River detection from remotely sensed imagery

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For more information, please see the paper:

Yang, K. , Karlstrom, L., Smith, L.C., Li, M., 2017. Automated high resolution satellite image registration using supraglacial rivers on the Greenland Ice Sheet. IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, 10(3): 845-856.

Yang, K. , Li, M., Liu, Y., Cheng, L., Huang, Q., Chen, Y., 2015. River Detection in Remotely Sensed Imagery Using Gabor Filtering and Path Opening. Remote Sensing, 7(7): 8779-8802.

Yang, K. , Li, M., Liu, Y., Cheng, L., Duan, Y., Zhou, M., 2014. River Delineation from Remotely Sensed Imagery Using a Multi-Scale Classification Approach. IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, 7(12): 4726-4737.

Environment:

MATLAB R2008a (or higher)

Add MATLAB Tools:

Use **2DSpecTools** for band pass filter.

Use **OBNLMpackage** for denoising.

Use **DIPimage** for path opening.

1. **Install tools:**

   2DSpecTools and OBNLMpackage tools have been offered on the GitHub.

   Download DIPimage from http://www.diplib.org/download and install it.

Operating system		Matlab R2008a -	Images
Linux 32-bits		dipimage_2.9_lin32.tbz	images.tbz
Linux 64-bits		dipimage_2.9_lin64.tbz	
MacOS X (10.6 or higher)		dipimage_2.9_darwin.tbz	
Windows 64-bits	automatic install	DIPimage 2.9 installer win64.exe	images.zip
	manual install	dipimage_2.9_win64.zip	

2. Set Path:
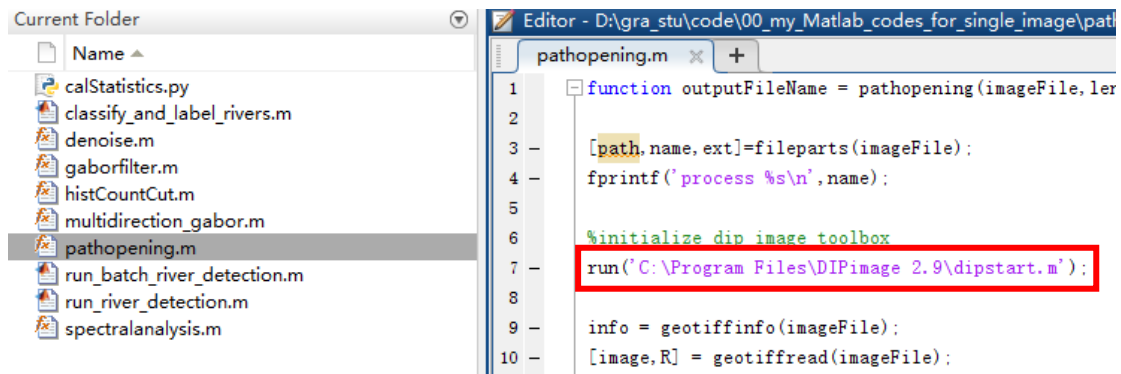
1) Click set path in Matlab GUI.

2) Add 2DSpecTools, OBNLMpackage, DIPimage tools, 'Matlab River Detection code' folder to MATLAB environment.

