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Crop FVC retrieval

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1 *Works for me* dx.doi.org/10.17504/protocols.io.btmynk7w

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ABSTRACT

This protocol describes the method of crop fractional vegetation cover (FVC) retrieval from the PROSAIL-GP model. This method can be applied to UAV-based multispectral images to accurately estimate crop FVC in oilseed rape, rice, cotton and wheat.

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KEYWORDS

FVC, PROSAIL-GP, crop, UAV, Multispectral images

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GUIDELINES

Here, the canopy reflectance can be input, which can match with the simulated reflectance. Canopy reflectance is determined based on a weighted combination of the bi-directional and hemispherical-directional reflectance with weights corresponding to the fraction of diffuse incident solar radiation (skyl). The detailed information can be fould in chi2P5B.m and PRO4SAIL.m.
In addition, the retrieval results may be slightly affected by the iterative optimization function, while they don't produce the significant difference for model inversion.
The detailed descriptions about the datasets can be found in our published papers.

MATERIALS TEXT

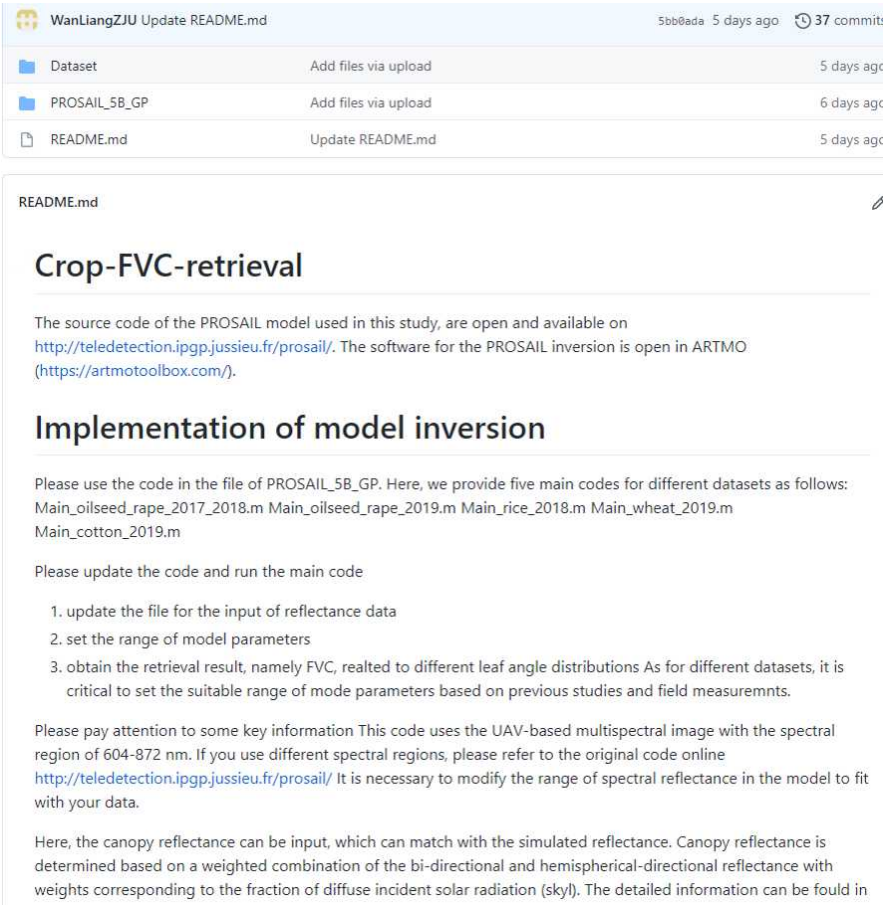
The code of the PROSAIL-GP model and all of the datasets are available on https://github.com/WanLiangZJU/Crop-FVC-retrieval.

BEFORE STARTING

The source code of the PROSAIL model used in this study, are open and available onhttp://teledetection.ipgp.jussieu.fr/prosail/. The software for the PROSAIL inversion is open in ARTMO (https://artmotoolbox.com/).

