

Morphological Snakes Basic - Readme

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1- Compiling morphological snakes source code

1.1- Make morphological snakes

1.1.2- Windows

The project has a GNU makefile. To compile the project, you can open a console (cmd) and go to the directory where you have decompressed MorphologicalSnakes zip file. Next you go to the source directory. ("your_path/MorphologicalSnakes/source"). In the file "WindowCompilationSample.bat" located in the "MorphologicalSnakes/source" path, you can find bat file examples to compile the program.

The way to compile the program depends on: (i) the compiler you use and (ii) if you want to use OPENMP multithreading directives. Next you will find some source compilation example command line. In the examples we have used MinGW compiler. But you can use another make and g++ distribution and specify the path in the calling.

Using ming32-make with only ami_bmp (bmp) and without openmp

```
C:\MinGW\bin\mingw32-make.exe -e CXX= C:/MinGW/bin/g++.exe
```

Using ming32-make with only ami_bmp (bmp) and with openmp

```
C:\MinGW\bin\mingw32-make.exe -e CXX= C:/MinGW/bin/g++.exe -e OMPD=-DAMI_OMP_H -e OMPF=-fopenmp
```

Using with the make and compiler added in the system path with openmp and ami_bmp (bmp)

```
make -e CXX=g++ -e OMPD=-DAMI_OMP_H -e OMPF=-fopenmp
```

IMPORTANT: If the next error appears during the compilation procedure:

undefined reference to '__sync_fetch_and_add_4'

You have to add in the make line the next option: -e ARCH=-march=i586, for example:

```
make -e CXX=g++ -e OMPD=-DAMI_OMP_H  
-e OMPF=-fopenmp -e ARCH=-march=i586
```

1.1.3- Linux

The project has a GNU makefile. To compile the project, we have to open a console and go to the directory where you have decompressed MorphologicalSnakes zip file. Next you go to the source directory. ("your_path/MorphologicalSnakes/source").

According with the compiler you use and if you want to use OPENMP multithreading directives you have to use different way to compile. Next you will find some source compilation options, we suppose you have installed make and g++ in usr/bin, but you can use another make and g++ distribution and specify the path in the calling.

Using make, openmp and ami_bmp (bmp)

```
usr/bin/make -e CXX= usr/bin/g++  
  
-e OMPD=-DAMI_OMP_H -e OMPF=-fopenmp
```

Using make with ami_bmp (bmp) and without openmp

```
usr/bin/make -e CXX= usr/bin/g++
```

Using with the make and compiler added in the system path and ami_bmp (bmp)

```
make -e CXX=g++
```

IMPORTANT: If you have an error during compile procedure like this:

```
undefined reference to '__sync_fetch_and_add_4'
```

You have to add in the make line the next option: -e ARCH=-march=i586 , for example:

```
make -e CXX=g++ -e OMPD=-DAMI_OMP_H  
  
-e OMPF=-fopenmp -e ARCH=-march=i586
```

2.- Run morphological snakes

The executable generated is in the source directory. We go to “your_path/MorphologicalSnakes/source”, and there we can find “morphological_snake.exe”, that’s the program that we’ll use. To run it, we only type “morphological_snake” and the parameters that will be detailed below.

2.1 Parameters

In the next table we present the Morphological snakes function parameters. To identify the parameters we use a parameter option identifier before parameter value.

<i>Parameter</i>	<i>Option</i>	<i>Needed</i>
Input image file	-I	Yes
Output image file	-O	Yes
Input contours file	-C	Yes
Output contours file	-F	Yes
Gaussian Standard Deviation	-S	No
Snake type {expected values are 0,1 or 2}	-T	No
Number of iterations	-N	No
Snake ballon {expected values are -1,0 or 1}	-B	No
Snake ballon difference radius	-R	No
Edge detector threshold	-P	No
Edge ballon threshold	-E	No

You can pass the parameters in any order. In the case of ballon propagation, there are 2 ways of performing it. The first one is to propagate the ballon while the image value is inside a given interval. The parameter -R is used to fit the interval radius. The second one is to propagate the ballon while there is not edge point found. The parameter -E is used to fit a percentage of points that are considered as edge while ballon propagation.

