

Using the PhenoCam GUI Tool

Overview

The PhenoCam GUI Tool is a MATLAB[®] application. It is written specifically to process images from the PhenoCam network (<http://phenocam.sr.unh.edu/>). To run the tool you will either need to have a MATLAB license, or if no license is available, you can download one of the precompiled versions (if it's available for your platform). The precompiled versions include a run-time version of MATLAB for a specific platform. The source files, precompiled versions, and sample data are available for download at:

<http://phenocam.sr.unh.edu/webcam/tools/>

Image Collection Organization

The Phenocam Tool was designed to conform to the file structure and file naming conventions of the Phenocam (<http://phenocam.sr.unh.edu>) project. You can use the available test data from the Bartlett site as an example. The conventions we have adapted are:

Image Filenames are in the form: `sitename_YYYY_MM_DD_hhmmss.jpg` where,

YYYY - year
MM - month
DD - day of month
hh - hour
mm - minute
ss - second.

The images are organized by site, year and month where each month is represented using a two-digit number (i.e. 01, 02, 03... 12). If you download the sample data, the zip listing is as follows:

```
unzip -l sampledata.zip
Archive: sampledata.zip
      Length      Date    Time     Name
----- -----
          0 2012-10-15 15:36  bartlett/
          0 2012-10-15 15:34  bartlett/2006/
          0 2012-10-15 15:33  bartlett/2006/01/
1855584 2012-10-15 15:33  bartlett/2006/01/bartlett_2006_01_01_124550.jpg
183378 2012-10-15 15:33  bartlett/2006/01/bartlett_2006_01_01_130115.jpg
190476 2012-10-15 15:33  bartlett/2006/01/bartlett_2006_01_01_131642.jpg
188838 2012-10-15 15:33  bartlett/2006/01/bartlett_2006_01_01_133207.jpg
193053 2012-10-15 15:33  bartlett/2006/01/bartlett_2006_01_01_134732.jpg
.
.
.
```

If you download images from the phenocam site they will be organized in the above manner. Besides the sample images available on the “Tools” page you can download data from any of our camera sites here:

<http://phenocam.sr.unh.edu/webcam/network/download/>

(Before downloading image data you will be asked to register using a valid e-mail account.)

Installation Instruction – Source Version

Download the source version from the “Tools” page at (<http://phenocam.sr.unh.edu/webcam/tools/>). Unpack the .zip file into a directory. Start the MATLAB desktop and add the installation directory to your MATLAB path. On a unix/linux system you do this by typing something similar to:

```
path(path,'/path/to/PhenoCamGUI');
```

in the MATLAB command window. For a Windows system it will be something like:

```
path(path,'c:\path\to\PhenoCamGUI');
```

To start the application you then just type:

```
phenocamimageprocessor
```

in the MATLAB command window. If you do not want to add the directory containing the source to your path just change the working directory to where the source files were extracted, then run the above command.

Installation Instructions – Windows Precompiled Version

There are two Windows precompiled versions, one for a 32-bit Windows installation and one for a 64-bit Windows installation. Download the appropriate version for your platform and double-click the appropriate executable (either *phenocamW32_pkg.exe* or *phenocamW64_pkg.exe*). Follow the prompts to install the MATLAB Compiler Runtime (MCR) as if you were installing any other Windows software program. This installation will also create a folder in your C: drive for MATLAB program files.

During installation, you will likely be asked to also install *VCREDIST_V90_X86* and *VCREDIST_X86*. Click **Install** to install them. The full installation should take 5-10 minutes.

Once installed, you should have the following four files in the installation directory:

- `MCRInstaller.exe` - ~196 Mb
- `PhenocamW32.exe` or `PhenocamW64.exe` - ~2Mb
- `PhenocamW32_pkg.exe` or `PhenocamW64_pkg.exe` - ~195Mb
- `readme.txt` – 1Kb

You can erase the `MCRInstaller.exe` and `phenocamW32_pkg.exe/phenocamW64_pkg.exe` files. Be sure to retain the `phenocamW32.exe (32-bit systems)/PhenocamGUIW64.exe (64-bit systems)` file which can be moved to a different folder if you like. To start the application double-click on the `PhenocamW32.exe (32-bit systems)/PhenocamW64.exe (64-bit systems)`.

