SS-SIM Quick Operation Manual

1. Principle

Structured illumination microscopy (SIM) is a powerful super-resolution optical technique most suitable for live sample imaging. However, conventional SIM suffers from limited penetration depth (tens of micrometers) since its wide-field illumination is susceptible to sample scattering. To overcome this limitation, we developed a sparse scanning structured illumination microscopy (SS-SIM) as a super-resolution imaging technique for thick sample imaging. SS-SIM utilizes sparse fringe patterns generated by resonant scanning of a focused laser spot and synchronized intensity modulation. SS-SIM achieves a spatial resolution of 154 ± 12 nm, ~1.6-fold enhancement over conventional wide-field microscopy, across an imaging depth range from 0 to 600 μm. We envision that our technique will find applications in imaging cells, tissues, and organisms, as well as other areas of the life sciences.

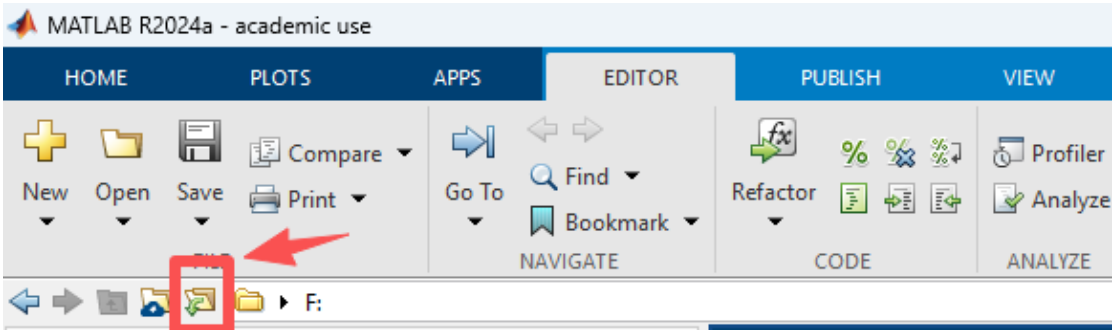
2. Requirement on input data

The sample is illuminated by sparse structured light fringes in two orthogonal directions using multi-step phase shifting to acquire multiple phase-shifted images. Recommended parameters: Fringe period: 2.4 μm; Phase steps: 12.

