ENHANCED TIMESAT ENVELOP FILTER IN ILWIS OBJECTS

PURPOSE

Reduce noise in time series data such as NDVI using a modified adaptive Savitzky-Golay filter, and forcing an upper envelope. It is a modification of the filter in TIMESAT 2.3.

This document describes the operation of ILWIS Objects through the command line using internal ILWIS commands. In future the commands will become available through Python.

USAGE

The input data is expected as byte values (domain IMAGE); the output data will also be byte data (domain IMAGE for ILWIS 3 output). Also the filter assumes 10 day data (36 images per year). For proper operation at least one year of data is recommended.

There are two (necessary) steps to execute the filter:

1. Set the working catalog
2. Execute the envelop filter command

Step 1 in principle can be left out when full paths are used for all input data files. When processing multiple times in the same folder however, it is recommended to add step 1, because then the filenames can be specified without the full path.

SYNTAX

The syntax of the used commands:

> **setworkingcatalog(url)**

Where:

url = the name of the new working folder; f.e.: *file:///c:/output data/filter*; note that URL notation is required

> **output{format(ilwis3, \"map\")}=timesat(inputgridcoverage, iterations, upperenvelop, fitlastiteration, extendwindow**

Where:

output	the name of the output object
format(ilwis3, \"map\")	Connect to the ILWIS 3 connector to create ILWS 3 output files, in this case a maplist
	The filter uses byte values internally. When floating point values are supplied
iterations	The filter iterates using different filter window sizes; this aids in filtering without losing too much detail. By specifying the number of iterations automatically the window sizes are calculated. For example 4 iterations will generate window sizes of 3, 5, 7, and 9; the filter always starts with the smallest window size. The window size is calculated as <current iteration> * 2 + 1.
upperenvelop	If set to true the filter will use the original value in favor of the fitted value if the fitted value is lower than the original value.
fitlastiteration	If set to true the filter will force the upper envelope for all filter window

	sizes except for the last. If set to false the envelope will also be forced to the upper envelope for the last windows size. This is only active when upperenvelop is set to true.
extendwindow	If set to true the input maplist is extended with data from the front appended to the end, and data from the end appended to the beginning to account for the filter window size.
	If set to false the filter assumes the extension is already done by the user
Output	The output of the filter

FILTER DESCRIPTION

The steps the filter is executing for the data series at each location:

1. Spike detection and removal

2. Check for data validity; locations without enough data points are skipped and the output will be set to zeroes. Data is skipped (1) when more than 75% of the data is to low or (2) when a period of more than 120 days (12 values) is found with too low values

3. Iteratively apply Savitzky-Golay filtering. First a check is made if enough data points can be found; if not the data is calculated as the median of the available values. If enough data values are available the data is curve fitted.

REFERENCES

Beltran Abounza, J.M. (2009) Method development to prepare from hyper - temporal images remote sensing RS - based change maps. Enschede, ITC, 2009. 53 p. (full text)

Original TIMESAT software: http://www.nateko.lu.se/timesat/timesat.asp