Instructions

## Open a photo

Click “Open Photo”. Select your file as normal. The photo should be gray scale.

## Open a set of points:

Click “Open points”, and chose a file. File format must be comma delimited xy data in two columns.

## Calibrate Photo:

For calibrating the image, that is to determine the scale factor (picture units to pixels), it is assumed that one has a reference distance in the image, such as a scale bar or feature of knowledge length. Enter the scale bar value or the length of this feature in the calibration box.

To then calibrate with the picture scale bar, click calibrate. Select the two ends of the scale bar.

Note that only the horizontal distance is used to calculate the units to pixel scale factor. Also note that while the units are quoted as microns/pixel, the units if the picture is arbitrary, and may be in meters, cm, mm, nm, etc. I used um, because that was the scale length of interest for my work.

In the case of points loaded, the calibration variable is set to 1, i.e., 1um/pixel, where again um is arbitrary.

# Point Analysis

## Selecting points

Click select points, and select all the points you wish by clicking with the mouse.

You can delete a point by right clicking on it.

End the select points mode by pressing enter.

## Save points

To save points in a csv (comma delimited format), click “Save Points.0”

## Select Region of Interest (ROI) in set a points

To select a ROI, click “Select ROI Points”, and draw a box around the points of interest. Press enter to complete the selection. Included is a sample of points data, that can be loaded and analyzed.

# Point Functions

Given a set of points, you can perform the following functions:

1. Structure Factor Calculation
2. Voronoi Plot
3. Delaunay Plot

# Correlation Functions

Given a set of points, you can perform the following calculations:

1. 2D Pair correlation – see <http://www.physics.emory.edu/~weeks/idl/gofr.html>
2. O6-Correlation - see *J. Mater. Chem.,* 2009, 19, 344–349.
3. O2-Correlation – just another derivation of O6
4. Orientational Order parameter - see *J. Mater. Chem.,* 2009, 19, 344–349.
5. Bond Order - - see *J. Mater. Chem.,* 2009, 19, 344–349.

Note: The correlation functions may have a lot of noise in them or be limited in their radial data. This can be changed in the gofrone2D.m, g6ofrone2D.m, and g2ofrone2D.m m-files: change the number of steps (currently set to 1200) to increase and decrease the radial distance in which data is calculated; and change the radius factor (currently set to 0.025, so change the smoothness. The slice of code that requires adjustment is shown below:

for i = 1:1200 %300 steps

radius = i\*0.025; %of 0.1 microns

inn = radius-0.025;

## Save Correlation Data

To save the calculated correlation data, click “Save Correlation Data”, and the most recently calculation correlation data may be saved.

# Image Analysis

## Select Region of Interest (ROI) in an image

To select a ROI, click “Select ROI Area”, and draw a box around the area of interest. Press enter to complete the selection.

## FFT

Press the FFT button to calculate an FFT of the photo. It will open in a new figure.

## Particle Tracking

This program includes particle location, as implemented in the routines of John Crocker and David Grier (<http://www.physics.emory.edu/~weeks/idl/>). Information of the MATLAB implementation can be found here: <http://physics.georgetown.edu/matlab/>.

Note: The image must be gray scale.

The two fields pass the parameters to the function bpass, which is a spatial bandpass filter which smooths the image and subtracts the background off. The two numbers are the spatial wavelength cutoffs in pixels. The first one is almost always '1'. The second number should be something like the diameter of the 'blob's you want to find in pixels.

Image Process: Allows you to view the process of your image, to ensure that the background has been properly subtracted, and that the particles appear as “blobs” for ease in locating by the software. For For further information, please see: <http://physics.georgetown.edu/matlab/tutorial.html>.

Included is a sample photo (“sample\_particles.tif”), for which that particles can be located using (1,6) as the spatial wavelength cut off values.

Track: Once the optimal parameters are found, you can click “track” to have the software plot the locations of the particles, and store these points as xy data, which can be saved.

# Other functions

## Size determination

To determine the same of features, for example a set of spherical particles, one can simply click the sides of the particles to create pairwise locations, and then perform a Pythagorean distance calculation with the xy data in excel.