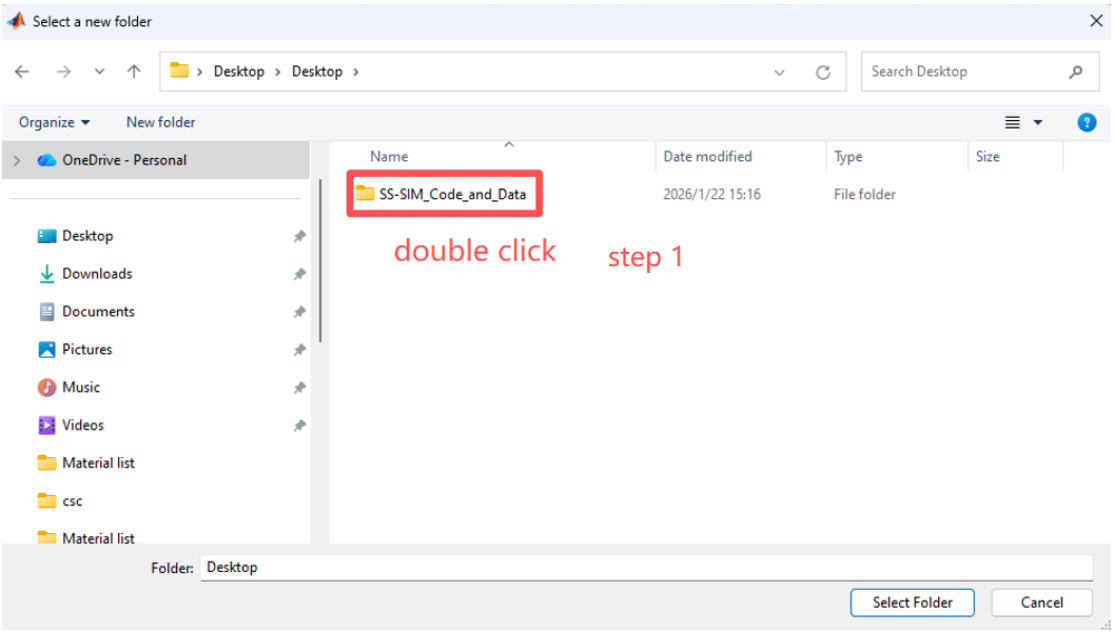
3. Reconstruction steps

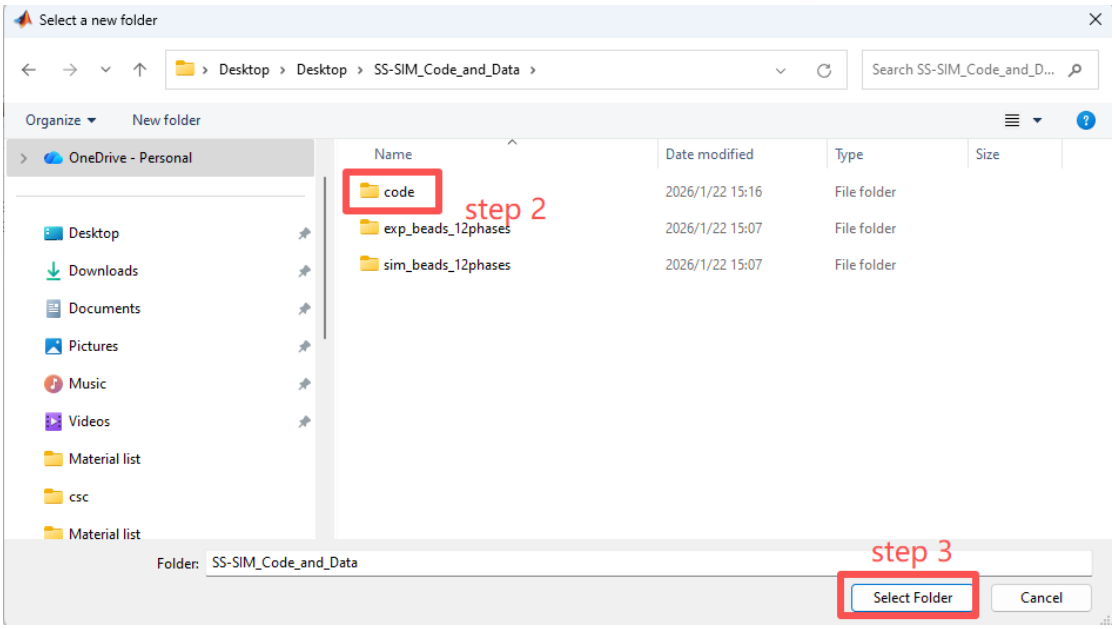
(1) Start the Matlab software.

(2) Click the file browser button on the main interface.

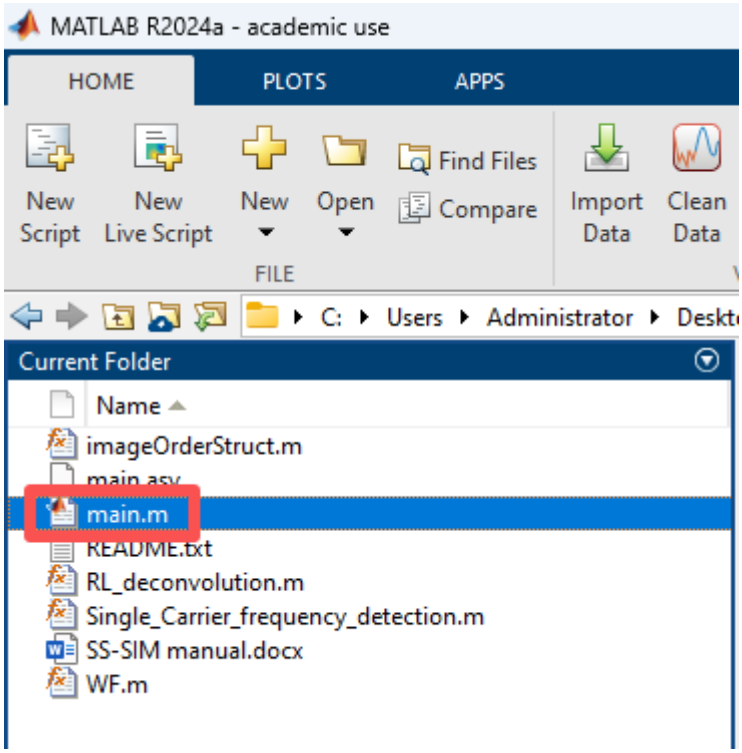


(3) Locate the folder containing the sample code in the file explorer.

