Short Guide to using the SWE Image Analysis Tool

Mehrin Azan, Andreas Haueise, Katrin Skerl

08.04.2025

Contact: katrin.skerl@hs-furtwangen.de

Overview

The SWE Image Analysis Tool is a Graphic User Interface designed to analyse DICOM clips of shear wave elastography captures. Two analysis options are provided: an analysis of a hand-drawn region of interest, and sequential analysis of small square regions within the entire SWE image, i.e. a grid. The tool exports the analysis results in a spreadsheet (excel file), which is saved in a predefined directory. After completion, a tone is played that indicates completion to notify the user.

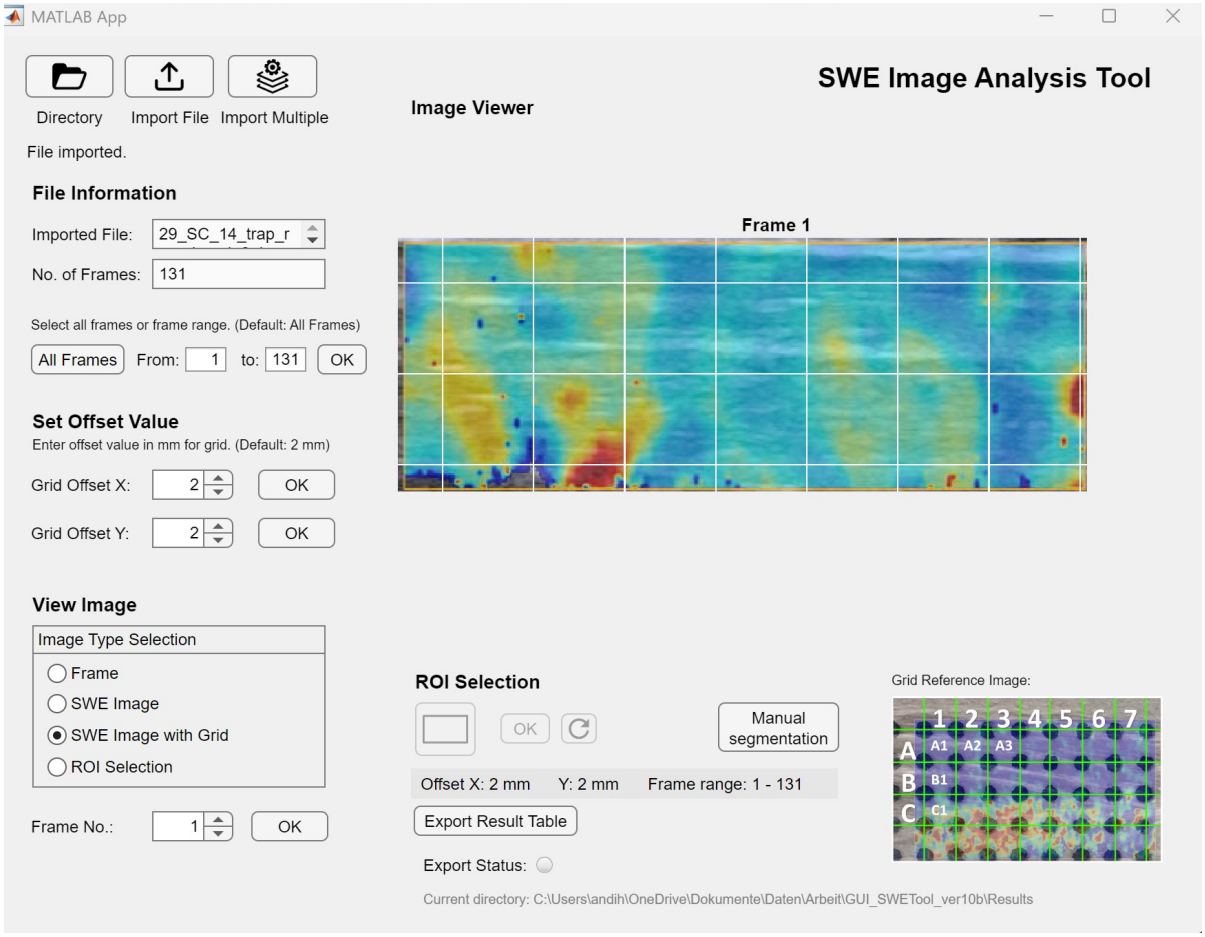

Figure 1: Example screenshot of GUI after completion of grid analysis of image.

