



AHELP for CIAO 3.4

dmfilth

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Synopsis

Replace pixel values in source regions of an image with values interpolated from surrounding background regions

Syntax

```
dmfilth infile outfile method srclist bkglist [randseed] [clobber]
[verbose]
```

Description

This tool replaces pixel values in a source region or stack of source regions in an input image with values interpolated from surrounding background regions. All regions are specified using standard region library syntax.

Interpolation methods

There are two different types of method for calculating the replacement pixels:

- The DIST, POISSON, and GLOBAL methods randomly sample values from a probability distribution.
- The POLY and BILINT methods fit a function to the data in the background region and use this fit to calculate the new pixel values.

These methods are described in more detail below.

DIST

Pixel values in the source region(s) are sampled from the distribution of pixel values in the background region(s). A single background region or stack of background regions may be used, but they must not include pixels in the source region(s).

POISSON

Pixel values in the source region(s) are sampled from the Poisson distribution whose mean is that of the pixel values in the background region. A single background region or stack of background regions may be used, but they must not include pixels in the source region(s).

Please see the "bugs" section of this file (e.g. "ahelp -b BUGS dmfilth") if you plan to use the POISSON method.

GLOBAL

Pixel values in the source region(s) are sampled from the Poisson distribution whose mean is that of all pixel values not within the source regions. The bkglist parameter is not used in this method.

POLY

A 2D bi-quadratic function of the form

$$A1+A2(X)+A3(X^2)+A4(Y)+A5(Y^2)+A6(X)(Y)+A7(X)(Y^2)+A8(X^2)(Y)+A9(X^2)(Y^2)$$

is fit to the data within the background region(s), and the results are used to compute pixel values within the source region(s). Users may specify one background region that includes all source regions, or a stack of background regions with one for each source region; in either case the background region(s) must include the pixels in the source region(s).

BILINT

The value for each source region pixel is a bilinear interpolation of the form

$$A1+A2*X+A3*Y+A4*X*Y,$$

using the 4 values in the nearest background pixels in the perpendicular directions +/-45 degrees and +/-135 degrees to determine the 4 interpolation coefficients. Since only 4 pixels are used, this method may produce noticeable "pattern noise" due to statistical fluctuations in regions of few counts. The bkglist parameter is not used in this method.

Example 1

```
dmfilth in1.fits out1.fits DIST "circle(4200.0,3600.0,15.0)"
"circle(3800.0,3900.0,7.0)"
```

Interpolate over the region

```
circle(4200.0,3600.0,15.0)
```

by sampling from the pixel distribution in the background region

```
circle(3800.0,3900.0,7.0).
```

Example 2

```
dmfilth in1.fits out1.fits DIST "circle(4200.0,3600.0,15.0)"
"circle(3800.0,3900.0,7.0)" randseed=123
```

This is the same as the first example except that the random-number generator is seeded with the value 123, rather than using the system time. Repeated runs of this example will create exactly the same output file, whereas they would be different if `randseed=0`.

Example 3

```
dmfilth in1.fits out1.fits POLY "circle(4200.0,3600.0,15.0)"
"circle(4200.0,3600.0,25.0)"
```

Here we have the same source image and source region as previously, but we use a two-dimensional polynomial fit over the region

```
circle(4200.0,3600.0,25.0)
```

to define the replace values. Note that the source region is entirely within the region used to fit the background.

Example 4

```
dmfilth in1.fits out1.fits POISSON @src.lis @bkg.lis
```

Each separate region in the file `src.lis` is filled with values drawn from a Poisson distribution whose mean is the mean level in the corresponding background region in `bkg.lis`.

Example 5

```
dmfilth in1.fits out1.fits GLOBAL "box(4200.0,3800.0,20.0,10.0)"
bkglist=""
```

The box region centered on (4200.0,3800.0) with width 20 and height 10 is replaced with values drawn from a Poisson distribution. The mean of this distribution is set to the mean level in all pixels in the image that do not lie within the source region. The `bkglist` parameter is not used here, and so is set to "".