1 Make sure you have MATLAB 2014b (or newer) installed on your computer.

2 Dowload the MATLAB scripts from https://github.com/WanLiangZJU/Crop-FVC-retrieval



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3 Please use the code in the file of ***PROSAIL_5B_GP***. Here, we provide five main codes for different datasets as follows: ***Main_oilseed_rape_2017_2018.m***, ***Main_oilseed_rape_2019.m***, ***Main_rice_2018.m***, ***Main_wheat_2019.m***, ***Main_cotton_2019.m***

4 Please update the code and run the main code

1. update the file for the input of reflectance data
2. set the range of model parameters
3. obtain the retrieval result, namely FVC, realted to different leaf angle distributions As for different datasets, it is critical to set the suitable range of mode parameters based on previous studies and field measuremnts.

```
clear all; clear all; clc;

for p=1:10 % number of sample
%% input canopy reflectance (name of excel file)
%% Notably, as for the canopy feflectance with different bands, we must modify the origianl data in dataSpect_P5B
%% dataSpect_P5B includes some prior information about leaf and canopy parameters in the region of 400-2500 nm
%% to fit with different range of spectral bands, this file should be changed
R=xlsread('F:\2018水稻\images\biomass-rice2018\FVC+LAI+PROSAIL\JEB\public\Dataset\oilseed rape 2017-2018 dataset.xlsx','spectra');
R1=R(p,1:25);
rmes=R1';
%% determinte the LAD
%% LAD=1, Planophile; LAD=2, Erectophile; LAD=3, Plagiophile;
%% LAD=4, Extremophile; LAD=5, Spherical; LAD=6, Uniform;
LAD=6;

%% The initial value for leaf parameters, which doesn't  significnatly affect the retrieval.
Cab=40;      % chlorophyll content (ug.cm-2)
Car=6;       % carotenoid content (ug.cm-2)
Cbrown=0.0; % brown pigment content (ug.cm-2)
Cw=0.015;    % EWT ((g.cm-2)
Cm=0.004;    % LMA (g.cm-2)
N=1.5;  % leaf structure parameter

%% The initial value for canopy parameters, which doesn't significnatly affect the retrieval.
LAI =3.;    % leaf area index (m^2/m^2)
tts=30; % solar zenith angle (sza)
tto=0;  % viewing zenith angle (vza)
psi=150;     % relative azimuth angle(raa?)
psoil=0;     % soil factor (psoil=0: wet soil / psoil=1: dry soil)
hspot =0.25;% hot spot
%% set the range of mode parameters based on previous studies and field measuremnts
```

5 This code uses the UAV-based multispectral image with the spectral region of 604-872 nm. If you use different spectral regions, please refer to the original code onlinehttp://teledetection.ipgp.jussieu.fr/prosail/.
It is necessary to modify the range of spectral reflectance in the model to fit with your data.

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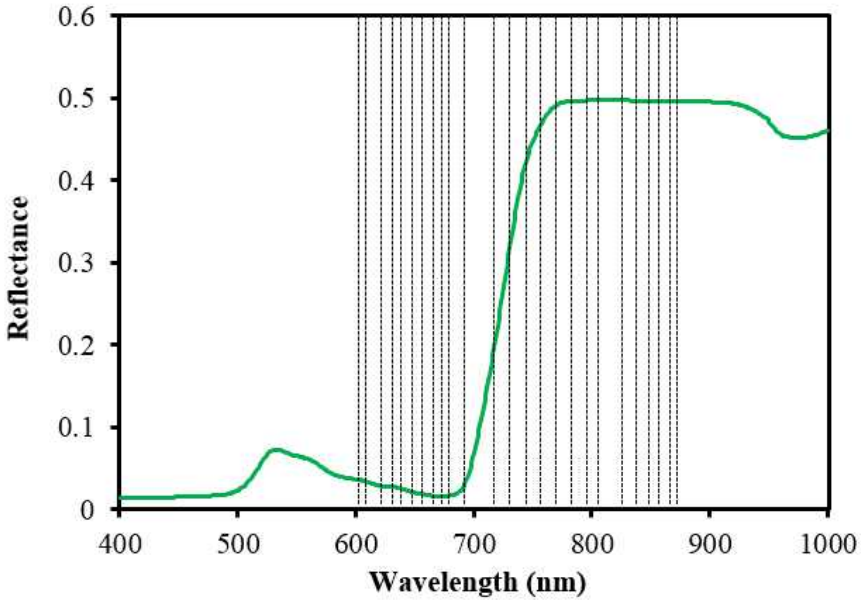

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