Diffraction patterns programs

This document describes briefly the results obtained from the execution of the programs involved and its proper uses.

Processing program − *circular-projection*

This program process one or a bunch of images and produces an output with the information obtained. This information is:

- Angle. Value of the orientation angle of the image intensity.
- Standard deviation. Value of the standard deviation of the orientation angle based on the distribution of the intensity in the radial direction.
- Angle range. Value of the orientation angle minus/plus the standard deviation.
- Area. Total intensity of the image.
- Ring X: Values obtained for the different rings detected. Batch mode prints up to 10 rings' information.
  - Radius. Distance from origin to the ring.
  - Variance. Standard deviation of the ring distribution in radial direction.
  - Peak value. Maximum value on the ring values.
  - Intensity. Average intensity on the ring based on the angle range.
  - Angle range. Angle range of the ring included inside the image.
- Minimize method. Method of minimization used to fit the Gaussian model for the radial integration histogram.
- Rings distance. Value of the 'normalized' distance between rings, although some of those rings could not be present on the image.

Use of the program

This program can be used as a single image processor or a batch mode processor producing figures and text output or a folder with the output images and a csv with all the information detailed before, respectively.

Single image processor

To process only one image, the program use is:

```
python circular-projection-v1.6 <options>

-h: Displays the help info about usage
-i: Specify the image to be processed
```

Batch mode processor

To process a bunch of images, the program use is:

```
python circular-projection-v1.6 <options>

-h: Displays the help info about usage
-b: Output CSV file name
-f: Path to images folder
```

In this case, the folder that contains the images should not contain other files than the images to process, although having other folders is compatible.

Results displayer – *display_results*

This program will allow you to display the information obtained in the processing of the images from different points of view. The figures shown are:

- o Total intensity map. It displays a heat map with the values of each image intensity, it allows to blur the image to smooth the image.
- o Distance between rings map. Displays the computed distance between rings as a heat map.
- o Angular range map. Heat map over the deviation of the intensity orientation.
- o Orientation and direction vector field. Vector field that shows the direction (orientation angle) and intensity (vector size and color) of the image. The interactive controls allows to change the vector size and smooth the image information.
- o Elliptical representation of orientation and angle range. Ellipses are used to display the orientation of each image (orientation of the ellipse) and angle range (width of the ellipses).

The user can also click on the pixel information of the heat maps to get the correspondent image displayed as well as some information printed out.

Use of the program

This program has an only use:

```
python display_results.py <csv file> <hdf file> <images folder path>
```

- - CSV file. Output file produced by the batch mode of the circular-projection program.
- - HDF file. File that contains the information about the specific experiment to display. It contains the coordinates of each image in the experiment tissue.
- - Images folder path. Path to the test images folder, it will be used to display the images when clicking on the pixels of the heat maps.