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Notes on optical imaging GUI "Optv27.m"

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Some useful commands in Matlab

- Editing the code: **Ctrl+** closes all the functions to overview the subroutines of the entire code
 - On the command line: **imaqreset** restarts the cameras if they hang after a crash
 - On the command line: **imaqtool** opens up a GUI to explore available cameras
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The GUI is run by typing "OptvXX" in the command line of Matlab.

The code has a main section, functions that control the buttons, and functions that do calculations.

General camera set up starts at the very beginning of the main code and will more than likely need changing before the code stands any chance of running.

Searching for "SYNC" and "ANALYSIS" in the code should locate the places where cameras are sync-ed and analysis is done, respectively. These will need changing for different cameras and approaches. Currently the code is set up for a Windows laptop using the built-in camera and an external webcam. They have quite different acquisition rates which cannot be controlled and do not start at exactly the same time. The SYNC sections of the code take account of this issue. The actual acquisition is frame-based and the number of frames for each camera is different and chosen so each acquires approximately the same amount of time each acquisition block.

To start the GUI:

1) choose a blue button:

- for acquisition, press ACQUIRE NEW DATA button
- for off-line analysis, press either ANALYZE SINGLE DATA SET or ANALYZE MULTIPLE DATASETS

2) press the green START button

if in acquisition mode, this starts the cameras

if in off-line modes, analysis does not start until the slider is moved/tapped

Adjusting parameters

Acquire new data

1 Camera approx rates

The program estimates the approximate acquisition rates for the cameras at the start of execution and writes them here.

2 Frames per acquisition

We need to set a buffer size in terms of numbers of time frames for each camera. Once this number of frames is acquired, they are written to memory, and are then available for analysis. For camera 1, the default buffer size for number of frames is set at 120 (`mydata.nFrames1 = 120`) and for camera 2, the buffer size is

computed so that the amount of time collected is very similar for both cameras i.e. the number of frames for camera 2 is calculated based on the relative camera acquisition rates as follows:

$$\text{mydata.nFrames2} = \text{ceil}(\text{fps2}/\text{fps1} * \text{mydata.nFrames1}).$$

Change these numbers within the code if needed (line 133, `%set up default values for speed`).

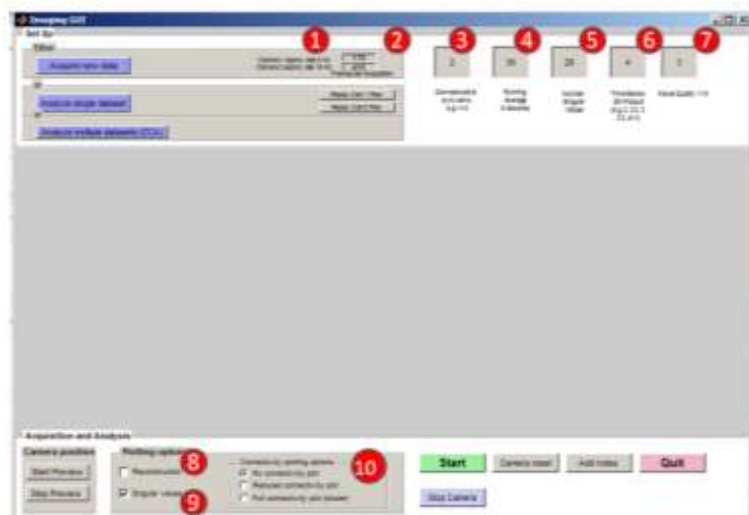
3 Downsample to sync cams e.g. 1-10

If the acquisition rates are very different, a method for synchronizing the data from the cameras is needed. If `downsample = 1`, then the time points are taken from the slower camera (camera 1) and then, at each time, the frame from camera 1 is paired with the frame with the closest corresponding time point from camera 2. If `downsample` is increased, the time points from the slower camera are downsampled and matched with closest times from the faster camera.

4 Running average in seconds

The running average is the length of time used in the SVD calculations.

5 Number of singular values



4/20/2012

Number of singular values used in data reduction.

6 Time-bandwidth product

Used in multitaper.

7 Movie quality

If $\alpha=1$, then no frames are skipped. If larger, then frames are skipped (but not lost) making viewing the movie faster.

8 Reconstruction

Check this if you want a movie to play

8 Singular values

Check this if you want the magnitudes of the singular values to update. This is helpful when trying to identify time periods of increased activity.

10 Connectivity plots

Check these for connectivity estimates. Full connectivity is (potentially prohibitively) slow to plot.

Analyze single dataset

Options 3-10 can be reset for analysis of the data. Once Start is pressed, a plot of magnitude of singular values against time (actually frames) will open. Once the slider is moved the analysis begins using the running average value selected in 4. If values in 3-10 are changed it is necessary to press Start again to update the GUI values.

Analyze multiple datasets

Canonical correlation analysis is performed on the data selected on the slider and using the value in 4 for the running average.

Overview of subroutines