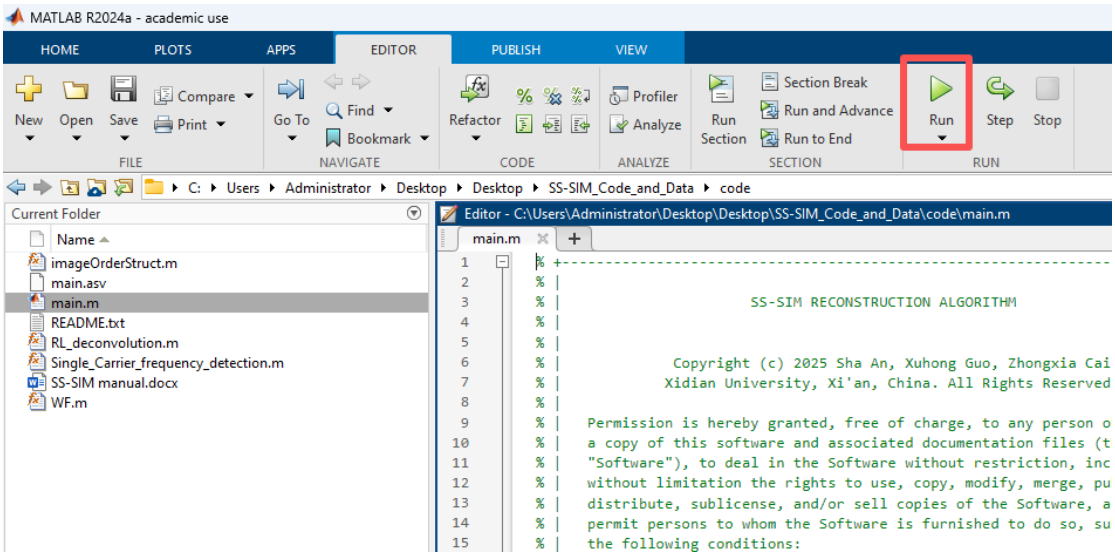




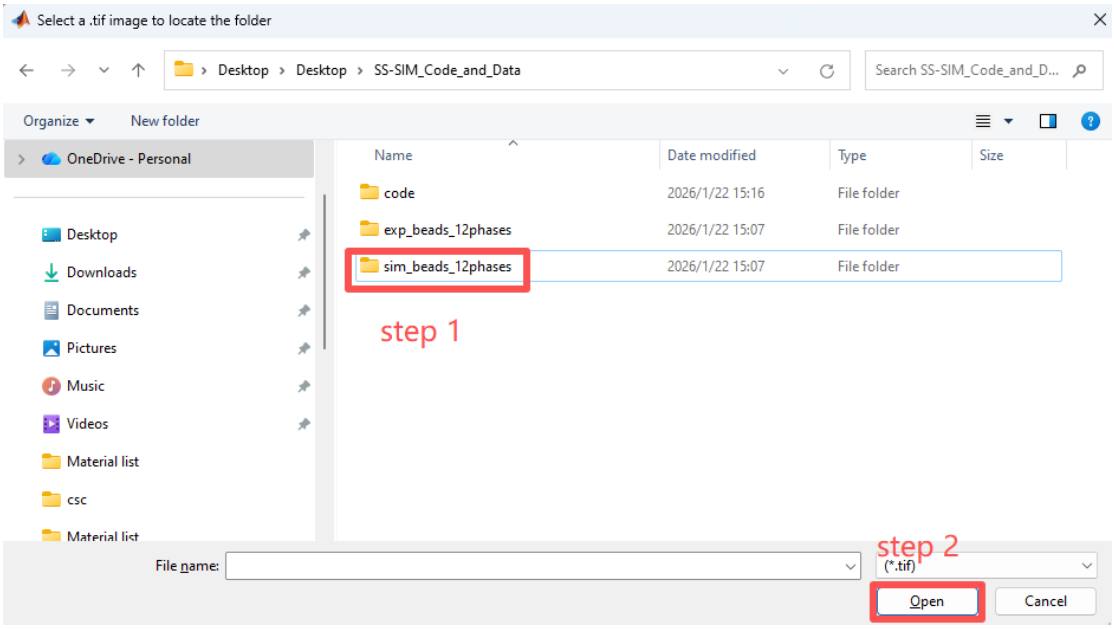
(4) Double-click main.m in the current folder.

