Question 2

## Geodesic Active Contour

Morphological geodesic active contour is an image segmentation technique that uses morphological operators and geodesic distance to segment an object of interest from the background in an image.

The morphological geodesic active contours method is particularly useful in segmenting objects with irregular shapes, weak or blurred edges, or in images with noise or intensity inhomogeneity.

I preprocessed using the *Inverse Gaussian Gradient* method. This method tries to highlight the edges and boundaries of objects in the image and helps distinguish them from the background.

I tuned the parameters and set these values:

* num\_iter=300
* smoothing=4
* balloon=-1
* threshold=0.69

As the result, I used the *contours* to show the segments on the image. The hand and violin are sometimes blended into the background, particularly the violin in the center of the picture. It is also difficult because this image's background contains a few small polygons, which are not considered noise to be removed in the preprocessing step.

## Watershed

The Watershed method is a technique used in image segmentation that is based on the concept of image topography. It treats the grayscale values of an image as heights and simulates the flooding of a landscape with water, starting at local minima, until distinct catchment basins are formed. Each catchment basin corresponds to a distinct object or region in the image.

The Watershed method is particularly useful for segmenting objects in images that have unclear or fuzzy boundaries.

I calculated the gradients and found edges in the image using Sobel filter.

I tuned the parameters and set these values:

* markers=120
* compactness=0.001

As the result, I used the *mark\_boundaries* to show the segments on the image. The result seemed good but some small correctness is needed in the right hand maybe.

## SLIC

SLIC (Simple Linear Iterative Clustering) method is useful when we want to segment an image into superpixels, which are regions with relatively uniform color and texture.

As this method needs a kind of smooth image, I used the Gaussian filter for preprocessing step.

I tuned the parameters and set these values:

* n\_segments=140
* compactness=10
* sigma=2
* start\_label=1

As the result, I used the *mark\_boundaries* to show the segments on the image. The result is similar to the Watershed method with some enhancements especially in detecting the violin. It seemed the best result of the 4 methods.

## Felzenszwalb

Felzenszwalb is useful in situations where the objects of interest in an image have relatively uniform color or texture and are distinct from their background.

For the preprocessing step, I used the Gaussian filter. This step involves filtering the input image to remove high-frequency noise and make the image smoother.

I tuned the parameters and set these values:

* scale=800
* sigma=0.5
* min\_size=200

As the result, I used the *mark\_boundaries* to show the segments on the image. The result seemed good and had some enhancements in comparison with the GAC and Watershed methods especially in detecting the hands.