# Filtering a single attribute – Program filter\_single\_attribute



## **Computation flow chart**

The input to program **filter\_single\_attribute** includes unfiltered input attribute as well as estimates of the inline and crossline dip components. Program **filter\_single\_attribute** can be run iteratively, whereby the output can be used as input for the next iteration.



## Computing mean, median, and other filtered dip volumes

In the **aaspi\_util** menu, find the Image Processing tab and choose program **filter\_single\_attribute.** 

aaspi_util GUI - Post Stack Utilities (Rele	ease Date: Septembe	er 30, 2015)						×
<u>File</u> Volumetric Attributes Horizon-	based Classification	Volumetric Classifi	cation	Image Processing	Display Tools	Other Utilities	Set <u>A</u> ASPI Default Parameters	<u>H</u> elp
SEGY to AASPI format conversion (multiple files)	AASPI to SEGY format conversion (single file)	AASPI QC Plotting	AASPI	stat3d kuwahara3d filter_single_attr	ibute ies			-
SEGY to AASPI - Convert Poststack seism	ic volumes from SEG	6Y to AASPI format		fault_enhancem	ient 18			
SEGY Header Utility :	SEGY Header Utility							
2D SEG-Y Line rather than 3D Survey ?	-							
SEGY format input file name (*.segy,*.sgy,*.SEGY,*.SGY):					Browse View	EBCDIC Header		
Unique Project Name:		_						
AASPI Output File Name (*.H):								
Verbose:	$\overline{\mathbf{v}}$							
VBlock:	10000							
Byte loc. of X-Coord:	181		4 b	yte int 💌				
Byte loc. of Y-Coord:	185		4 b	yte int 💌				
Byte loc. of line (inline) no.:	189		4 b	yte int 💌				
Byte loc. of cdp (xline) no.:	193		4 b	yte int 💌				
Override scalco	0 - use value in h	eader	•					
Override the time of the first sample (ms)	): 0							
Vertical Unit:	s 💌							
Horizontal Unit:	ft 💌							
Amplitude Threshold:	1E+010							
Max. no. spikes/trace:	2							
Read text header as ASCII:	Γ							
Execute								
								-

The following window appears:

aaspi_filter_single_attribute	GUI (Release Date: September 30, 2015)	- • ×						
∬ <u>F</u> ile	]] <u>F</u> ile							
filter_single_attribute - A suite of image processing filters that can be applied any attribute along structural dip (use program sof3d to filter seismic amplitude or impedance data)								
Attribute to be filtered (*.H):	Attribute to be filtered (*.H): F:\test_data\boonsville\d_mig_boonsville.H Browse							
Inline Dip (*.H):	\test_data\boonsville\inline_dip_boonsville_0.H Browse							
Crossline Dip(*.H):	\test_data\boonsville\crossline_dip_boonsville_0.H Browse							
*Unique Project Name:	ponsville							
Suffix 1								
Verbose: Г								
Primary Parameters Para	llelization parameters							
Filter to apply:	Filter to apply: LUM (Lower-Upper-Middle) filter along structure (rejection of attribute artifacts)							
Lower and Upper Percentile, beta: LUM (Lower-Upper-Middle) filter along structure (rejection of attribute artifacts)								
MSMTM range:	Alpha-trimmed mean filter along structure (rejection of attribute artifacts)							
. Window half length (ft):	Mean filter along structure (attribute smoothing)							
Window half width (ft):	Window half width (ft):							
Window half height (s): 0.002								
Use rectangular_window?:	Г							
Save filter_single_attribute pa	ameters for AASPI Geometric Attribute Workflow							
Save parameters and return	Save parameters and return to Workflow GUI							
(c) 2008-2015 AASPI - The Univ	Execute filte	r_single_attribute						

**filter\_single\_attribute** has three input files: (1) The attribute to be filtered (2) inline and (3) crossline components of dip. There is one output file – and the filtered. Like most AASPI programs the algorithm runs in parallel. In this example I've set the *Suffix* to be '1' indicating that this is the first pass of filtering. The possible filters include LUM (lower-upper-middle), MSMTM (multistage median-based modified trimmed mean), *median* and *mean* filters. AI-Dossary and Marfurt (2007) show the applicability of LUM and MSMTM filters.