If a parameter is needed and the user does not provide it, the program will stop, and an error will be showed. On the other hand, for non-required parameters, a default value is assigned in the case user do not use them.

2.3- Input / Output contours file format

2.3.1- Input contours file format

Two different formats are accepted like input. The first is the AmiLabContours Software format. And the second is a simple file with points coordinates (X Y). Below we present a description of both formats.

AmiLabContours format:

```
1
23
Axon
234
120 -5
120 -6
121 -23
....
```

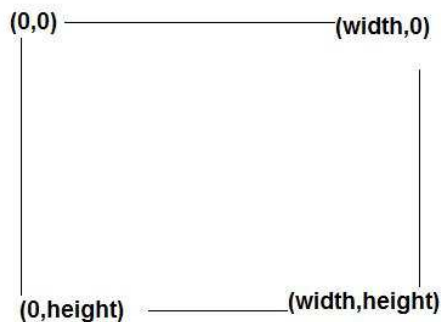
Where the first line indicates the number of contours, next for each contour we have a line indicating the contour index. Next, a line containing a contour description. Next, a line containing the number of contour points. Next lines contains the contour point coordinates We observe that the Y coordinates are negatives.

Simple format:

```
120 5
120 6
121 23
```

Directly the contour point coordinates. In this case Y coordinates are positive.

The two formats have a common reference system (illustrated below). The only difference is the sign of Y coordinates.



2.3.1- Output contours file format

The output will be written in a file with the same name that the output image but with the .cn extension. We use the simple version of contour format (Y positive).

2.4- Samples

Next, we show some samples using morphological snakes function and its parameters. You can run these samples using the batch file on:

“MorphologicalSnakes/source/build/samples.bat” and

“MorphologicalSnakes/source/build/samples2.bat”,

both samples run morphological snakes with the same images, but with different algorithm.

To run these samples on linux, we have to change files permissions with :

```
chmod 755 samples.bat
```

```
chmod 755 samples2.bat
```

and then run with ./samples.bat or ./samples2.bat

In the output images for the samples, you can see that the yellow contour is the last contour evolution, and the other contours (red,green,blue) , are the previous iterations.

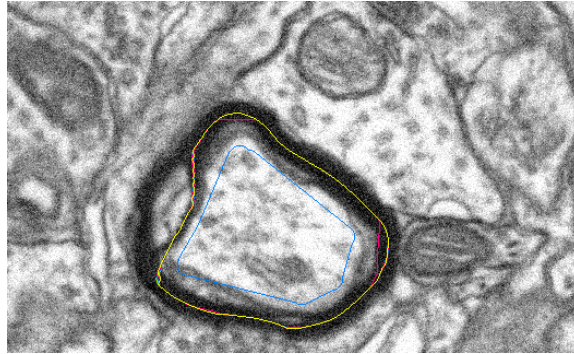
Next we present some *morphological_snake function calls and results*

morphological_snake -I ElectronicMicroscopy.bmp -O ElectronicMicroscopy_OUT.bmp

-C ElectronicMicroscopy.cn -F ElectronicMicroscopy_OUT.cn -S 8 -T 0 -N 100 -B 1 -R 50 -P 1

morphological_snake -I ElectronicMicroscopy.bmp -O ElectronicMicroscopy_OUT.bmp

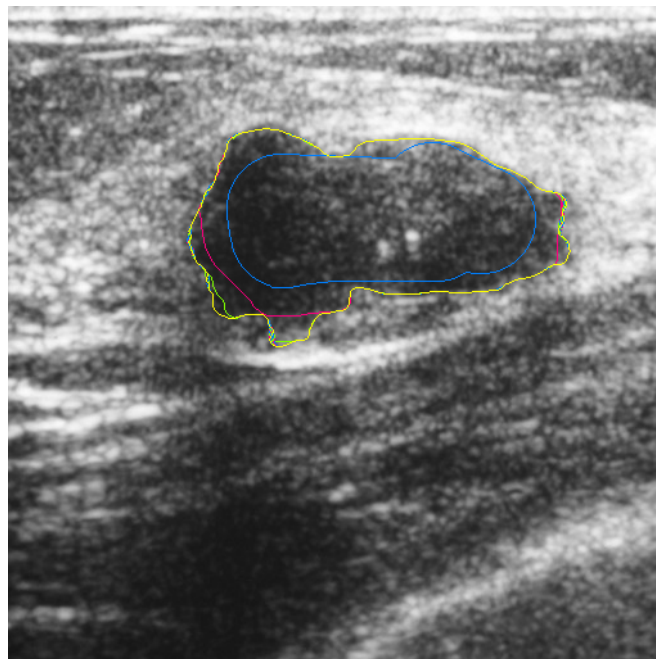
-C ElectronicMicroscopy.cn -F ElectronicMicroscopy_OUT.cn -S 8 -T 0 -N 100 -B 1 -E 0.4 -P 0.5