Installing Precompiled Mac OSX Version

A beta-version of a precompiled executable for 64-bit Mac OS X is available on the Tools page. (This version has a bug, which prevents it from saving the results of the time-series calculation. Hopefully we will have an updated version soon.) To install the software download the file,

`PhenoCamGUIMac64_pkg.zip`

The installation directory will contain the following files:

- `MCRInstaller.dmg`
- `phenocamMac64.app`
- `readme.txt`
- `run_phenocamMac64.sh`

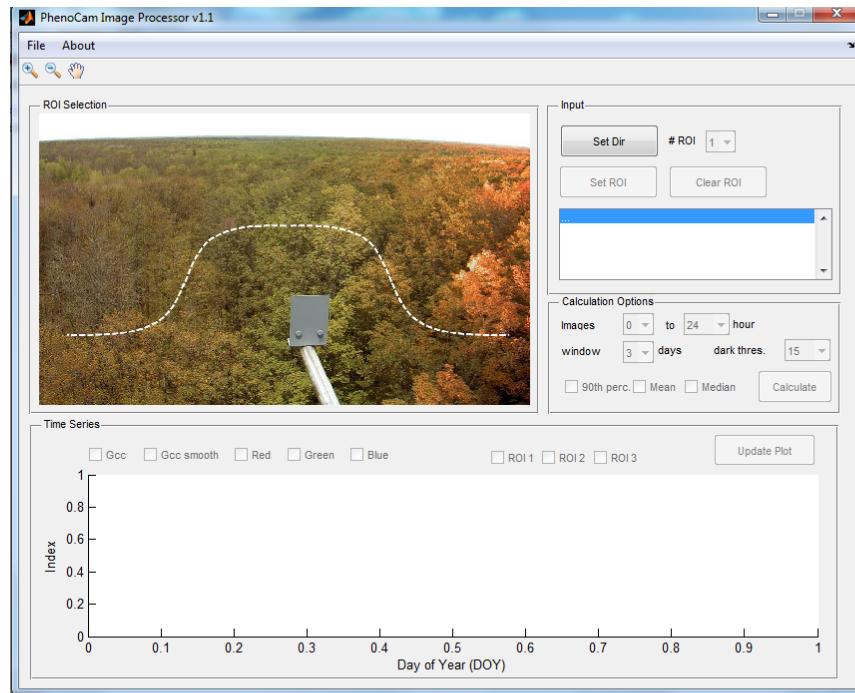
Double-click the file, `MCRInstaller.dmg`, to run the MCR installer. This will install the MCR into your Applications directory so you will be prompted to supply a password for an account with installation privileges. To start the application, open a terminal window and change directories to the installation directory. Then execute the shell script, `run_phenocamMac64.sh`, by typing:

```
chmod +x run_phenocamMac64.sh  
./run_phenocamMac64.sh
```

This will set some required environment variables and execute the precompiled application in the MATLAB run-time environment.

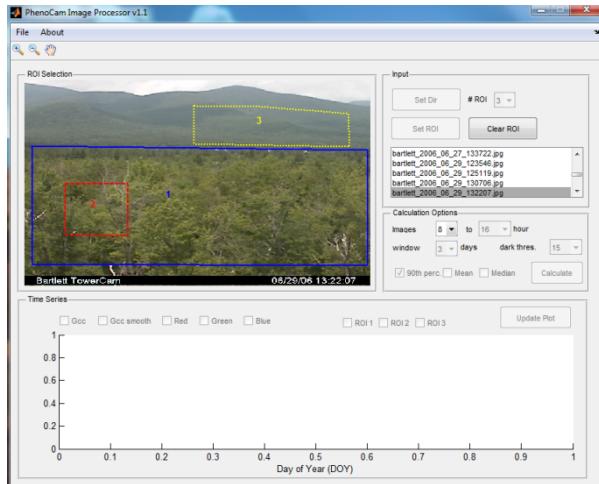
Using the GUI

Starting the PhenoCam GUI application will open the Phenocam Dialog window, as shown below.

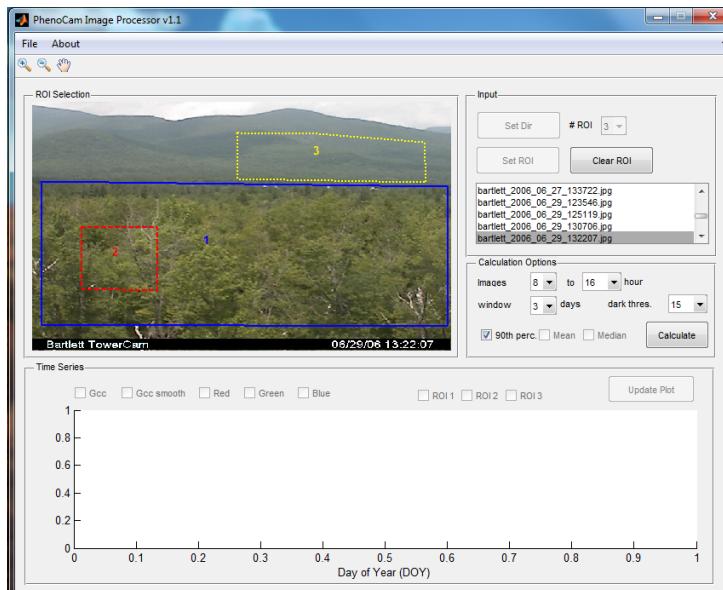


NOTE: Please follow instructions in the correct order as described below. The program will not respond or fail if done in the incorrect order.

