Instructions

# Installation

## Compatible Operating Systems

* 64-bit Modern operating system (Windows, MacOS, Linux)

## Initial Algorithm Download

The algorithm can be accessed directly by navigation to the GitHub link page and selecting the green “code” button. Here you will have the option to install the algorithm files with GitHub file manager or to download a zip file directly to your computer. For those who are not familiar with advanced or custom software the zip file download (SD-OCT-Points-Based-master.zip) is recommended. Once the zip file is downloaded to your computer, double click on the zip file to access the SD-OCT-Points-Based-master files on your computer.

Once the files have been downloaded move them to a visible place on your computer. We would suggest placing the “SD-OCT-Points-Based-master” on the desktop before proceeding with the rest of the instructions.

Optional: For advanced operation using the terminal application you will need to create three separate folder named “Data”, “Images” and “SmoothingLine” to properly load and interact with your data but this step is not required for using the algorithm through its user interface.

If any of the files become damaged or missing, reloading the files from GitHub is the best course of action. **Note, you will not need to perform the pre-requisite installation more than once on one computer.**

## Software Pre-requisite Installation

This next step will prepare your computer for the use of the algorithm and involves installing some pre-requisite software including python3 and some of its related packages. This operation will mainly take place using python package manager pip. As this algorithm uses python3 ensure that the commands “Python3” and “pip3” are used and not their equivalent to avoid using the wrong version of python installed on your system.

### Navigation:

The first step of this process is to open the “Terminal” application then navigating to the folder SD-OCT-Points-Based-master that you have moved to your desktop (Note: The Terminal application is the command prompt on windows while it is accessed under the Utilities folder in Applications on MacOs). Enter the command “cd Desktop/SD-OCT-Points-Based-master” in Terminal. After pressing enter the names of the files should be found before the “%” in your terminal denoting the start of the command line input. All python files will be denoted by the ending ”.py”.

### Installation:

Now that we are in the correct folder in Terminal, we can now look at the contents of the “requirements.txt” file. This file contains the names of individual python packages to be installed in Terminal and saved in your operating system python distribution. Note: These files will not appear on the desktop after installation. This requirements.txt file contains the name of the package followed by the “~=” which denotes an equivalent or compatible software version to be requested in reference to version number feature at the end of each line.

The following python packages are included in the requirements.txt file:

* matplotlib 3.1.0
* numpy 1.17.0
* opencv-python 3.4.4.19
* Pillow 6.1.0
* XlsxWriter 1.1.8
* Xlwt 1.3.0
* wxPython 4.0.7.post2

Each of the above packages can be installed one at a time using the command “pip3 install “package name” i.e. pip3 install numpy. Alternatively, to install all of the packages in a single command you can proceed as follows. The command “pip3 install -r requirements.txt” will get each of the files from the requirements.txt file and install them in the Terminal application individually. If you are concerned with the possibility of previous versions of some python packages inserting with the installation of the python package requirements, you can install these packages with the command “pip3 install -U requirements.txt” which is especially useful for those running the MacOS operating system.

## Running the Algorithm

The algorithm can be run by selecting one of the SD-OCT-Points-Based-master files. The “Z” before some of the files denotes the use of Zebrafish specific segmentation instead of Lumpfish specific segmentation. To use the algorithm with the user interface you can select the “Program.py” for Lumpfish or “ZProgram.py” for zebrafish. On windows, a double click of this file, when properly installed, will launch the algorithm user interface.

On other operating systems, you will need to navigate to the SD-OCT-Points-Based-master folder in the Terminal application first using the same command as in the installation folder each time you close Terminal in order to run the algorithm. Once there use the “python3” before the name of the file you wish to open including its “.py” ending. Use the command line version of the algorithm with the command “python3 ImagePointsBased.py” or “python3 ZPointsBased.py” for Zebrafish. To use the algorithm with the user interface run the command “python3 Program.py” for lumpfish or “python3 ZProgram.py” for zebrafish.

## Algorithm Settings

The algorithm features many settings to allow users to control key variables. The following settings will be shown upon opening the user interface (UI) with one of the program.py files. Once the user interface is opened, select the “Path” button to choose the folder containing the SD-OCT B-scan images to analyze. These images are required to be in a “TIFF” format.

• Starting height of the image (UI mode only)

• Ending height of the image (UI mode only)

• Starting width of the image (UI mode only)

• Ending width of the image (UI mode only)

• Starting image number

• Ending image number

• Image set number (starts at zero)

• White value threshold

• Minimum gap value (Must be negative in command version)

• Maximum gap value (Must be negative in command version)

• Minimum pixel gap value

• Storage type (Classic = xls, Modern = xlsx, CSV = csv)

• Heat map setting (A for automatic or provide a number in pixel to compare sets of heat maps)

• Smoothing line (S = smoothing line, N = turn off smoothing line)

• Heatmap Options (Original, Viridis, Plasma, Inferno, Magma)

Settings for the threshold and gap values can be adjusted to optimize the segmentation of the retinal layers. These settings can then be confirmed by the “test” mode before analyzing a complete set of SD-OCT B-scans.

Select the “test” button to analyze only one B-scan denoted as the starting image or the “Start” button to analyze the full range of B-scans denotes by the starting and ending image number.

Alternatively, to use the command line version of the program you will be editing the “setting.txt” file which will give the user access to the above-mentioned settings in order from left to right. The command prompt version may be used to compute larger datasets at a faster speed.

## Algorithm Data Output

The data output from the algorithm will appear in the SD-OCT-Points-Based-master folder with the same identification name as the original SD-OCT scan. The full scan mode will automatically create 2D and 3D heat maps unlike the test mode which only processes the selected B-scan TIFF file. The 3D heat map can be rotated and each specific view saved individually. Segmented B-scans will be saved under the “image” folder while the smoothing line folder will contain the B-scan images with the smoothing line. Thickness measurements and the 2D heat map will be saved automatically. Thickness measurements are calibrated to one pixel equals 1.62 micrometer.

If you have chosen the command line base method, data files will appear in their respective folder for “Images” and “SmoothingLine” with the measurements file and heatmap appearing in the software folder.