Functions

In the following, the functions of the tool will briefly be described.

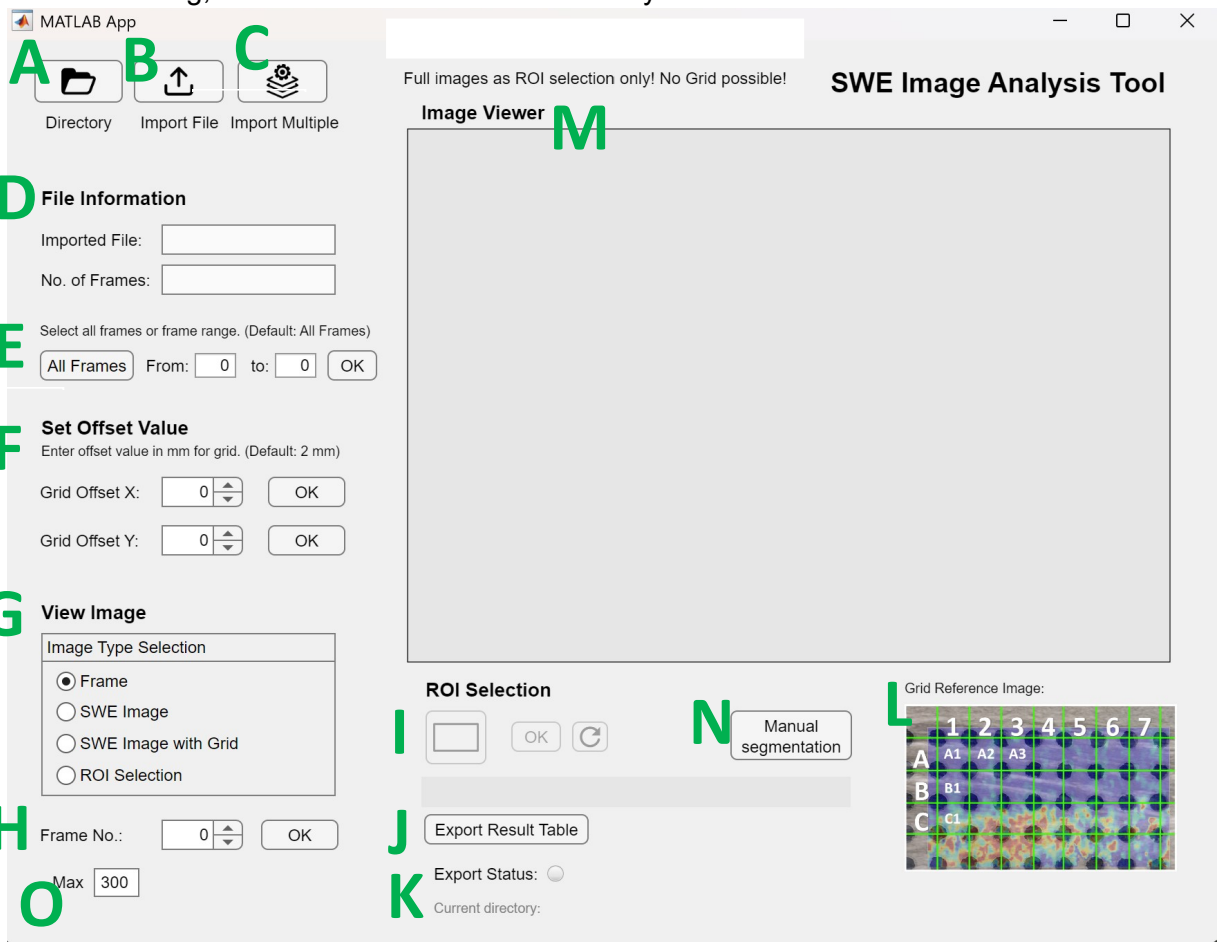

Figure 2: Screenshot of GUI with labelled functions.

Note: The automatic segementation is ONLY compatible with DICOM clips and ultrasound images with a top-bottom format where the SWE image is in the top ultrasound image!

A. Select a folder where the output excel table will be saved. The chosen directory is shown at the bottom of the window (K).

B. Import a single DICOM clip. The tool reads in the file directly from the directory. Therefore, the file cannot be renamed, moved or changed after importing.