Example 6

```
dmfilth in1.fits out1.fits BILINT @src.lis bkglist=""
```

Interpolate over the source region stack using bilinear interpolation between the nearest non-source pixels in directions of ± 45 degrees and ± 135 degrees. If, for a particular pixel within the source region, the interpolation matrix is singular, the average of the 2 linear interpolations between the nearest background pixels in the x- and y-directions is used instead. The `bkglist` is not used in this example.

Parameters

name	type	ftype	def	min	max	reqd	stacks
<u>infile</u>	file	input				yes	
<u>outfile</u>	file	output				yes	
<u>method</u>	string		GLOBAL			yes	
<u>srclist</u>	string					yes	yes
<u>bkglist</u>	string					yes	yes
<u>randseed</u>	integer		1	0	65536		
<u>clobber</u>	boolean		no				
<u>verbose</u>	integer		0	0	5		

Detailed Parameter Descriptions

Parameter=**infile** (file required filetype=input)

The input image. If using an event file, add a binning specification to the filename, e.g. `infile="acis_evt2.fits[bin sky=4]";` see `ahelp dmbinning` for more information.

Parameter=**outfile** (file required filetype=output)

The output dataset.

Parameter=**method** (string required default=GLOBAL)

The interpolation method.

The allowed values of this enumerated type are POLY, DIST, GLOBAL, POISSON, and BILINT.

Parameter=**srclist** (string required stacks=yes)

The `srclist` is a stack of region specifications to be interpolated over.

Parameter=**bkglist** (string required stacks=yes)

Region(s) from which to define the background (if the method is not GLOBAL or BILINT).

The `bkglist` is a stack of region specifications to be sampled from for the methods POISSON and DIST. For these methods, the background regions may not include any pixels contained in source regions. For the POLY method, a 2D polynomial is fit over the `bkglist` region(s), which must include all source region pixels.

For all three methods, if the number of background regions in `bkglist` is 1, that background region will be applied to all source regions. If the number of background regions in `bkglist` is equal to the number of source regions, each background region will be used with the corresponding source region. In all other cases, a fatal error will be reported.

The bkglist is not used for the GLOBAL and BILINT methods.

Parameter=randseed (integer default=1 min=0 max=65536)

The seed for the random number generator.

Specifies the seed for the random number generator used by the POISSON, DIST, and GLOBAL methods. A value of 0 uses the system time to set the seed.

Parameter=clobber (boolean default=no)

Specifies if an existing output file should be overwritten.

Parameter=verbose (integer default=0 min=0 max=5)

Specifies the level of verbosity in displaying diagnostic messages (0–5).

Bugs

The statistical distribution of total counts in regions filled with method=POISSON is broader than expected. In particular, tests with simulated blank fields containing hundreds of counts in each source region reveal that the quantity

$$\frac{[(\text{counts in filled region}) - (\text{original counts in region})]}{\sqrt{(\text{original counts in region})}}$$

has a standard deviation approximately 70% broader than expected from simple Gaussian statistics. Users should proceed with caution in performing rigorous quantitative analysis with dmfilth.

See the [bugs page for this tool](#) on the CIAO website for an up-to-date listing of known bugs.

See Also

calibration

[ardlib](#)

dm

[dmbinning](#), [dmimages](#), [dmimfiltering](#)

tools

[acis bkgnd lookup](#), [acis fef lookup](#), [acis set ardlib](#), [acisspec](#), [aconvolve](#), [acrosscorr](#),
[add grating orders](#), [add grating spectra](#), [arestore](#), [asphist](#), [dither region](#), [dmappend](#), [dmarfadd](#),
[dmcontour](#), [dmcoords](#), [dmcopy](#), [dmextract](#), [dmgroup](#), [dmimg2jpg](#), [dmimgcalc](#), [dmimghist](#), [dmimgpick](#),
[dmimgthresh](#), [dmregrid](#), [fullgarf](#), [get sky limits](#), [mkacisrmf](#), [mkarf](#), [mkexpmap](#), [mkgarf](#), [mkgrmf](#),
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