3) Save.
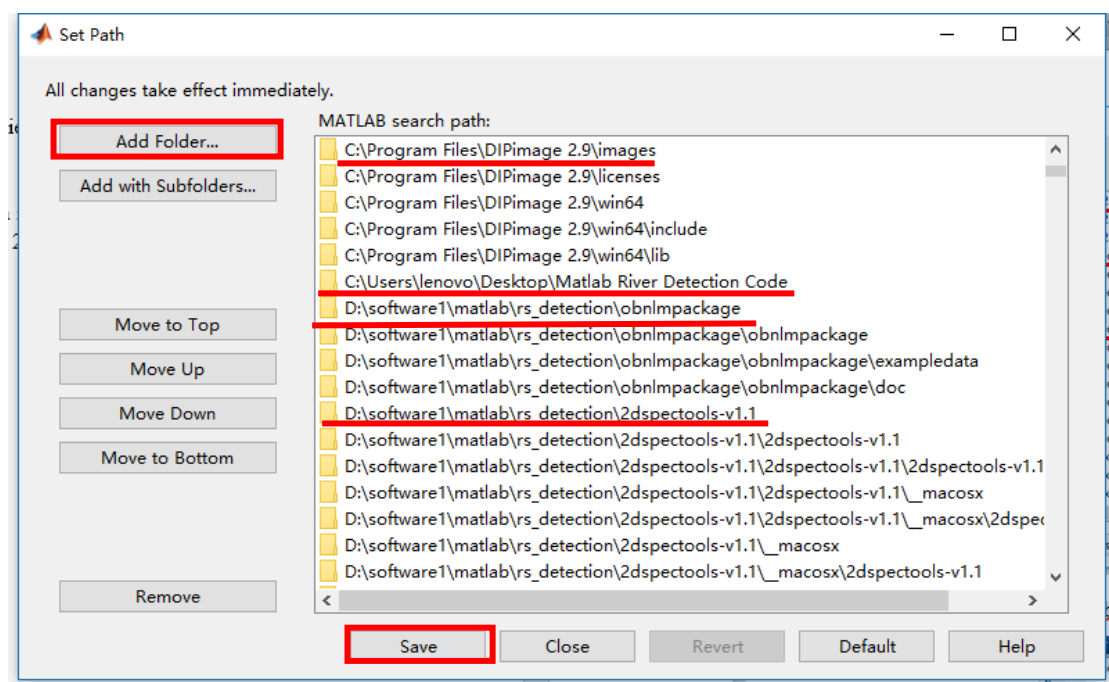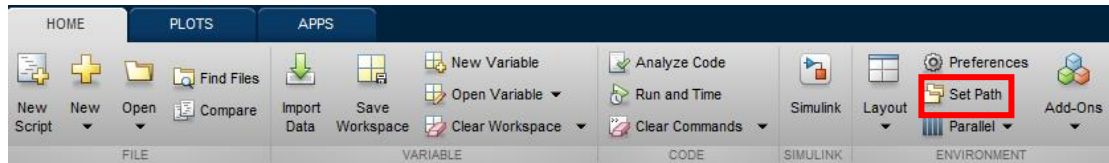
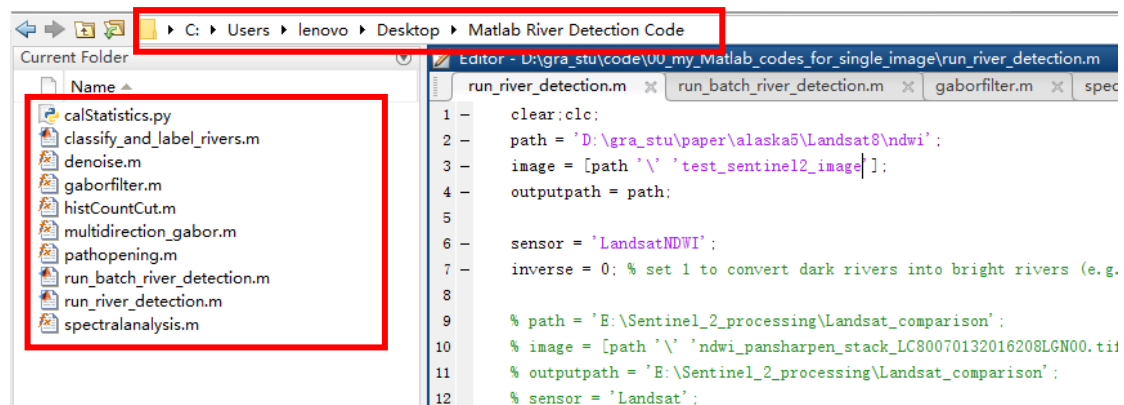
3. Open 'Matlab River Detection code' folder in MATLAB.
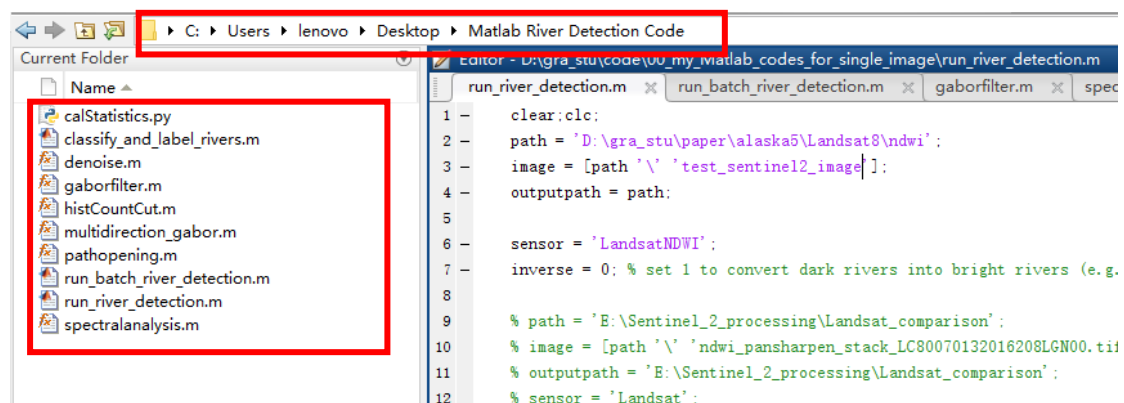
4. Change the path of DIPimage in 'pathopening.m'.