C. Import a folder containing DICOM clips for multiple file processing. IMPORTANT: The folder should ONLY contain DICOM clips. No other file or file format should be in this folder!

D. Displays information of the input file, i.e. name of the file and the number of frames it has. If multiple files from a folder have been imported, only information of the first file in the folder is displayed. If other files within this folder need to be viewed, input them individually using function B.

E. Select a range of frames from the clip that should be analysed. ‘All Frames’ selects frame range from start to end. Manually entering a start frame and end frame and confirming with ‘OK’ saves the defined frame range.

F. Offset values for the grid overlay can be manually defined in millimetres. The image is only analysed beginning from the offset. The default X and Y offset is 2mm. This means that 2mm from the left (X) and 2mm from the top (Y) of the image are excluded from the analysis. Between each intersection, there is a 4mm distance. Only whole squares are analysed; partial squares are excluded.
The squares resulting from the grid are labelled according to the following image:

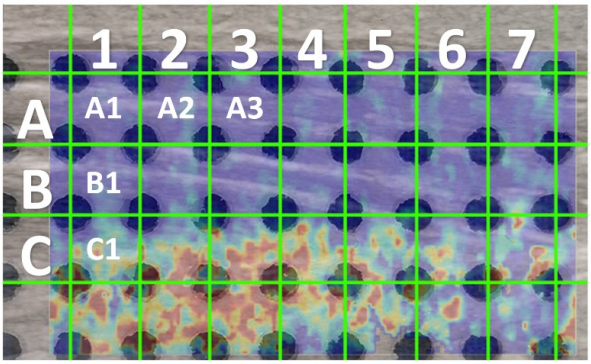

Figure 3: Labelling of squares in grid.

G. There are four viewing options to view each frame of the clip:
- Frame: To view the entire frame (default),
- SWE Image: To view only the SWE image,
- SWE Image with Grid: To view the SWE image with the calculated grid overlay and defined offset.
- ROI Selection: To view only the SWE image. This activates the drawing tools (I), enabling the user to manually draw on the image to define a ROI.

H. View different frames of the clip. Press OK to confirm defined frame number. This can also be used to define the ROI in a different frame than the default setting (which is the first frame of the clip)

I. ROI selection tools activated by selecting ‘ROI Selection’ radio button (G). Selecting the square enables the user to draw directly on the image viewer (N), which displays the SWE image only. Once the user is satisfied with the drawing, selecting OK saves the region. The defined region is then displayed in the image viewer (N). If the user is not satisfied with the selected region, the refresh button resets the SWE image, allowing the user to redefine a region. Only one ROI can be defined per clip in this way. This ROI is kept consistent throughout the whole clip/the range of frames that was selected (E).

J. This button analyses the image and exports the result table in a spreadsheet (, i.e. excel file) depending on what the user wants to analyse. Above the button, an information section informs the user on whether a grid analysis or a ROI analysis will be executed. It also displays the frame range (right) and the X and Y offset values (left) if a grid analysis is chosen.

   Exporting can only be done if a directory for the output has been selected (A). If a folder containing multiple files is imported (C), the button exports multiple excel files in the chosen directory. If only one file is imported (B), one excel table is saved in the directory. If in (G) the user has selected the 'ROI Selection' radio button, the chosen region of interest is analysed and results are saved. For all other radio button options, a grid analysis is executed and results saved in the excel file where each square is analysed and labelled according to Figure 3.

K. This information section displays the status of the export. The lamp is red if there is an error, yellow if the execution is in progress and green if exporting is complete. The red lamp and green lamp are accompanied with a short sound to notify the user.

   Beneath this, the current chosen directory for the output files is shown to inform the user where the files will be saved.

L. This is a reference image to inform the user how each square is labelled.

M. The image viewer displays whichever frame or image type the user wants to see. Upon importing, the first entire frame of the input file is displayed by default. Manual segmentation opens the ultrasound frame in a new window. There the user should select the top left and the bottom right corner of the greyscale image containing the elastogram (Figure 4). Next, the selected region is opened in a new window again, where the user should select the top left and bottom right corner of the elastogram (Figure 5). The user is instructed about this through MATLABs command window.

