

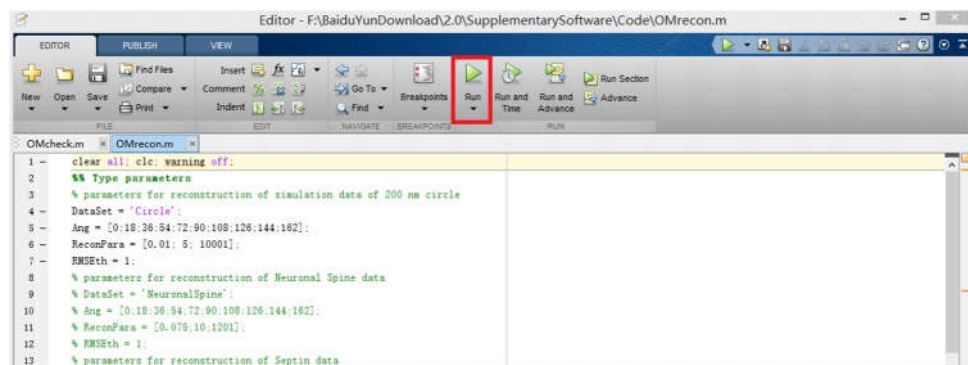
# A tutorial of using SDOM software for reconstruction and analysis

## Content

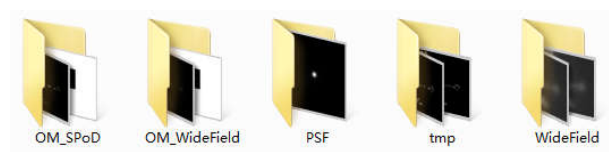
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## A. Step-by-Step Instruction

1. Install Matlab (<http://www.mathworks.com/> , R2012b, 2013b and 2014a have been tested).
2. Download and install Anaconda (<http://www.continuum.io/downloads>), choose python 2.7 version.
3. Download and unzip supplementary software (no special characters or space in the file pathway).
4. Open Matlab from startup menu and Open './Code/ OMrecon.m'.
5. Set parameters in 'Type parameters' (Uncomment the DataSet needing process and comment other DataSets); parameter description is in Part D.
6. Click on 'RUN' button or press 'F5' to run this code; the whole processing will last for several minutes.

