Chandra X-ray Center

URL: http://cxc.harvard.edu/ciao3.4/bugs/csmooth.html
Last modified: 21 November 2006

Bugs: csmooth

Caveats

1. ***When working with extended sources, the background should be supplied in an external file, not computed from the input data.***

   The background is calculated from the region surrounding the smoothing kernel when using the "local" option (`bkgmode` parameter). Working with extended sources in this mode causes `csmooth` to use the extended emission of the source as the background in the calculation of the significance map, and the smoothed image will not be correct.

   Users should be extremely cautious when using a background option in `csmooth` while working with extended sources (and diffuse emission). The user should always go back to the un−smoothed data and determine if the results of the smoothing seem reasonable.

   Three parameters are used to specify the background file:

   - `bkgmode = "user"`
   - `bkgmap = background image file`
   - `bkgerr = background error image file`

   Note that the image must be of the same dimensions as the data, and is assumed to be in the same units. The ACIS Background file thread shows how to create a background file for your data.

   For pointlike objects the surrounding background is close to the true background, so the "local" mode works much better than it does for extended sources.

Bugs

1. ***There is a bug in the logic of `csmooth` that may cause the tool to hang near the 99.5% completion mark, then slowly creep towards max kernel size.***

   If the tool appears to be running for a long time on a particular dataset, try setting `verbose` > 0. It may be getting stuck on a particular kernel size (or only asymptotically approaching the maximum kernel), as shown here:

n_max	m_krnl_min	smoothing radius	out/in diffl	pixels cumul	pixels done (%)	counts done (%)	significance range min	significance range med	significance range max
....									
8.00	10.35	36.663	1.000	1.000	53.12	97.44	3.00	3.89	9.87
8.00	13.47	36.673	1.000	1.000	54.35	99.42	3.00	5.29	34.67
4.00	12.47	36.683	1.000	1.000	54.77	99.52	3.00	3.49	11.73
2.00	***14211.30***	37.351	1.000	1.000	***54.77***	***99.53***	11.59	11.59	11.59
1.00	13920.84	37.685	1.000	1.000	54.77	99.53	3.20	3.20	3.20
3.00	14215.57	38.019	1.000	1.000	54.77	99.53	3.28	3.97	14.99

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Notice that the kernel size explodes to 14211.30 (from 12.47); at this point, something in the statistics/guessing/etc. goes awry, and the 99.53% complete takes forever to finish. Note that when running with `verbose` > 0, `csmooth` actually has to compute all those statistics. ***If you do not need them, set `verbose = 0` and the tool will finish more quickly.***

Workaround:

There is no fail−safe workaround, but there are a few changes to make if you are affected by this bug:

- `csmooth` work best with images that have 2^n axes. Either clip or pad the image to change the axes.
- Try changing the parameter defaults, especially for the `sclmax` and/or the `sigmin`/`sigmax`. These choices can significantly affect the run−time (both negatively and positively). The bigger the range between `sigmin` and `sigmax`, the fewer scales will be run.

  Actually, one of the main reasons `csmooth` runs slowly is that many users leave `sclmax = INDEF`, in which case it has to try to get the last few/partial %'s by increasing the cell size. Choose a reasonable value for this parameter and the tool won't waste a lot of time smoothing at very large scales. For the above example, `sclmax = 37` would be a good starting point.
- Crop image to data−size so there is always some background. This does have the caveat that FFT convolutions do suffer from edge effects that are usually mitigated by padding (and while slide−convolve is an option, it's very slow). But if the interesting part of the image is in the center, edge effect are less of an issue.

2. ***Problem in algorithm includes background doubling in the smoothed region which is ONLY an issue with very high background data.***

   An example of a high background is 50 counts per pixel.

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