Run river detection code:

Here, we provide 'run_river_detection.m' to detect river in single image and 'run_batch_river_detection.m' for batch detection.

1. Open 'Matlab River Detection code' folder in MATLAB.

2. Open 'run_river_detection.m' or 'run_batch_river_detection.m'.

3. Write the image path. 'test_sentinel2_image.tif' is provided as test image.

4. Set input 6 parameters.

    1) **sensor**: type of your input image, we gave 6 types of input.

        WV: WorldView image;

        SPOT: SPOT image;

        SETSM: ArcticDEM image;

        Sentinel2: Sentinle-2 image after NDWI calculation;

        Landsat: Landsat panchromatic image

        LandsatNDWI: Landsat image after NDWI calculation;

    2) **inverse**: set 1 to convert dark rivers into bright rivers (e.g., for panchromatic

image); set 0 to keep bright rivers (e.g., for NDWI images).

3) **width**: small river width for Gabor filter, default = 2.

4) **ppo_length:** path opening length, default = 20.

5) **histCountThreshold**: a pixel count threshold to stretch image pixel values, default = 1000.

6) **Smooth (optional)**: this parameter is used for denoise algorithm. Because denoise algorithm is too slow and scale dependent, is is abandoned for large images,　default = 0.7

7) 　You can add your customized sensor (image) easily. The only requirement is to reset the band pass frequency based on the spatial resolution of your input image.

5. Click run.

If you see these commands in the command window, the river detection code is running successfully.

```
Command Window                                                    ⊙

    process test_sentinel2_image
    process test_sentinel2_image_bandpass
    process test_sentinel2_image_bandpass_gabor

    DIPlib 2.9 (Oct 17 2017 - Release [on Cygwin (with OpenMP)])
        Scientific Image Analysis Library
        Quantitative Imaging Group, Delft University of Technology 1995-2017
        info@diplib.org


    dipIO 2.9 (Oct 17 2017 - Release)
        File I/O library for DIPlib
        Quantitative Imaging Group, Delft University of Technology 1999-2017
        info@diplib.org

fx >>
```

6. You will get 3 processed images. 'test_sentinel2_image_bandpass_gabor_cpo20.tif' is the final result.

- test_sentinel2_image.tif
- test_sentinel2_image_bandpass.tif
- test_sentinel2_image_bandpass_gabor.tif
- test_sentinel2_image_bandpass_gabor_cpo20.tif