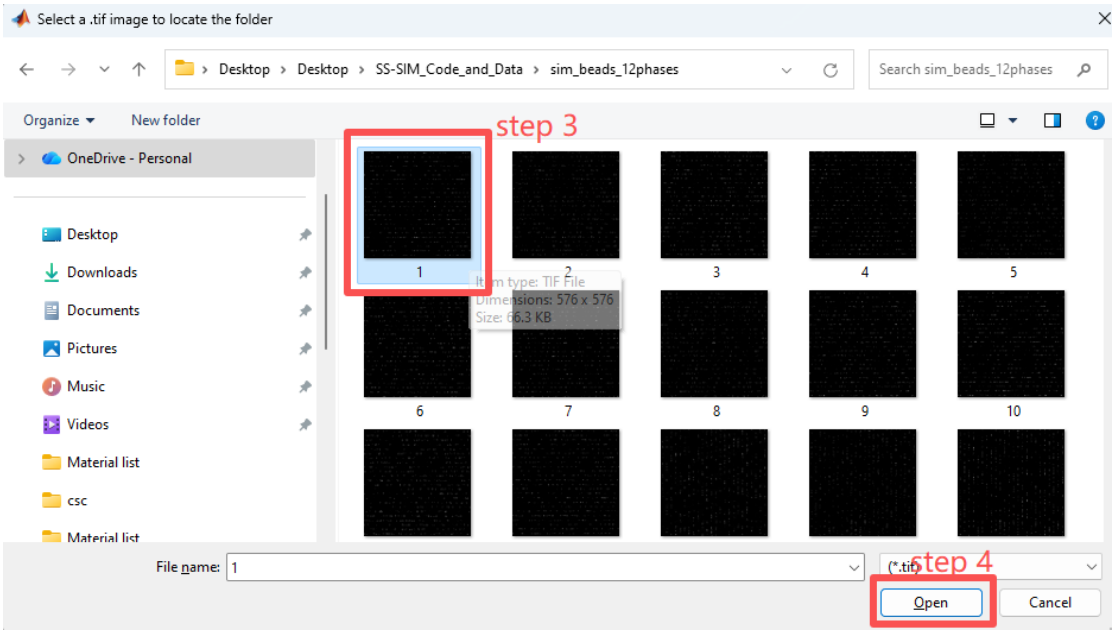


(5) Click the Run button.