This is the center line snake (type 0.) We look for dark center lines in the structure boundary.

morphological_snake -I m4ORI.bmp -O m4ORI_OUT.bmp -C m4ORI.cn -F m4ORI_OUT.cn -S 8 -T 1 -N 200 -B 1 -R 48 -P 0.5

morphological_snake -I m4ORI.bmp -O m4ORI_OUT.bmp -C m4ORI.cn -F m4ORI_OUT.cn -S 8 -T 1 -N 200 -B 1 -E 0.4 -P 0.5



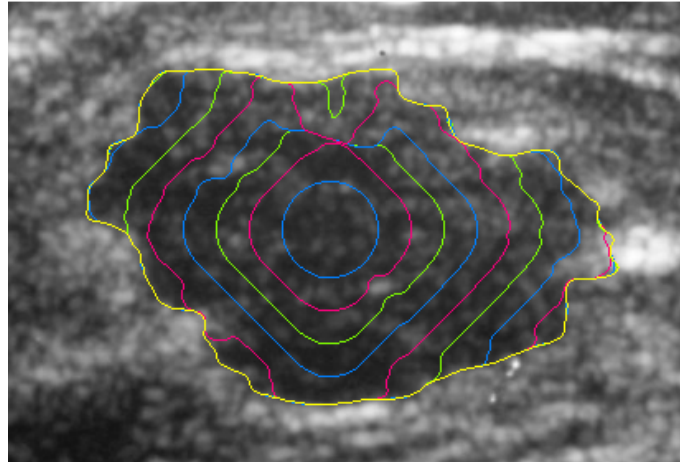
Border snake (type 1): We look for boundaries of high-contrast areas

```
morphological_snake -I m5ORI.bmp -O m5ORI_OUT.bmp -C m5ORI.cn -F m5ORI_OUT.cn -S 8
```

```
-T 1 -N 200 -B 1 -R 48 -P 0.5
```

```
morphological_snake -I m5ORI.bmp -O m5ORI_OUT.bmp -C m5ORI.cn -F m5ORI_OUT.cn -S 8
```

```
-T 1 -N 200 -B 1 -E 0.4 -P 0.5
```



Border snake (type 1): We look for boundaries of high-contrast areas

```
morphological_snake -I synthetic.bmp -O synthetic_OUT.bmp -C synthetic.cn
```

```
-F synthetic_OUT.cn -S 3 -T 2 -N 200 -B 1 -R 90 -P 0.5
```

```
morphological_snake -I synthetic.bmp -O synthetic_OUT.bmp -C synthetic.cn
```

```
-F synthetic_OUT.cn -S 3 -T 2 -N 200 -B 1 -E 0.01 -P 0.5
```



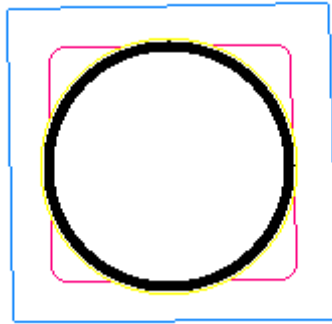
Ballon snake (type 2): Expand the original contour while the grey level is similar.

morphological_snake -I synthetic.bmp -O synthetic_2_OUT.bmp -C synthetic2.cn

-F synthetic2_OUT.cn -S 3 -T 2 -N 200 -B -1 -R 90 -P 0.5

morphological_snake -I synthetic.bmp -O synthetic_2_OUT.bmp -C synthetic2.cn

-F synthetic2_OUT.cn -S 3 -T 2 -N 200 -B -1 -E 0.1 -P 0.5



Ballon snake (type 2 with ballon -1): Contract the original contour while the grey level is similar.