emask

April 16, 2023

Abstract

Creation of detection mask (from exposure images), marking the area on which source searching will be performed.

1   Instruments/Modes

Instrument	Mode
EPIC MOS:	IMAGING
EPIC PN:	IMAGING

2   Use

pipeline processing	yes
interactive analysis	yes

3   Description

Using an exposure image from any of the EPIC instruments, a mask image is constructed, representing the area on the sky which is searched by the source detection tasks. Optionally. circular or (rotated) box regions are excluded from the mask. They are read from a FITS region file which must contain the columns SHAPE, X, Y, and R in the extension REGION. This format is provided by the SAS task **ds9tocxc**. The coordinates in X, Y must be image pixels. Up to 1000 regions from the region file will be processed. The detection mask is a FITS image containing the integer values 0 and 1, where 1 marks the image area on which source searching will be performed.

4   Parameters

This section documents the parameters recognized by this task (if any).

Parameter	Mand	Type	Default	Constraints

expimageset	yes	filename	expimage.fits	

Names of exposure images

detmaskset	yes	filename	detmask.fits	

Name of detection mask file

detmasktable	no	string	MASK	

Name of detection mask table (may be PRIMARY)

threshold1	no	float	0.3	[0.0<param<1.0]

Threshold parameter 1: fraction of maximum exposure

threshold2	no	float	0.5	[0.0<param<10.0]

Threshold parameter 2: threshold for gradient of exposure

withregionset	no	binary	false	

Read a FITS region file and exclude circular/box regions from the mask

regionset	no	filename	region.fits	

Name of the FITS region file providing the regions to be excluded

5   Errors

This section documents warnings and errors generated by this task (if any). Note that warnings and errors can also be generated in the SAS infrastructure libraries, in which case they would not be documented here. Refer to the index of all errors and warnings available in the HTML version of the SAS documentation.

ImageMismatch *(fatal)*
  Exposure images from different instruments have different pixel sizes, image sizes, center coordinates (RA, Dec), or north vectors (not yet implemented)

FileMismatch *(error)*
  Inconsistent number of input images, instruments, bands, or detector mask(s)

MissingParameter *(error)*
  Missing input file name

WrongInst *(error)*
  Unknown instrument

WrongType *(error)*
  Input image has wrong type

ColumnNotFound *(warning)*
  Column `X`, `Y`, `R` or `SHAPE` missing in region FITS file
  corrective action: Ignore region file

EmptyTable *(warning)*
  Region table has 0 rows
  corrective action: Ignore region file

TooManyRegions *(warning)*
Region table has more than 16384 rows
corrective action: Truncate region list

MissingAttribute *(warning)*
Keyword is missing
corrective action: Keyword is not copied to output

6 Input Files

1. PPS product (from task **eexpmap**): EPIC exposure image

7 Output Files

1. Detection mask (to be used by tasks **eboxdetect**, **esplinemap**, **esensmap**) The detection mask is a FITS image with the same binning as the EPIC FITS images and contains the integer values 0 or 1. By default the mask is written in an extension called MASK.

8 Algorithm

```
Begin subroutine emask

  Determine maximum of exposure
  Multiply threshold parameters with exposure maximum

  Optionally read region file

  Loop over image pixels
    Set pixels of detection mask to 1 if exposure is above cutoff
      and 0 otherwise.
    Set pixels inside excluded regions to 0.
  END Loop

  Loop over image pixels
    Set pixels of detection mask to 0 if gradient of exposure
      is above threshold.
  END Loop

End subroutine emask
```

9   Comments

10   Future developments

- Add error handling and verbosity control.
- Add capability to operate on multiple exposure maps (see developer notes).

References