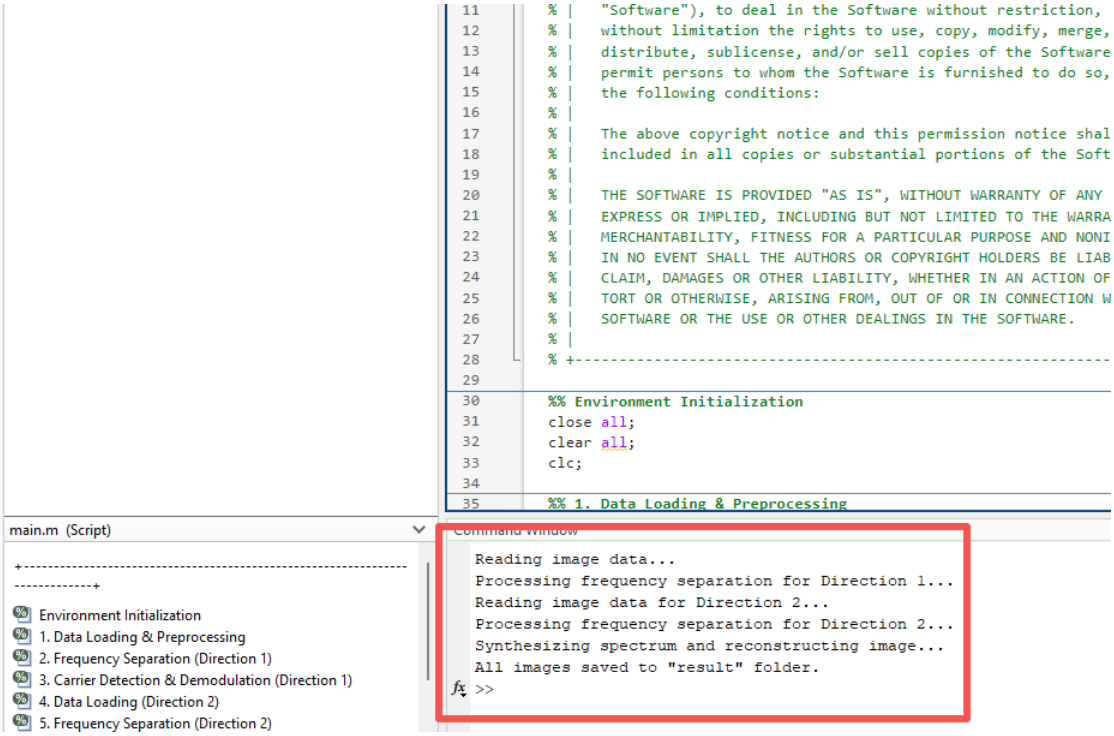


(6) Perform the following operations according to the pop-up window.