1. Click on **Set Dir** and direct the Windows Explorer window to a folder containing your imagery archive. The program is designed to operate on one year's worth of imagery at a time. And so, if we wanted to process Bartlett imagery, we would direct it to Bartlett\2006 and press **OK**. One image should appear in the viewing window to the left. You can set which picture appears by selecting it from the list produced at right.
2. Choose the number of Regions of Interest (ROI) using the menu, **# ROI**. Then, click on **Set ROI** to create the ROI(s). Designating a ROI will depend on the science question being asked: it may range from one particular tree to a stand dominated by one species or even the entire vegetated area. As a rule of thumb, the ROI should be large enough, however, that any minor shifts in the field of view over time will not substantially alter the delineated region. Left-click on the image to enter nodes of a polygon and right-click to finish each polygon. Click on **Clear ROI** if you need to start over. If you want to zoom in/out or pan the image, you can use the corresponding icons (magnifying glasses and hand) in the upper left-hand corner.



3. We can now set the **Calculation Options**. First, set the minimum (left pull-down menu) and maximum (right pull-down menu) hour of the images to include in analysis next to **Images**. Generally, one should set the hours to remove most nighttime images from analysis, although there is another filter that separately removes very dark images.
4. We will now choose the filtering window. This is the number of days over which the data will be smoothed and filtered – use the pull-down menu next to **Windows** to enter a number. We generally suggest a window of 3 days based on prior research.
5. Choose a darkness threshold using the menu next to **dark thresh**. This number dictates the minimum digital number value (pixel brightness). We generally suggest a value of 15%.
6. Lastly, choose either **90th perc.** (percentile), **mean** or **median** filtering using the radio buttons. This smoothing will produce a time series of the 90th percentile, mean or median value at the interval (window) chosen above. At this point, the dialog box with typical settings should appear as below:



7. Click on **Calculate**. A progress bar will open up.
8. After calculating, you can display both the raw results (**GCC, red, green** and **blue** values for every photo) and smoothed results (**GCC smooth**) using the radio buttons. The GCC smoothed data represent the results from filtering (90th percentile, median or mean) over the given time window (e.g. 3-day, 5-day). To switch between plots, click on **Update Plot**.
9. You can save your results (as a normal, comma-separated-value (CSV) text file) and the ROI file (as a binary MATLAB file) by clicking on **File>Save ROI** and **File>Save Time Series Data**, respectively.
10. To analyze an additional year of data from another folder, click on **Clear ROI** and **Set Dir** to select the new folder. To reload a saved ROI, go to **File>Load ROI**.

Special Considerations

Because of the way that ROIs are interpreted by MATLAB, all photos from the entire year analyzed must have identical dimensions. Even a minor change from, say 1024 x 1096 to 1024 x 1090 would cause the output results to be entirely unreliable. However, camera settings may be changed and/or cameras may be replaced. If that is the case, take careful note of when any changes may have occurred and run the Phenocam Tool twice – once for the first photo dimension and again for the period after the change in dimensions - or more if there are multiple changes. For instance, if a camera change occurred on March 24th at 11:36, run Phenocam twice. On the first run, be sure to use a photo from before that date to draw the first ROI. On the second run, be sure to use a photo from after March 24th to draw the second ROI and run again. You will then want to merge the output text files to create one representative GCC time series for the year. The same process should be followed if there are substantial changes in the field of view of the images which render the ROI useless for a latter period of the year.

This manual editing is of course, not ideal. For users with a high number of changes in the field of view or dimensions, or for those processing a large number of sites, MATLAB code is available for more efficient data processing. However, a MATLAB license is needed.

Uninstalling the PhenoCamGUI

For precompiled versions the MCR is installed as a standard application. As a result follow normal operating system procedures for installing the MCR. For Windows users you go to **Control Panel > Programs and Features** to uninstall the MATLAB Compiler Runtime 7.15 program. You can also erase the *phenocamW32.exe/phenocamW64.exe* and *readme.txt* files from your computer. For Mac OSX users, the MCR is installed in the Applications folder.