Among the parameters, (7) is the filter we would like to apply, in this case the LUM filter. The default window size consists of the neighboring traces and samples, in this case  $\pm$ -110 ft and  $\pm$ -0.002 s.

If you have selected the LUM filter, then the (8) *beta* value becomes active. If we set *beta* to be 50%, the result will be the same as using the median filter. In contrast, if we set it to 0%, the result will be as if we had not filtered the data. If we set *beta* to be 20%, then values which fall between 20 - 80

% of the confidence estimate will be kept. Values that fall below 20% of the confidence estimate will be set to the lower threshold 20% confidence value, and values that fall above 80% of the confidence estimate will be set to the upper threshold 80% confidence value. In this manner values that fall below our lower threshold and above our upper threshold will be clipped.

The MSMTM (Multistage median-based modified trimmed mean) filter is able to preserve detail, meaning it acts as a lineament preserving filter that can smooth noise. The MSMTM is a modified trimmed mean (MTM) filter that implements a multistage median filter (MSM). A data sample's value is kept if it lies in the range of [m - q, m + q], where *m* is calculated using an MSM filter and *q* is a user defined range. Larger values of *q* result in some smearing of lineaments through higher amplitude "noise" areas, while smaller values of *q* better preserve narrow lineaments. For further discussion, please refer to Al-Dossary and Marfurt (2007).

The *Parallelization parameters* panel only asks for the list of nodes and the number of processors per node:

<u>F</u> ile		Н
filter_single_attribute - A suit (use program sof3d to filter s	e of image processing filters that can be applied any attribute a eismic amplitude or impedance data)	long structural dip
Attribute to be filtered (*.H):	E:\test_data\boonsville\d_mig_boonsville.H	Browse
Inline Dip (*.H):	E:\test_data\boonsville\inline_dip_boonsville_0.H	Browse
Crossline Dip(*.H):	E:\test_data\boonsville\crossline_dip_boonsville_0.H	Browse
*Unique Project Name:	boonsville	
Suffix:	1	
Verbose:	Γ	
Primary Parameters P	arallelization parameters	
Use MPI: 🔽		
Processors per node: 24	Determine Maximum Processors on localhost	
Node list (separated by bla	nks): localhost	
Build an LSF Script?	Do Not Run Under LSF	
Build a PBS Script?	Do Not Run Under PBS	
Maximum LSF run time (hr	s): 10	
Available batch processors:	0	
	Determine Optimum Number of Batch Processors	
LSF Batch Queue:		

Like all AASPI codes, click *Execute* and intermediate information will be printed in the xterm from which aaspi\_util was launched:

,	process			*			task		time	(hr)	time/	trace	(s
í	20:				read	data			0.000	)		0.000	
		Ø	: memory	deallocate	ed residi	ng on	ly on	mast	er dea	lloca	ted		
		Ø	: shared	arrays res	siding on	both	mast	er and	l_slau	e dea	llocat	ed	
	1:	-		<b>.</b> .	read	data			0.000	)		0.000	
		У	number of	f traces p	rocessed:			582					,
L.	process						task		time	(hr)	time/	trace	٢s
ŕ		10	and loop	a ouen lin									
		10	-enu 100	$t_{\text{baces}}$	ss nocessed •			592					
	nrocess	10	number of	craces pi	rocesseu.		task	302	time	(hp)	time/	trace	( 9
ь	p100000						ocon		0 1110	(111.)	0 Inor	VI ((00	
1	12:				read	data			0.000	)		0.000	
	16:				read	data			0.000	)		0.000	
	16:			send	d data vi	a MPI			0.000	)		0.000	
	16:			receive	e data vi	a MPI.			0.000	)		0.000	
	16:			send re	esults vi	a MPI			0.000	)		0.000	
	16:			receive re	esults vi	a MPI			0.000	Į į		0.000	
	16:			calcula	ate attri	.buteş			0.000	1		0.000	
	16:			write re	esults to	disk			0.000	]		0.000	
	17:				read				0.000	]		0.000	
	17.			send	u data vi s data vi	a mpi			0.000	) 1		0.000	
	17.			send w	s uata vi sculte ui	a MPI			0.000	ì		0.000	
	17:			receive re	esults vi	a MPI			0.000	í		<b>0.000</b>	
	17:			calcula	ate attri	butes			0.000	í		0.000	
	17:			write re	esults to	disk			0.000	i		0.000	
	17:				total	time			0.001			0.004	
		17	: memory	residing a	only on s	laves	deal	locate	ed				
		17	: shared	arrays res	siding on	both	mast	er and	l slav	ve dea	llocat	ed	
	20:			send	d data vi	a MPI			0.000	)		0.000	
	20:			receive	e data vi	a MPI			0.000	1		0.000	
	20:			send re	esults vi	a MPI			0.000	Į		0.000	
	20:			receive re	esults vi	a MPI			0.000	]		0.000	
	20:			calcula	ate attri	butes			0.000	]		0.000	
	20-			write re	esults to	aisk			0.000	)		0.000	
	20-	20		wasiding (	total		deal	locate	9.001 9			0.005	
		20	- memory	awalle we	siding on	hoth	maet	ew and	su Telau	e de a	llocat	ьd	
	21:	20	• shareu	arrays re:	bead	data	masu	cr and	0 000	יכ ננכמ 1	IIUCAU	ด็ดดด	
	21:			senr	data ui	a MPI			0.000	í		<b>0</b> .000	
	21:			receive	e data vi	a MPI			0.000	i		0.000	
	21:			send re	esults vi	a MPÎ			0.000	)		0.000	
	21:			receive re	esults vi	a MPI			0.000	)		0.000	
	21:			calcula	ate attri	butes			0.000	)		0.000	
	21:			write re	esults to	disk			0.000	)		0.000	
	21:	~			total	time			0.001			0.005	
		21	memory	residing o	only on s	laves	deal	locat	ed _				
		21	: shared	arrays res	siding on	both	mast	er and	t slav	e dea	llocat	ed	