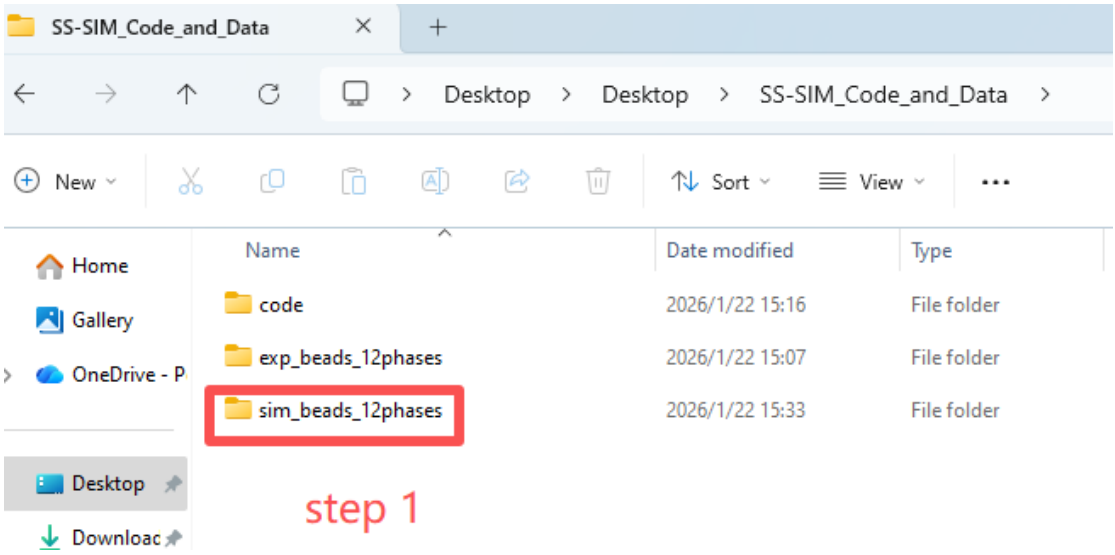


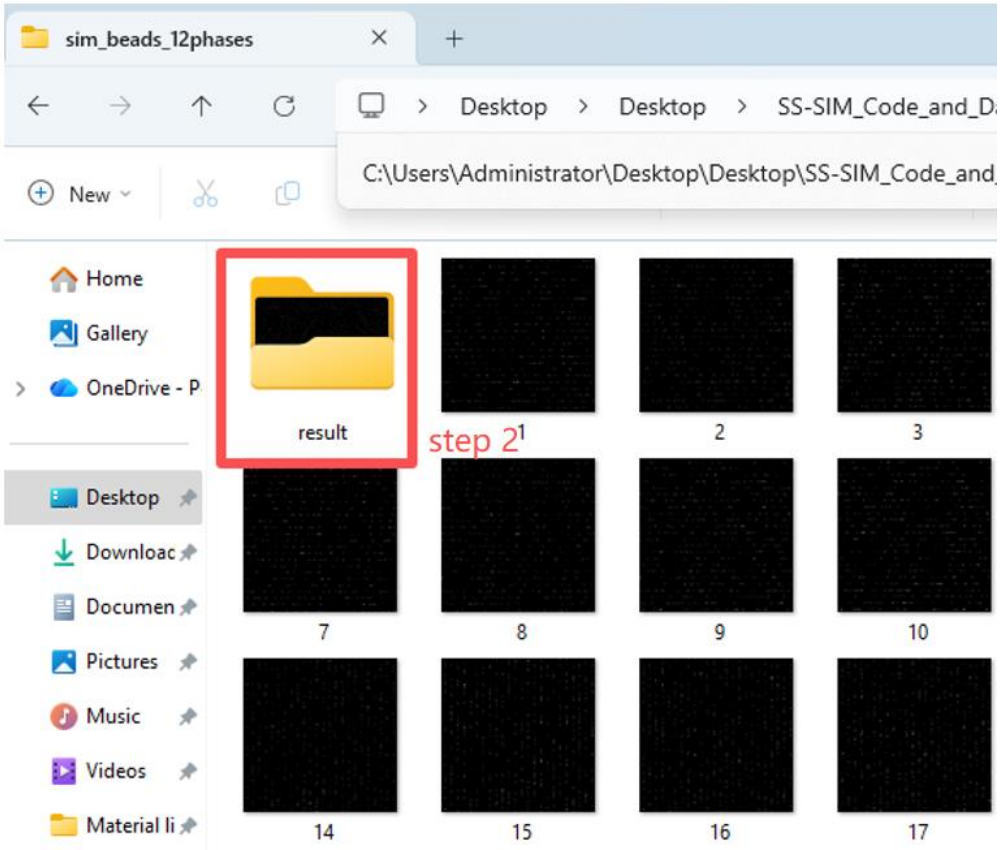


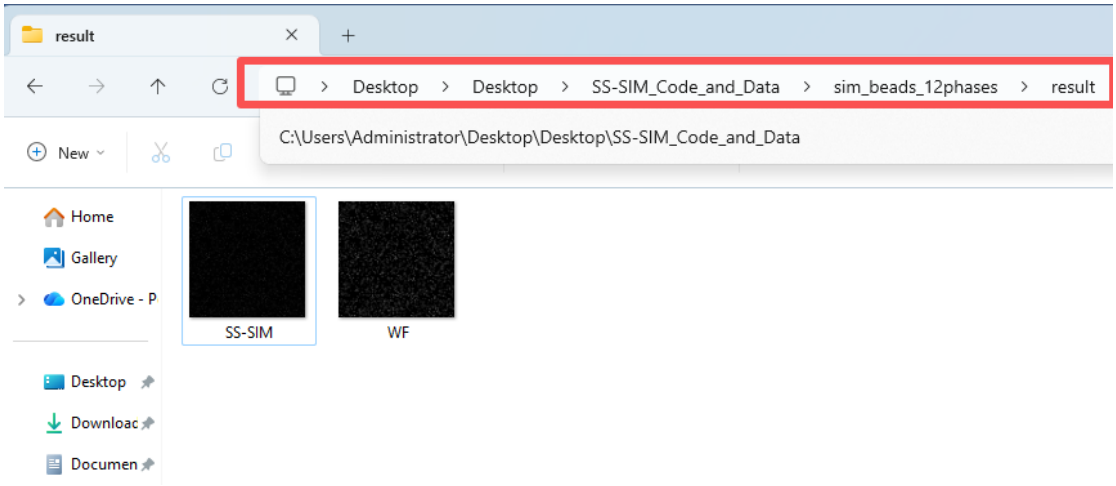
(7) Wait for the code to finish running.



(8) Open the folder where the program is located, find the result folder within the simulated data, and you will obtain the recovery results.







Note: Real data recovery is similar to simulated data recovery; you only need to select the experimental data folder.