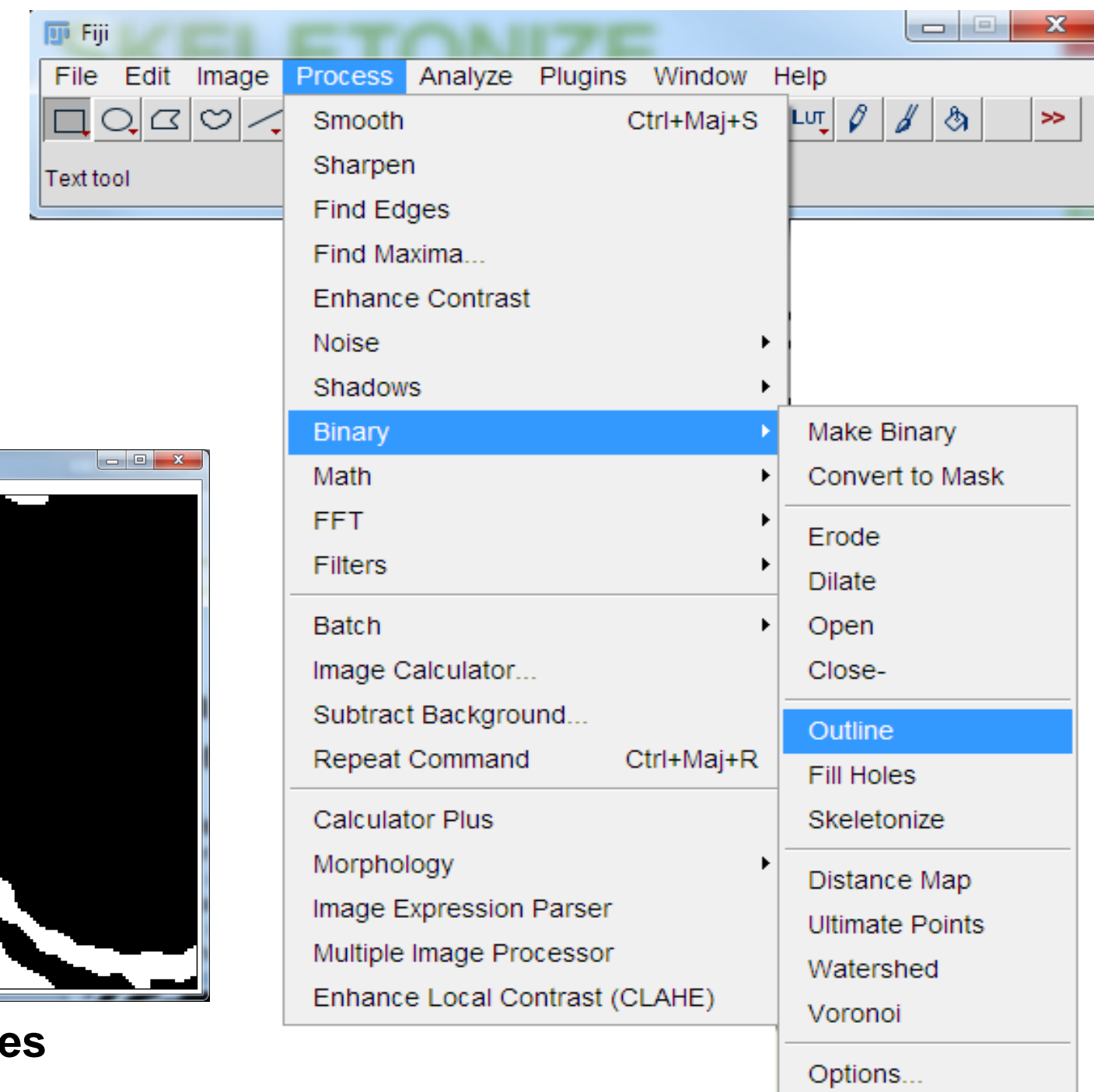
**Closing**  
Iterations: 2  
Count: 3



**Outlines**



**Fill Holes**

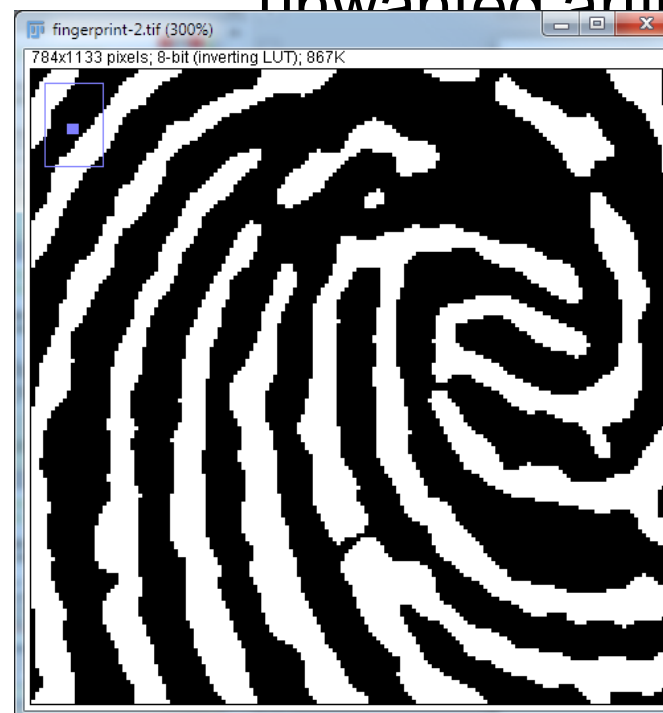


# Fill Holes, Skeletonize, Outline

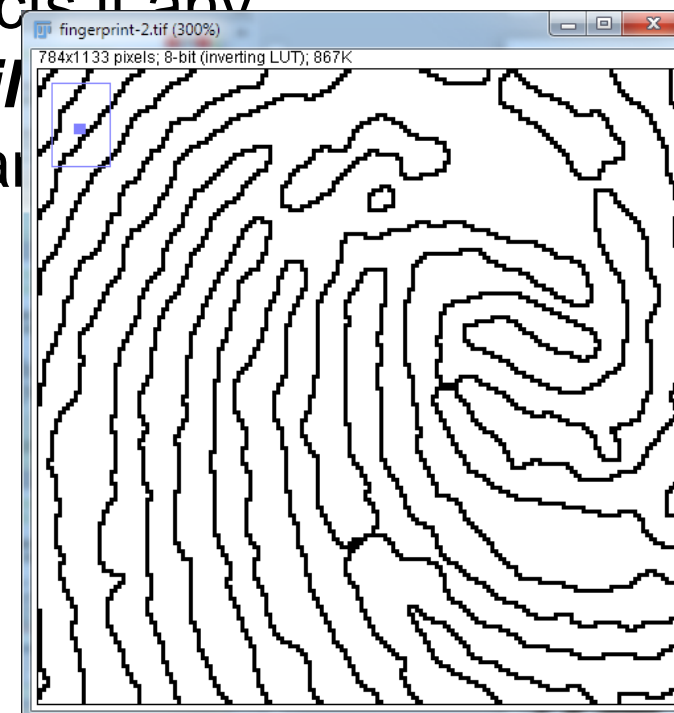
- Goal: Understand and use morphological operations to extract features from an image

