

User Guide

Lumen Detector and Quantification Software

Article: Deconstructing the principles of ductal network formation in the pancreas

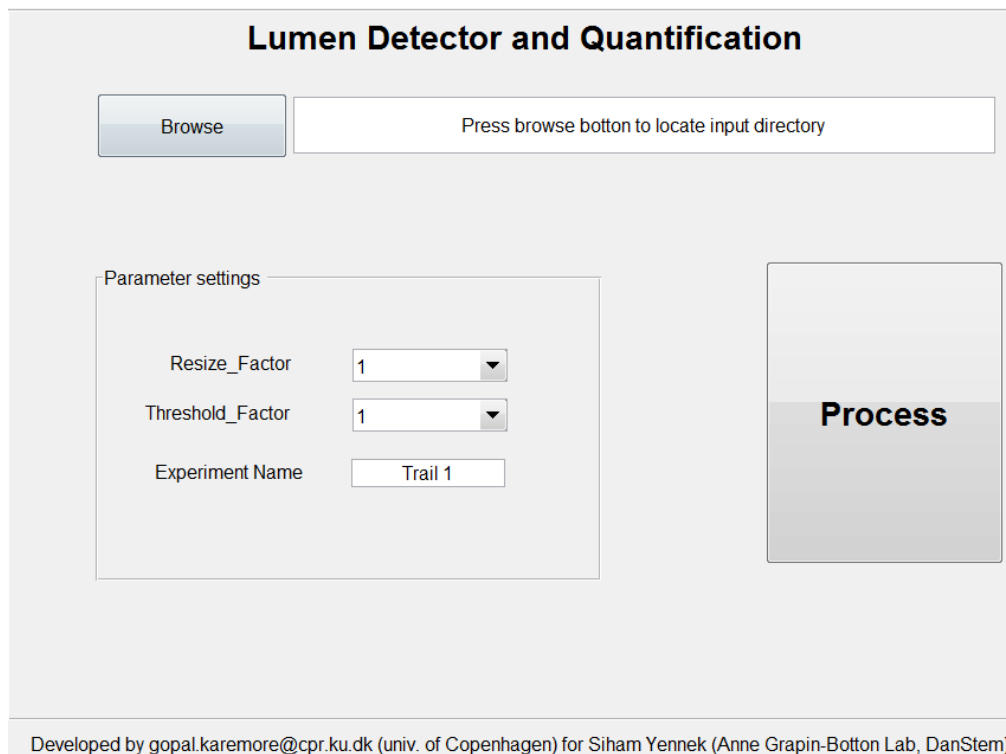
How to use the software (windows and mac versions):

Step 1: Download this repository https://github.com/gopalrk/Lumen_Detector_and_Quantification.

Step 2: Open the Matlab and change the directory to downloaded folder.

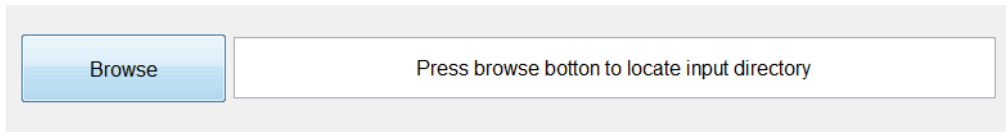
Step 3: Type GUIDE on Matlab command prompt and Open the file “[LumenThickness_Detector.fig](#)”

Step 4: Click the execute button on GUIDE app, following GUI will be displayed. Now User is ready to use the software.



How to use the software:

Step 1: Browse the location of your image files.