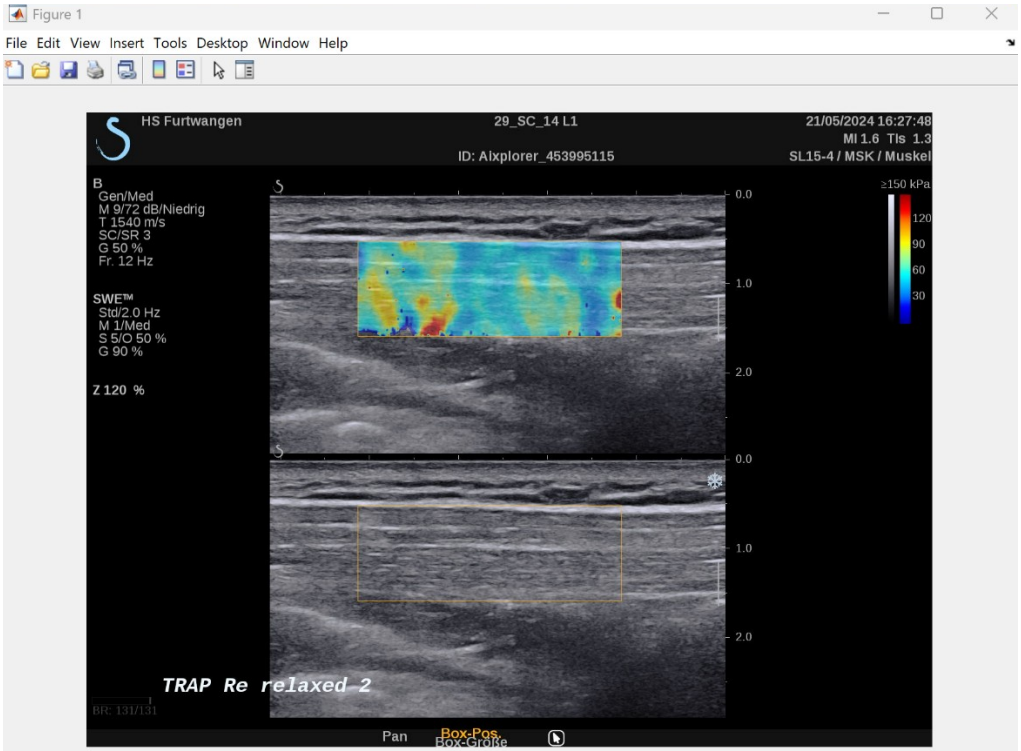

Figure 4: Full ultrasound image, opened as a new window in which the image can be segmented manually.

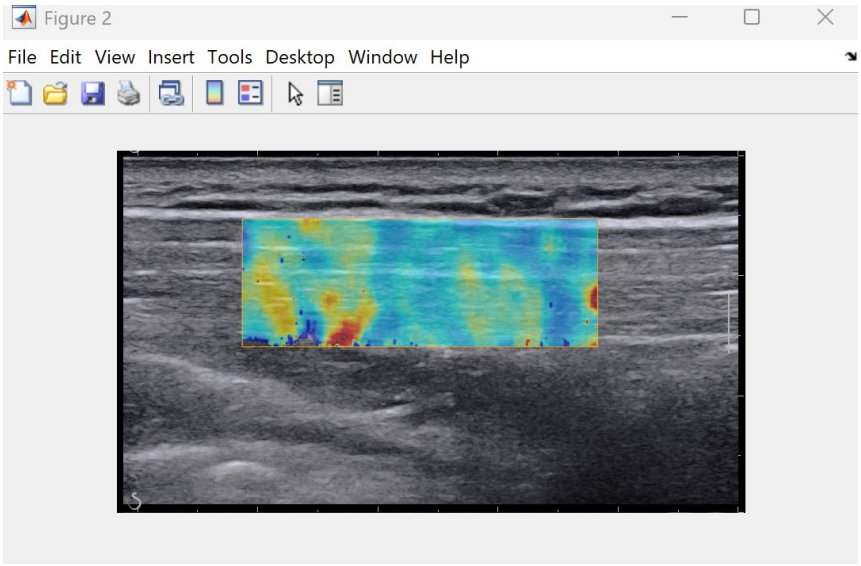

Figure 5: Greyscale image containing the superimposed elastogram, opened as a new window in which the elastogram can be segmented manually.

N. This will enable the user to manually segment the ultrasound image, if the image segmentation was not satisfactory or if the image is not oriented in the vertical format.

O. This will set the maximum value of the colormap. Must be the same value as the elasticity range of the colormap at the device prior to export.