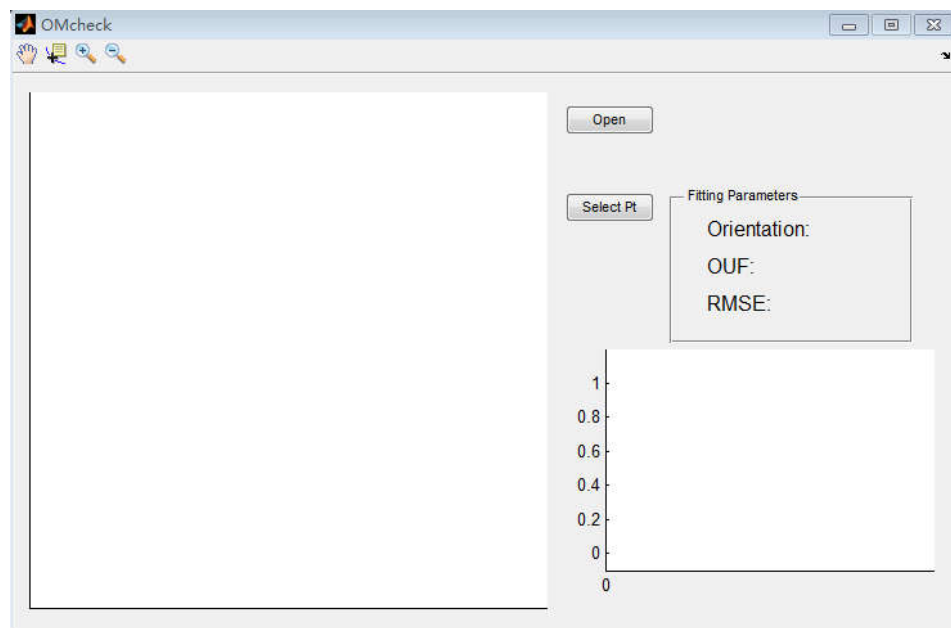


7. All the results are stored in './Data/DataSet/' and see "C. File Description" for details;

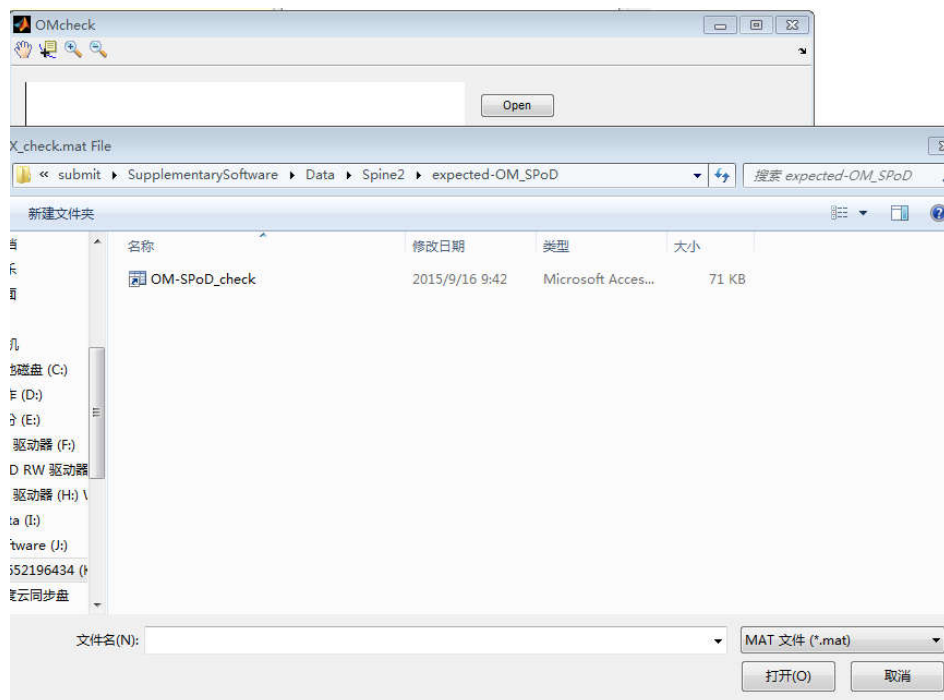


8. 'OMcheck.m' can be used to check detailed fitting effects. Using Matlab

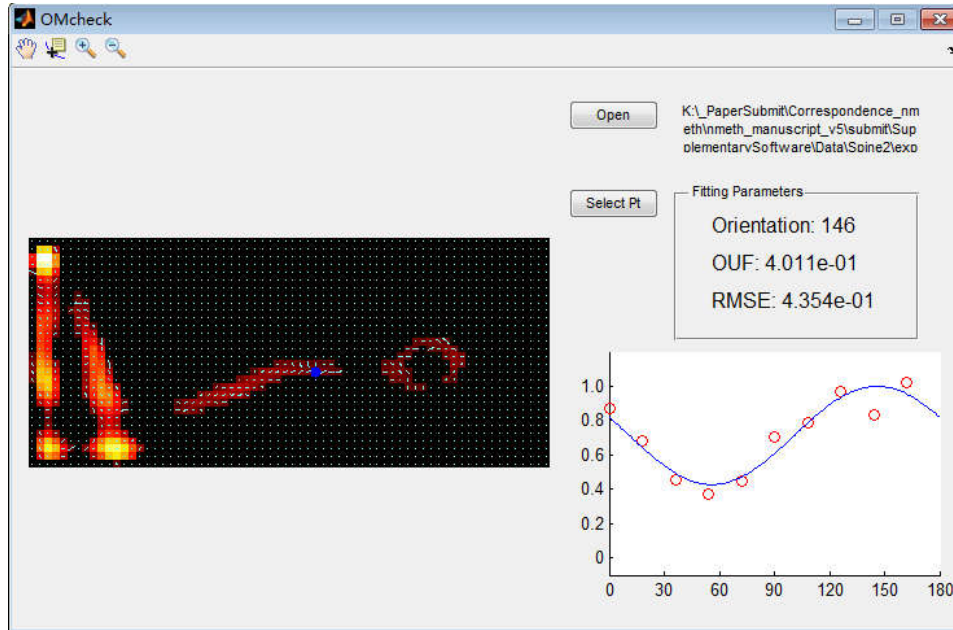
open this file, this GUI would appear:



9. Click 'Open' button, choose  
'./Data/DataSet/OM\_SDOM/OM-SDOM\_check.mat'



10. Left-click 'select pt' button and **RIGHT-CLICK** on any point of the image, original modulation information and fitted curve would appear on the axes right



## B. Installation

This software has been tested on Win 7 operating system with MATLAB (R2012b, 2013b and 2014a have been tested) and Python 2.7 with numpy, scipy, matplotlib installed. Matlab is a charged software, which, however, could be replaced by Octave (<http://www.gnu.org/software/octave/>, free software, NOT tested). Python is a free software which can be downloaded via internet. Here we choose Anaconda (<http://www.continuum.io/downloads>) for setting up the python distribution, which includes all the libraries needed to run our code.

## C. File Description

1. './Data/DataSet/':
  - 'WideField' and 'PSF' directory are data stored before running reconstruction program. They are original images captured by camera and point spread function of the system. All the images are in '.tiff' format.
  - 'OM\_WideField' directory stores orientation mapping results of original wide field images.
  - 'OM\_SDOM' directory stores orientation mapping results of SDOM reconstructed images.
  - 'tmp' directory is a run-time directory which can be ignored.
  - Five different data sets of sample data are provide to reproduce most figures in main text and supplementary information.
2. './Code/':

- ‘OMrecon.m’ is the main function to start the whole processing to obtain super resolution image and orientation mapping result.
- ‘OMcheck.m’ and ‘OMcheck.fig’ are to visualize the orientation mapping analysis result.
- ‘SDOM.py’ is called in ‘OMrecon.m’ for SDOM reconstruction.
- ‘./Code/Util/’ contains function files to fit the reconstructed data and calculate orientations.

## D. Parameter Description

1. ‘DataSet’: this is a string, which is the same with the directory name in ‘./Data’.
2. ‘Ang’: this is a vector, whose length is the same with the number of images. Each value means the polarization angle of incident laser when the image was acquired.
3. ‘ReconPara’: this is 3\*1 vector. First two parameters is regularization coefficients  $\lambda_1$  and  $\lambda_2$  in the optimization model. They are empirical parameters, set large  $\lambda_1$  or small  $\lambda_2$  to increase background level and vice versa. The third parameter is iteration number.
4. ‘adjR2th’: threshold for adjusted R2.
5. ‘vecZoom’: zoom factor for orientation mapping with wide-field image since their OUFs are relatively small.