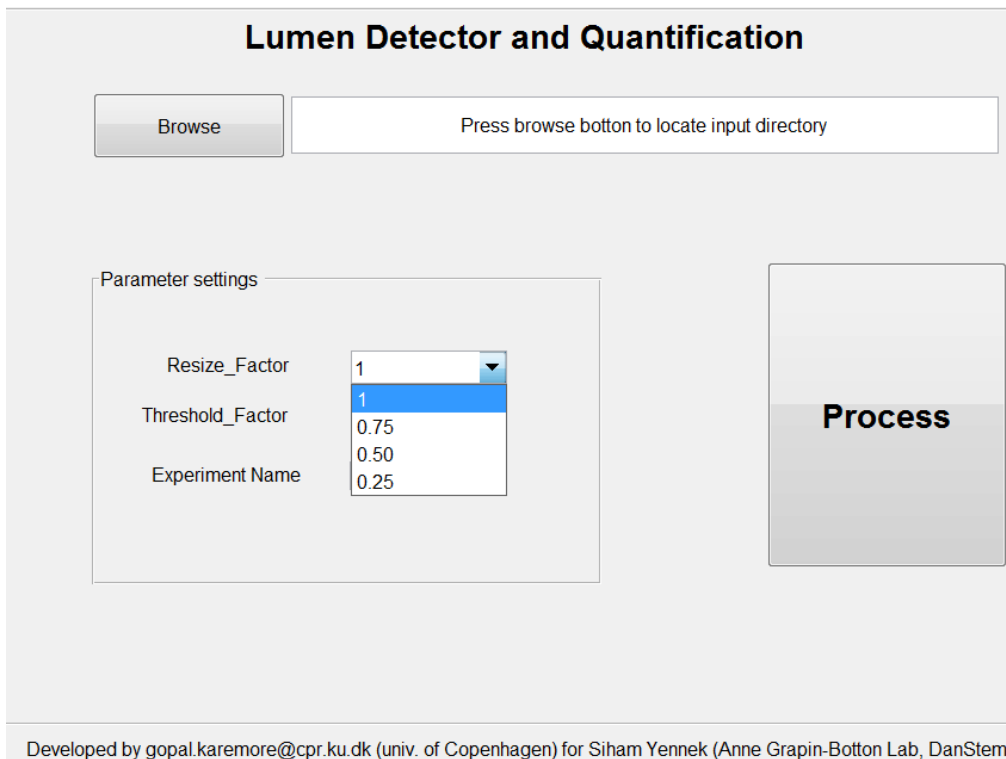


The screenshot shows a light gray rectangular area. On the left is a blue button with the text 'Browse'. To its right is a white rectangular box containing the text 'Press browse button to locate input directory'.

*Note: Majority of microscope vendor specific image file format are supported as software use **BioFormat Matlab** plugin for reading the images.*

Step 2: Adjust the Parameter Settings.

Resize_factor: Using this setting, user can down-sample the original image in order to speed up the segmentation process.



The screenshot shows the main window of the 'Lumen Detector and Quantification' software. At the top, the title 'Lumen Detector and Quantification' is centered. Below the title, there is a 'Browse' button and a text box with the instruction 'Press browse button to locate input directory'. In the center, there is a 'Parameter settings' section with three labels: 'Resize_Factor', 'Threshold_Factor', and 'Experiment Name'. To the right of these labels is a dropdown menu. The dropdown menu is open, showing the following options: '1', '1', '0.75', '0.50', and '0.25'. The first '1' is selected. To the right of the parameter settings is a large gray button labeled 'Process'. At the bottom of the window, there is a footer text: 'Developed by gopal.karemore@cpr.ku.dk (univ. of Copenhagen) for Siham Yennek (Anne Grapin-Botton Lab, DanStem)'.

Threshold_Factor: This is the threshold factor required for the segmentation of the lumen using Otsu algorithm. This threshold factor will be multiplied to Otsu threshold in order to tune the segmentation.

Note: User will have to set this factor depending on the particular image.

Lumen Detector and Quantification

Parameter settings

Resize_Factor

Threshold_Factor

Experiment Name

1.1
1.2
1.3
1.4
1.5
0.9
0.8
0.7

Process

Developed by gopal.karemore@cpr.ku.dk (univ. of Copenhagen) for Siham Yennek (Anne Grapin-Botton Lab, DanStem)

Experiment Name: This is the name of the output excel file generated by the software containing the results of the segmentation.

Note: The output directory “OP” will be created automatically under the input path. OP directory contains the snapshots of the segmentation results as well as the excel sheet.

Step 3: Process.

Click on “**Process**” button to start the segmentation and quantification.

Batch Mode:

In order to work in Batch mode with multiple Images, please have a look at example script [“Script BatchMode.m”](#)

Results:

Structure of the output Excel file:

