Manual (script version)

---------System Requirement---------

1. Cuda GPU (4GB memory or more)
2. CPU calculation is also supported (2016b and later version), but it is slow (~10-30s/pattern).
3. Matlab 2016a and later version
4. For Pascal GPU, Matlab 2017a and later version is required.

main_PACBED_identify_demo.m

----------FUNCTION----------

1. Align a series of PACBEDs
2. Measure their thickness and tilt values

----------HOW TO RUN----------

1. Contact Prof. LeBeau (jmlebeau@ncsu.edu) to get all large network files before run the code
2. Setup network name correctly in the **load NN model for PACBED** section
3. Setup input data in the **load data** section, you can call **file_load** function for direct input from image files
4. Setup parameters in the **PACBED alignment** section
5. Setup parameters in the **thickness/tilt measurement** section
6. Run code (recommend Run Section)

----------OUTPUT----------

1. Output thickness/tilt measurement are in **thickness_determine** and **tilt_determine** variables, respectively
2. Aligned images are in **img_out** cell.
   Call **Img_series_Looper(img_out, name_list)** to view
3. Center, shift and rotation angle of PACBEDs can be found in **para_in** cell

main_PACBED_identify_4D_STEM_demo.m

----------FUNCTION----------

1. Align PACBEDs from 4D-STEM
2. Measure their thickness and tilt values

----------HOW TO RUN----------

1. Contact Prof. LeBeau (jmlebeau@ncsu.edu) to get all large network files before run the code
2. Setup network name correctly in the **load NN model for PACBED** section
3. Setup input data in the **load database** section
4. Setup parameters in the **PACBED alignment** section
5. Setup parameters in the **thickness/tilt measurement** section
6. Run code (recommend Run Section)

----------OUTPUT----------

1. Output thickness/tilt measurement are in **thickness_determine** and **tilt_determine** variables, respectively
2. Run **Display thickness/tilt map** section to visualize the result
3. Aligned images are in **img_align_cell** cell.
   Call **Img_series_Looper(img_align_cell, name_list)** to view
4. Center, shift and rotation angle of PACBEDs can be found in **'para_in'** cell

main_Hybrid_CNN_LSF_demo.m

----------FUNCTION----------

1. Align PACBEDs using CNN
2. The thickness and tilt measurement serves as initial input to LSF
3. Fast LSF to measure PACBED thickness and tilt

----------HOW TO RUN----------

1. Contact Prof. LeBeau (jmlebeau@ncsu.edu) to get all large network files and simulations before run the code
2. Setup LSF search range in the **LSF Parameter Setup** section
3. Setup network name correctly in the **CNN - load NN model for PACBED** section
4. Setup input data in the 'load data' section, you can call **file_load** function for direct input from image files
5. Setup parameters in the **CNN - Image alignment and thickness/tilt measurement from CNN** section
6. Setup parameters in the **LSF - get tilt label number and its neighbour list** section
6. Run code (recommend Run Section)

----------OUTPUT----------

1. Output CNN thickness/tilt measurement are in the **thickness_determine_CNN** and **tilt_determine_CNN** variables, respectively
2. Output LSF thickness measurement is in the **thickness_determine_LSF** variable
3. Output LSF tilt measurement (component along [100] and [010] direction, amplitude, azimuth angle) are in the **tilt_HG**, **tilt_r**, and **tilt_azimuth** variables.
4. Run **Look at the best match and the difference** section to visualize the result
5. Final and intermediate result from LSF can be found in **data_out** cell

If you find this software package is useful, please cite:
Weizong Xu, James M. LeBeau, A Deep Convolutional Neural Network to Analyze Position Averaged Convergent Beam Electron Diffraction Patterns, arXiv:XXXX.XXXXX, 2017

Please contact Prof. James LeBeau (jmlebeau@ncsu.edu) and Dr. Weizong Xu (wxu4@ncsu.edu) if any questions.