# Spectral Tools

## Purpose

This module offers a set of functions for handling spectral data. These functions are:

* Spectrum extraction: extract a spatially aggregated spectral profile with a user specified rectangular kernel size.
* Spectrum extraction: extract a spatially aggregated spectral profile delimited by polygons

## Installation

Install the .sav files in the save\_add folder (see also [ENVI .sav files: Installation and configuration](http://www.itc.nl/personal/nieuwenh/installations.html).

\_nrsmenu.sav Define NRS menu item in ENVI

nrs\_Utils.sav Library with NRS utility routines

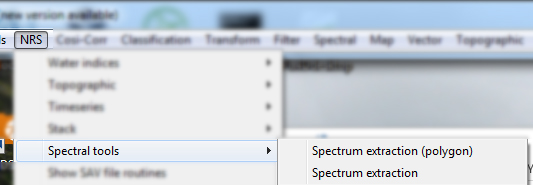
NRS\_libs.sav Library with ENVI utility routines

nrs\_Spectral\_tools.sav The actual software

## Usage (gui)

|  |  |
| --- | --- |
| nrs\_aggregate\_spectrum\_gui | Start the user interface of the spectrum extraction. |

Alternatively the commands can be started from the ENVI menu: ‘NRS | Spectral Tools’:

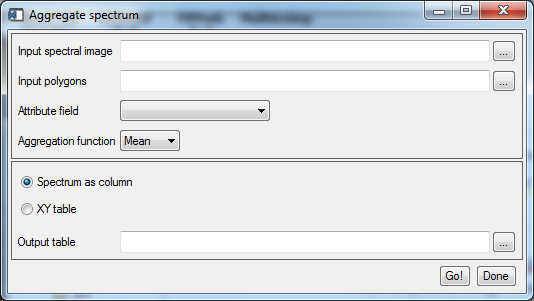


### Spectrum Extraction (polygon)

Menu option is ‘NRS | Spectral Tools | Spectrum Extraction (polygon), the command line is ‘nrs\_aggregate\_spectra\_by\_pol’. This function uses polygon features from a shape file to extract spectral profiles from a spectral image. It uses a square window around the locations in the spectral image, collects the spectra of all these location and applies a spatial aggregation function to these profiles.

The resulting profiles for all locations are then written to a text table. The header line of each column contains the coordinates of that location.

The user interface is shown below:



Explanation of all the fields:

|  |  |
| --- | --- |
| Input spectral image | Select an spectral input image. This can either be an image stack or a list file, that is: a text file with a list of images. |
| Input polygons | Select a polygon shape file. For each of the polygons one output profile is calculated |
| Attribute field | Select a (unique) attribute field from the polygon shapefile. The attribute will end up in the output making it easier to join the result. |
| Aggregation function | Select the aggregation function. The GUI supports *mean*, *median*, *min* and *max*. The default is *mean*. |
| Spectrum as column | Save the output table with one spectrum per column (field); the header line contains the polygon values from the selected attribute field |
| XY table | Save the output table with one location and spectrum per row (record). |
| Output table | The filename of the output profile table. |

The list file contains a list with fully specified filenames of existing images. Each of the images is expected to have a single band.

Example of a list file:

E:\NRS\Roshanak\Extract Program\S-1A\Sigma0\_VH\_slv23\_01Nov2016.img

E:\NRS\Roshanak\Extract Program\S-1A\Sigma0\_VH\_slv29\_13Nov2016.img

E:\NRS\Roshanak\Extract Program\S-1A\Sigma0\_VH\_slv37\_25Nov2016.img

E:\NRS\Roshanak\Extract Program\S-1A\Sigma0\_VH\_slv43\_07Dec2016.img

E:\NRS\Roshanak\Extract Program\S-1A\Sigma0\_VH\_slv47\_19Dec2016.img

E:\NRS\Roshanak\Extract Program\S-1A\Sigma0\_VH\_slv51\_31Dec2016.img

…

Examples of the output table (shortened):

With the option *Spectrum as column*:

Image\_name,POLY\_VB2L,POLY\_VB2H,POLY\_VB1,POLY\_VB3,POLY\_VB4,POLY\_VB5,POLY\_VB6,  
"Sigma0\_VH\_slv23\_01Nov2016.img",0.0110575,0.0230216,0.0126508,0.0175933, …  
"Sigma0\_VH\_slv29\_13Nov2016.img",0.0117314,0.0139674,0.0121838,0.00993833, …  
“Sigma0\_VH\_slv37\_25Nov2016.img",0.0230780,0.0452031,0.0231850,0.0119630, …  
"Sigma0\_VH\_slv43\_07Dec2016.img",0.0175682,0.0363350,0.0173483,0.0114895, …  
"Sigma0\_VH\_slv47\_19Dec2016.img",0.0176689,0.0322381,0.0179493,0.0213098, …  
"Sigma0\_VH\_slv51\_31Dec2016.img",0.0257462,0.0410493,0.0210682,0.0285247, …

