**Readme**

1. **Introduction**

This deliverable is a C++ version of implementation of SL2P. The input data is the tile of mosaic Landsat 8, the format is top of atmosphere (TOA). The codes handle the scenario with only one land cover class and assume the sensor azimuth and the sensor zenith to be 0.

1. **Input data**
2. Image data

The input image file name uses the naming convention of CCRS Landsat mosaic tile.

Tile\*\_cch3.raw- mosaic channel 3 of Landsat 8, \* indicates the number of title. The data was multiplied by 10000, and the format is 16 bit short, the following input channels are the same.

Tile\*\_cch4.raw- mosaic channel 3 of Landsat 8, \* indicates the number of title

Tile\*\_cch5.raw- mosaic channel 3 of Landsat 8, \* indicates the number of title

Tile\*\_cch6.raw- mosaic channel 3 of Landsat 8, \* indicates the number of title

Tile\*\_cch7.raw- mosaic channel 3 of Landsat 8, \* indicates the number of title

Tile\*\_ind.raw- mosaic index of Landsat 8, \* indicates the number of title

lsit\*\_angl.txt- look up table associated with the above index file, \* indicates the year, like 2016

1. Input coefficient files

There is a subdirectory called coefficients, which includes the following text file:

Fileslist.txt - includes the full path of the following text file.

fapar\_netpara.txt - neural network coefficients for FAPAR

fcover\_netpara.txt - neural network coefficients for FCOVER

lai\_netpara.txt- neural network coefficients for LAI

lai\_cab\_netpara.txt- neural network coefficients for LAI.Cab

lai\_cw\_netpara.txt- neural network coefficients for LAI.Cw

fapar\_unnetpara.txt- neural network coefficients for uncertainty FAPAR

fcover\_unnetpara.txt- neural network coefficients for uncertainty FCOVER

lai\_unnetpara.txt - neural network coefficients for uncertainty LAI

lai\_cab\_unnetpara.txt- neural network coefficients for uncertainty LAI.Cab

lai\_cw\_unnetpara.txt- neural network coefficients for uncertainty LAI.Cw

fapar\_bar.txt - parameters for FAPAR in BIO\_VAR\_bounding\_box

fcover\_bar.txt - parameters for FAPAR in BIO\_VAR\_bounding\_box

lai\_bar.txt - parameters for FAPAR in BIO\_VAR\_bounding\_box

lai\_cab\_bar.txt - parameters for FAPAR in BIO\_VAR\_bounding\_box

lai\_cw\_bar.txt - parameters for FAPAR in BIO\_VAR\_bounding\_box

convex.txt- parameters for convex hull

1. **Output files** 
   1. Biophysical parameter files

Tile\*\_FAPAR.raw - output of biophysical parameter FAPAR, \* indicates the tile number, the output is 32 bit float, the following outputs are the same.

Tile\*\_FCOVER.raw - output of biophysical parameter FCOVER

Tile\*\_LAI.raw- output of biophysical parameter LAI

Tile\*\_LAI\_Cab.raw- output of biophysical parameter LAI.Cab

Tile\*\_LAI\_Cw.raw- output of biophysical parameter LAI.Cw

1. Uncertainty files

Tile\*\_FAPAR\_uncertainty.raw - output of uncertainty of biophysical parameter FAPAR

Tile\*\_FCOVER\_uncertainty.raw - output of uncertainty of biophysical parameter FCOVER

Tile\*\_LAI\_uncertainty.raw - output of uncertainty of biophysical parameter LAI

Tile\*\_LAI\_Cab\_uncertainty.raw - output of uncertainty of biophysical parameter LAI.Cab

Tile\*\_LAI\_Cw\_uncertainty.raw - output of uncertainty of biophysical parameter LAI.Cw

1. Flag files

Tile\*\_flag\_FAPAR.raw - output of quality flag of biophysical parameter FAPAR

Tile\*\_flag\_FCOVER.raw - output of quality flag of biophysical parameter FCOVER

Tile\*\_flag\_LAI.raw- output of quality flag of biophysical parameter LAI

Tile\*\_flag\_LAI\_Cab.raw- output of quality flag of biophysical parameter LAI.Cab

Tile\*\_flag\_LAI\_Cw.raw- output of quality flag of biophysical parameter LAI.Cw

1. log file

Tile\*\_log.txt- a log file created to record path, the input files name, the output file names and time.

1. **Classes and functions in the code**

Class BioPhy is a biophysical wrapper class to access the parameters in Class Network, class Convexhull, class BioVARboundingbox.

Class Network is the kernel part in the implementation, which include parsing the coefficients of neural network, and computation of the output of neural network.

Class Convexhull is to parse the parameters from the convex.txt and has the regular functions of setter and getter.

Class BioVARboundingbox is to parse the parameters from the input text file and has the regular functions of setter and getter.

SL2P.cpp is the main function with the following functions:

* calculateAngles - function to calculate solar and sensor angles based on tile index
* CalBioPhy - function to calculate BioPhysical parameters based on input imagery cubes
* CalNeuralNetFlagOutput - function to calculate biophysical parameters and flag based on the input pixels
* CalunNeuralNetOutput - function to calculate uncertainty biophysical parameters based on the input pixels
* outputToFile - function to save the result to file

1. **Testing**

There are two testing methods:

One is used the executable file BioPhy.exe located at BioPhy -Tileprocessing - \x64\Release with the following data setting.

Copy the sample data (5000 by 50000) under C directory.

The second is to change the code at the beginning of SL2P.cpp to reflect the input data path and data size; at the same time, change the content of Filelist.txt located at Tile43\coefficients with the full path name of those coefficients.