	Time	ImageName	OuterDiameter	InnerDiameter	InnerDiameterVsOuter	SegmentationOP	OuterArea	OuterPerim	InnerArea	InnerPerim	OuterAreaThickness
1											
2	1	Ctrl_forsk_Subset1.czi	47.44562693	33.33973789	0.702693589	POST DOCS\Siham Yennek\20180131\CTRL1\	1774	139	878.125	102	895.875
3	2	Ctrl_forsk_Subset1.czi	47.28433822	33.28240382	0.703877966	POST DOCS\Siham Yennek\20180131\CTRL1\	1762.125	138	874.875	102	887.25
4	3	Ctrl_forsk_Subset1.czi	47.33816218	33.30152614	0.703481601	POST DOCS\Siham Yennek\20180131\CTRL1\	1766.75	135	876	99	890.75
5	4	Ctrl_forsk_Subset1.czi	47.18999856	33.18662692	0.703255519	POST DOCS\Siham Yennek\20180131\CTRL1\	1755.625	134	870.125	98	885.5
6	5	Ctrl_forsk_Subset1.czi	47.08195034	33.16743835	0.704461861	POST DOCS\Siham Yennek\20180131\CTRL1\	1747.25	137	868.75	97	878.5
7	6	Ctrl_forsk_Subset1.czi	46.91941147	32.95562671	0.702387896	POST DOCS\Siham Yennek\20180131\CTRL1\	1735.25	135	858.25	95	877
8	7	Ctrl_forsk_Subset1.czi	46.83793052	32.93630356	0.703197242	POST DOCS\Siham Yennek\20180131\CTRL1\	1729.625	132	857.375	94	872.25
9	8	Ctrl_forsk_Subset1.czi	46.70181303	32.95562671	0.705660542	POST DOCS\Siham Yennek\20180131\CTRL1\	1719.375	134	857.25	97	862.125
10	9	Ctrl_forsk_Subset1.czi	46.66090035	32.82012576	0.703375321	POST DOCS\Siham Yennek\20180131\CTRL1\	1716.75	131	850.625	96	866.125
11	10	Ctrl_forsk_Subset1.czi	46.56529754	32.62557677	0.700641431	POST DOCS\Siham Yennek\20180131\CTRL1\	1709.75	131	840.875	94	868.875
12	11	Ctrl_forsk_Subset1.czi	46.4557965	32.46909628	0.698924585	POST DOCS\Siham Yennek\20180131\CTRL1\	1701.625	132	832.625	94	869
13	12	Ctrl_forsk_Subset1.czi	46.41466697	32.33155836	0.696580639	POST DOCS\Siham Yennek\20180131\CTRL1\	1698.5	131	825.75	93	872.75
14	13	Ctrl_forsk_Subset1.czi	46.4420907	32.19343084	0.693195124	POST DOCS\Siham Yennek\20180131\CTRL1\	1700.625	132	819	91	881.625
15	14	Ctrl_forsk_Subset1.czi	46.42838086	32.13405158	0.692120875	POST DOCS\Siham Yennek\20180131\CTRL1\	1698.875	134	815.25	93	883.625
16	15	Ctrl_forsk_Subset1.czi	46.30480991	32.05470812	0.692254398	POST DOCS\Siham Yennek\20180131\CTRL1\	1690.25	131	811.5	91	878.75
17	1	Ctrl_forsk_Subset10.czi	55.74923971	46.38722702	0.832069231	POST DOCS\Siham Yennek\20180131\CTRL1\	2449.25	157	1696.25	133	753
18	2	Ctrl_forsk_Subset10.czi	55.85191926	46.34603664	0.829802042	POST DOCS\Siham Yennek\20180131\CTRL1\	2458.375	158	1693.625	132	764.75
19	3	Ctrl_forsk_Subset10.czi	55.77207373	46.33229837	0.830743691	POST DOCS\Siham Yennek\20180131\CTRL1\	2451.125	160	1692.625	132	758.5
20	4	Ctrl_forsk_Subset10.czi	55.72639635	46.31855603	0.831178025	POST DOCS\Siham Yennek\20180131\CTRL1\	2447.625	160	1691.375	134	756.25
21	5	Ctrl_forsk_Subset10.czi	55.78348723	46.27730453	0.829587873	POST DOCS\Siham Yennek\20180131\CTRL1\	2452.875	156	1688.5	133	764.375
22	6	Ctrl_forsk_Subset10.czi	55.80630723	46.26354585	0.829002099	POST DOCS\Siham Yennek\20180131\CTRL1\	2454.375	158	1687.5	133	766.875
23	7	Ctrl_forsk_Subset10.czi	55.74923971	46.33229837	0.83108395	POST DOCS\Siham Yennek\20180131\CTRL1\	2449.375	158	1692.5	133	756.875

Meaning of various column features:

OuterDiameter: Outer diameter of the fitted disk over the segmented lumen.

InnerDiameter: Inner diameter of the fitted disk over the segmented lumen.

InnerDiameterVsOuter: Ratio between inner and outer diameters.

SegmentationOP: Location of the snapshots of segmented images.

Outer Area: Area of the fitted disk over the outer lumen surface.

Inner Area: Area of the fitted disk over the inner lumen surface.

Outer Perimeter: Perimeter of the fitted disk over the outer lumen surface.

Inner Perimeter: Perimeter of the fitted disk over the inner lumen surface.

Outer area Thickness: Thickness of the cell layer.

Note: If user does not have Matlab license. We have made executable that can work for both Windows and Mac operating system without Matlab license. Since the size of executable is more than the acceptable limit by GitHub please contact corresponding author Anne Grapin-Botton at anne.grapin-botton@sund.ku.dk to get executables.