Medical Imaging Lab 2: Snake object selection

Master IN COMPUTER VISION AND ROBOTICS
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Objective:

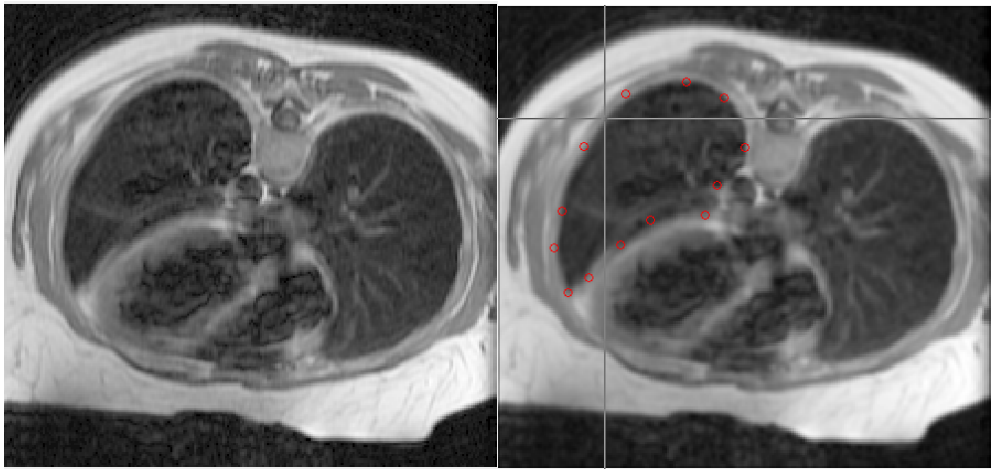
The objective of the homework is to study the effects of different parameters and initialisation condition on the snake object selection algorithm and report the observation.

Instruction to use code:

Following instructions were followed and first result was achieved as shown in Fig.1.

1. Type guide on the MATLAB prompt.
2. Click on "Go to Existing GUI"
3. Select the snk.fig file in the same directory as this file
4. Click the green arrow at the top to launch the GUI Once the GUI has been launched, you can use snakes by

1. Click on "New Image" and load an input image. Samples image are provided.
2. Set the smoothing parameter "sigma" or leave it at its default value and click "Filter". This will smooth the image.
3. as soon as you click "Filter", cross hairs would appear and using them and left click of you mouse you can pick initial contour location on the image. A red circle would appear everywhere you click and in most cases you should click all the way around the object you want to segment. The last point must be picked using a right-click in order to stop MATLAB for asking for more points.
4. Set the various snake parameters (relative weights of energy terms in the snake objective function) or leave them with their default value and click "Iterate" button. The snake would appear and move as it converges to its low energy state.



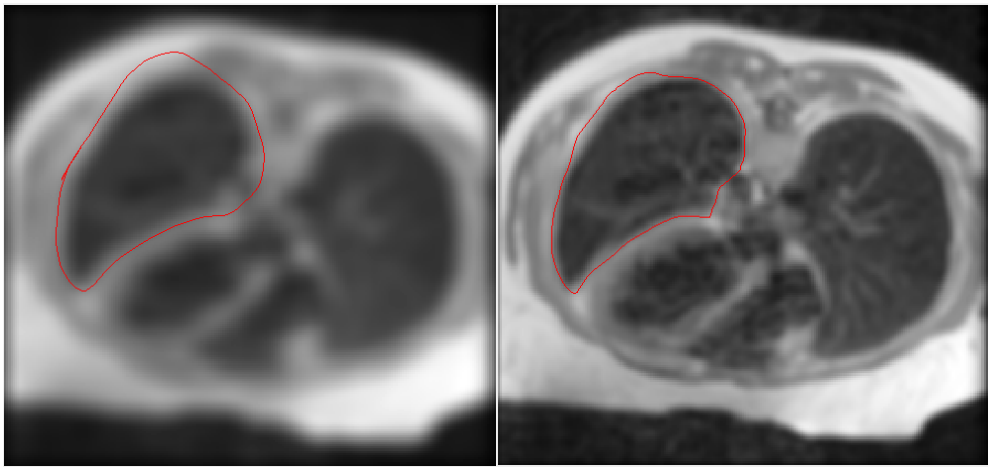


Fig.1 (top left) original image, (top right) selected counter, (left bottom) high smoothing factor (5) (right bottom) low smoothing factor (2)

The result as shown in Fig.2 and Fig.3 were achieved when two type of database were tried. It seems algorithm works quite fine for uniform images.