Once the job is completed, typing ls - ltr at the terminal prompt shows that the following files were created:

-rw-rr	1	kmarfurt	aaspi	31	Aug	З	16:10	live_processor_list	
-rw-rr	1	kmarfurt	aaspi	1921	Aug	з	16:10	inline dip median filt boonsville 1.H00	
-rw-rr	1	kmarfurt	aaspi	2987	Aug	з	16:10	inline dip median filt boonsville 1.H	
-rw-rr	1	kmarfurt	aaspi	1927	Aug	з	16:10	dip_magnitude_median_filt_boonsville_1.H00	
-rw-rr	1	kmarfurt	aaspi	3023	Aug	з	16:10	dip_magnitude_median_filt_boonsville_1.H	
-rw-rr	1	kmarfurt	aaspi	1925	Aug	з	16:10	dip_azimuth_median_filt_boonsville_1.H00	
-rw-rr	1	kmarfurt	aaspi	3040	Aug	з	16:10	dip_azimuth_median_filt_boonsville_1.H	Υ
-rw-rr	1	kmarfurt	aaspi	1927	Aug	3	16:10	crossline_dip_median_filt_boonsville_1.H00	T
-rw-rr	1	kmarfurt	aaspi	3005	Aug	3	16:10	crossline_dip_median_filt_boonsville_1.H	
-rw-rr	1	kmarfurt	aaspi	1909	Aug	3	16:10	conf_median_filt_boonsville_1.H00	
-rw-rr	1	kmarfurt	aaspi	2776	Aug	з	16:10	conf_median_filt_boonsville_1.H	
-rw-rr	1	kmarfurt	aaspi	22535	Aug	3	16:11	image_filt3d_boonsville_1.out	
[kmarfurt@o;	pa:	l boonsvil	lle]\$						

Note that we have created filtered versions of the input attribute data. The part of the name *median\_filt* denotes the kind of filter that was applied. Had we applied an LUM filter, we would see *lum\_filt* instead.



The results of the median filter look like this (time slice, t = 1.1 sec):

Here we see what the result of the LUM filter looks like (time slice, t = 1.1 sec):



And here is the result of the MSMTM filter with q = 4 (time slice, t = 1.1 sec)



We note that the median filtered image is overall is less noisy, smoother, with a little less N-S acquisition footprint. However, it also has lower resolution than the input image shown previously. In comparison to the median filter, the LUM filtered image shows more acquisition footprint, but it has enhanced the collapse features too. The MSMTM filter improves in regards to the footprint and shows better details near the collapse features.

References:

S. al-Dossary, K. J. Marfurt, 2007, Lineament-preserving filtering: Geophysics, **72**, P1-P8.