…

With the option *XY table*:

Pol\_ID,Sigma0\_VH\_slv23\_01Nov2016.img,Sigma0\_VH\_slv

"POLY\_VB2L",0.0110575,0.0117314,0.0230780,0.017568, …

"POLY\_VB2H",0.0230216,0.0139674,0.0452031,0.036335, …

"POLY\_VB1",0.0126508,0.0121838,0.0231850,0.0173483, …

"POLY\_VB3",0.0175933,0.00993833,0.0119630,0.011489, …

"POLY\_VB4",0.0200927,0.0149918,0.0324837,0.0292062, …

"POLY\_VB5",0.0182327,0.0272886,0.0321729,0.0173514, …

"POLY\_VB6",0.0264694,0.0293610,0.0107444,0.0248240, …

"POLY\_VB7",0.0245019,0.0327391,0.0408860,0.0349105, …

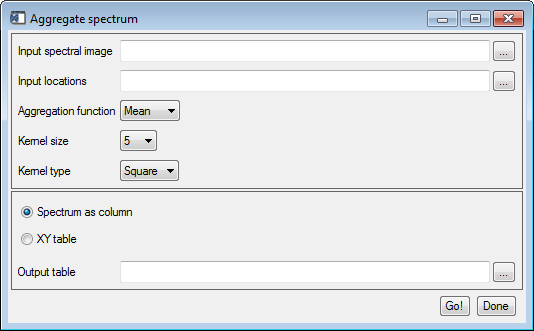
…

### Spectrum Extraction

Menu option is ‘NRS | Spectral Tools | Spectrum Extraction, the command line is ‘nrs\_aggregate\_spectrum\_gui’. This function reads the coordinates of point features from either a text table or a shape file to get spectral profiles from a spectral image. It uses a square window around the locations in the spectral image, collects the spectra of all these location and applies an aggregation function to these profiles.

The resulting profiles for all locations are then written to a text table. The header line of each column contains the coordinates of that location.

The user interface is shown below:



Explanation of all the fields:

|  |  |
| --- | --- |
| Input spectral image | Select an spectral input image |
| Input locations | Select a point feature table; this can either be a comma-delimited file (\*.csv) or a shape file. In case of a text table file: the file must contain a header line indicating the coordinate columns; the coordinate columns are recognized by the texts *lat*, *lon* or *x* and *y*. |
| Aggregation function | Select the aggregation function. The GUI supports *mean*, *median*, *min* and *max*. The default is *mean*. |
| Kernel size | The size of the window. Supported are 1 (single spectrum), 3 (3 x 3), 5, 7, 9, 1 |
| Kernel type | Specify the area to sample the spectra. Possible are **square**, and **circle**. The sampling assumes equal size pixels. |
| Spectrum as column | Save the output table with one spectrum per column (field); the header line contains the coordinate pair of the location |
| XY table | Save the output table with one location and spectrum per row (record). This type of table is easier to import into GIS software as features. |
| Output table | The filename of the output profile table. |

An example of the input point table (in csv format); note that extra columns are allowed, here the pixel coordinates are added as well:

lat,lon,px,py

33.70480278,107.8058417,57,12

33.55983889,107.8718278,83,79

33.63168611,107.6789417,7,47

Examples of the output table (shortened):

With the option *Spectrum as column*:

(31.335300:-22.759450),(31.324700:-22.761067),(31.324833:-22.761683)

400.680,400.920,506.560

…

420.600,450.600,544.320

2089.28,2022.96,1982.36

1580.40,1554.16,1664.60

912.480,975.960,1104.48

949.920,1009.32,1132.96

879.680,940.840,1059.00

726.400,804.240,911.800

590.320,674.000,763.280

…

With the option *XY table*:

X,Y,band\_1,band\_2,band\_3

31.33530000000000,-22.75945000000000,400.6799926757813,420.6000061035156,2089.280029296875

31.32470000000000,-22.76106700000000,400.9200134277344,450.6000061035156,2022.959960937500

31.32483300000000,-22.76168300000000,506.5599975585938,544.3200073242188,1982.359985351563

31.32391700000000,-22.76123300000000,505.0400085449219,579.8800048828125,2060.439941406250

31.32390000000000,-22.76180000000000,509.9200134277344,550.7199707031250,2099.800048828125

31.31465000000000,-22.76345000000000,468.5599975585938,549.3599853515625,1905.239990234375

31.31421700000000,-22.76266700000000,465.4800109863281,530.2000122070313,1856.599975585938

31.30395000000000,-22.76573300000000,480.4800109863281,532.5200195312500,1951.880004882813

31.30351700000000,-22.76591700000000,495.5599975585938,473.2399902343750,2198.159912109375