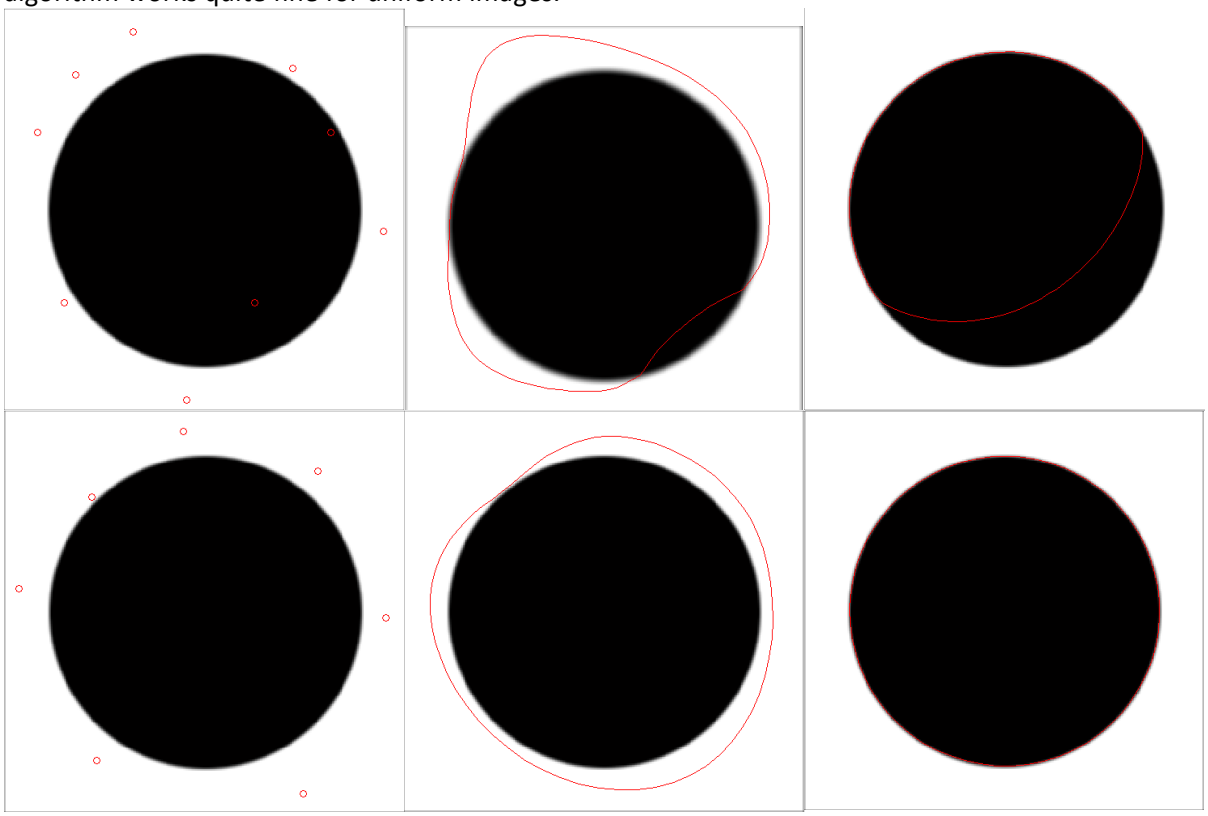


Fig.2 (top) when the points are badly selected on the uniform image (bottom) all the selected points are outside.

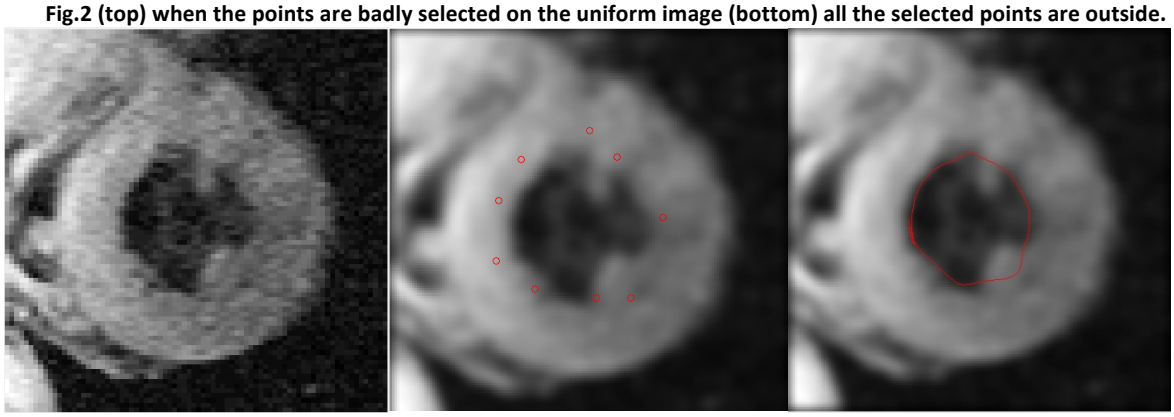


Fig.3 implementation of the method on the medical image

The effect of the parameters:

A large sigma value blurs the image which removes a lot of detail and helps the algorithm converge faster. The edges are not well defined thus and the algorithm is difficult to converge – takes a greater number of iterations to converge.

Alpha controls the tension in the contour by combining with the first derivative term – the algorithm segments faster for the same number of iterations. Gamma is the step size, larger step sizes do not converge while too small step sizes miss the edges. As a result the values should be selected not be very small not very big.

Kappa is the energy term and the convergence of the algorithm is sensitive to its values. Value range is small (0.01-0.05) to see significant effects. Large value doesn't allow the algorithm to fit to edges perfectly. Too small a value doesn't catch edges.

$Eline$, $Eedge$, and $Eterm$ are related to the energy of different features. The weighting factors W($Eline$) for intensity based potential, W($Eedge$) for edge based potential , and W($Eterm$) for termination potential. According to the observation, $Eedge$ is the term that affects binary images the most while $Eterm$ has some effect on how the iterations terminate. W($Eedge$) has some sort of repelling force on the contour. Snake takes the shape but remains away from the edges at negative values