

MIO: Mosaicing Indirect Ophthalmoscopy 3.0

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1 Overview

The Mosaicing Indirect Ophthalmoscopy (MIO) program allows you to easily obtain a single, high-quality mosaic given either a video indirect ophthalmoscopy (VIO) video or a set of still color images. The acceptable video formats are AVI, MPG, and WMV, while the supported image formats are PNG, JPEG, GIF, and TIFF. All output images are saved as PNG files.

The program has two modes: **Video Mode** is for VIO videos and **Image Mode** is for pre-existing sets of still images. The mode can be changed as needed prior to opening any files. Once a file of a given type has been opened, though, the chosen mode will remain fixed as long as the program stays open. To switch to the other mode, close the program, then reopen it and switch the mode before opening any files. We explain each mode in more detail below.

In both modes, the program saves four files on a folder called `mosaic` in the same folder as the original files. The four images in the folder are as follows:

- `mosaic_color_only`: The mosaic produced by using only the original color images.
- `mosaic_gabor`: The mosaic produced by using only the Gabor filtered images. These filtered images are obtained by filtering the color images with a filter bank of Gabor functions at different scales and orientations.
- `mosaic_color_enhanced`: The mosaic produced by enhancing the original color images with the Gabor responses.
- `mosaic_mix_075`: The mosaic produced by a linear combination of 75% `mosaic_color_only` and 25% `mosaic_gabor`.

Note that both the folder location and file names are fixed, so running the mosaicing command overwrites any existing files with those names in that location.

2 Video Mode

In **Video Mode**, the program creates a mosaic given a VIO video. To set the program in this mode, click on the menu item **Mode** → **Video Mode** or click *Ctrl-V* prior to opening any files. The current mode is listed below the main window on the lower left-hand side.

To create a mosaic from a VIO video, first load the chosen video using the **Open** command or by clicking *Ctrl-O*. The first twenty still images in the same folder as the chosen video will be shown in the small displays on the right. This still images are used to set the range of retinal colors and the location of the optic nerve. In this version, we require that there be at least one still image of the retina captured from the target video. In future versions, we plan to remove this restriction.

You can view any of the still images on the large display in the left by either clicking on the desired image or by scrolling through the images using the **Next** and **Previous** buttons below the main display.

Now, select one of the still images so that it is visible on the large display. We recommend choosing the highest quality still image from this set. Then, click on either the **Select Frames 1st Half** or the **Select Frames 2nd Half**

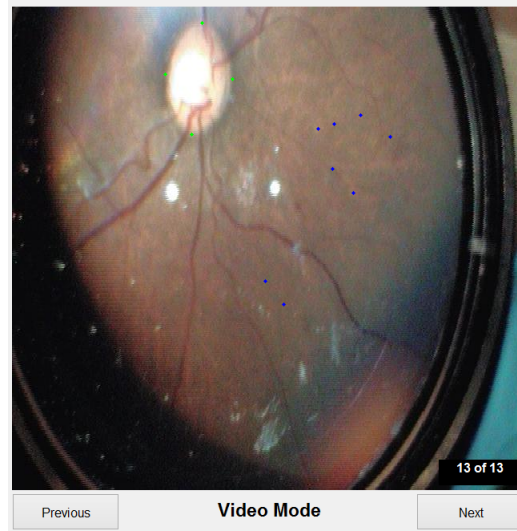


Figure 1: Screenshot of a chosen still image after selecting both the retinal points (in blue) and the optic nerve points (in green). Note how the optic nerve points are spread out around the optic nerve as far away from each other as possible.

button. Clicking on one of these buttons will turn the mouse icon into a large cross. First, click on a handful of retinal pixels in the chosen image. This step allows the algorithm to estimate the range of retinal colors in the video. Once you have selected enough points (we recommend between 3 and 8), right-click to go to the next step. In the second step, you must click on four points that delineate the optic nerve in the chosen image. These four points should be as spread out across the optic nerve as possible. Figure 1 shows a screenshot of a still image after both the retinal points (in blue) and the optic nerve points (in green) have been selected.

After selecting the optic nerve points, the program will automatically scan through the video to find the best retinal frames. If the **Select Frames 1st Half** button was pressed, the program will search in the first half of the video; if the **Select Frames 2nd Half** button was pressed instead, the search will be over the latter half of the video. When the search is completed, the top twenty frames will be displayed on the small displays on the right, in order of estimated quality. That is, image 1 is the frame that the algorithm considers to have the highest quality, image 2 the second best quality and so on.

Once the twenty images have been displayed on the right, click on **Best Images** to select the images that you want to fuse into a single mosaic. Once the button has been pressed, the cursor changes to a large cross. Now, clicking on any of the right-hand displays will select that image (and show it on the large display). Selected images are indicated with a red border. Clicking on a selected image unselects it. Right-click to finish selecting the best images.

If you select two or more images, then the **Create Mosaic** becomes active. Click on this button to obtain the final mosaic. Once the command has finished, the mosaic will be displayed on the large display. As noted above, the program automatically saves four mosaic images to a `mosaic` folder in the folder where the video is located. The mosaic shown on the large display corresponds to the `mosaic_mix_075` file.

You can start the whole process over by reloading the video using **Open**. Alternatively, you can generate a different mosaic by clicking on either the **Select Frames** or **Best Images** buttons. The former will require you to re-input the retinal and optic nerve points and will obtain twenty new frames, while the latter allows you to compute a new mosaic using any combination of the twenty frames currently displayed on the right.

3 Image Mode

Image mode is similar to Video Mode, with two key differences: (1) there is no automatic frame selection and (2) you have to manually specify the center image. In more detail, you must first set the program on image mode by either clicking on the corresponding menu item or by clicking *Ctrl-I* before opening any files. The text below the main display should read **Image Mode**.

Now, click the **Open** button or click *Ctrl-O* to bring up the load image dialog. Navigate to the folder that contains the images that you wish to fuse. Note that all the files must be in the same folder. Click on any image file in the chosen folder. The program will then load the first twenty images in that folder and display them on the right-hand side.

After the images have been loaded, click on **Best Images** to select the images that you wish to fuse. The mouse cursor will change to a large cross. Select an image by clicking on it; selected images are indicated by a red border. To unselect an image, click on it again. Right-click to finish selecting images.

If two or more images have been selected, the **Center Image** button will become active. Click on this button to pick the image that will serve as the frame of reference for the remaining images. We recommend selecting the image where the optic nerve is most central. The central image is indicated by a green border.

Once the central image is chosen, the **Create Mosaic** button will become active. Clicking on this button will start the mosaicing process using the selected images. As noted above, the program automatically saves four mosaic images on a subfolder in the folder where the original images are located and the mosaic corresponding to the `mosaic_mix_075` file is shown on the large display.

To create a new mosaic, either load a new set of images or click on the **Best Images** or **Center Image** buttons to change the selected images or which image is used as the center of reference.