## Exercise:

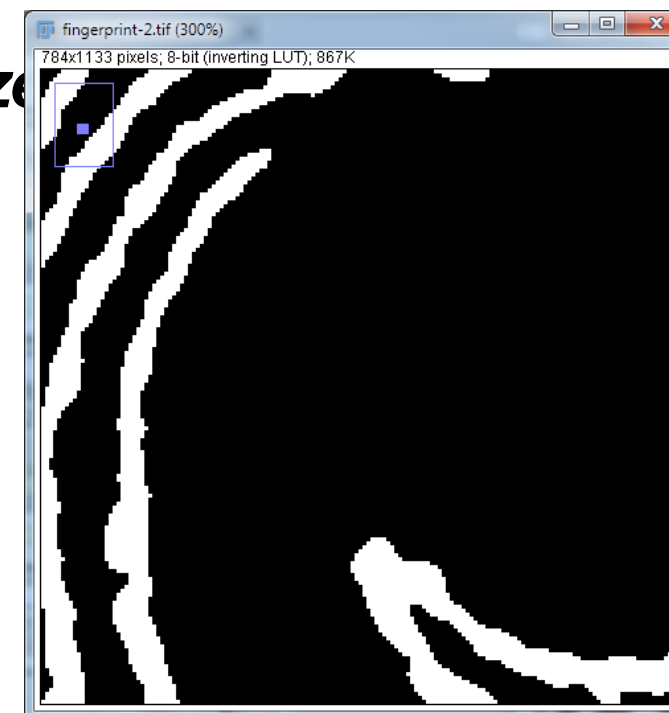
1. Open **fingerprint.tif**, **text1.tif** and **text2.tif**
2. Use openings and closings to remove unwanted artifacts if any



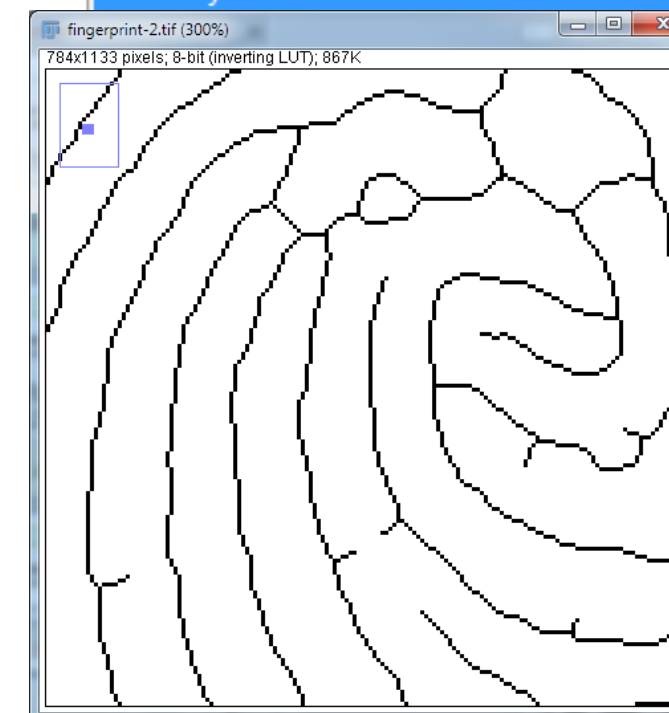
**Closing**  
Iterations: 2  
Count: 3



**Outlines**



**Fill Holes**



**Skeletonize**

