makethumbs

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Abstract

This task creates thumbnail GIF(s) around source locations.

1 Instruments/Modes

Instrument	Mode
EPIC	Imaging

2 Use

pipeline processing	no
interactive analysis	yes

3 Description

3.1 Overview

The task **makethumbs** reads an EPIC image, as well as optionally the source list file in each observation (as is included in the standard distribution of the pipe-line processing) and/or the external catalogue file in the format of the 2XMM catalogue, then outputs the thumbnail GIF images of the sources of user's choice. This task is mainly designed to produce a GIF image of each source or simply of a sky position so that the user can have a quick look at it.

This task has two processing modes: a single source (hence a single output file) and multiple sources (hence multiple output files). Only in the former case (single-source mode), users can specify the name of the discrete and complete output filename via the command-line parameter `outfilename`. If not, users can specify the root filename via `gifroot` and can control the rules of subsequent identifier via a few command-line arguments. If none is specified, the default filename(s) will be used.

Note that SAS tasks in default have the clobber setting activated. Therefore, unless users explicitly specify `--noclobber` (see Section 9 for an important note for `--noclobber` option), all the existing files with the identical names will be overwritten.

The basic input parameters for each source, such as its celestial coordinates, are read from the given source-list and/or the external catalogue in default. Only in the single-source mode, the position can be given via the command-line arguments, `ra` and `dec`. Some strings displayed in all the output GIF files can be given via several command-line arguments.

In determining the output filenames (unless a user specifies the discrete filename in the single-source mode), this task uses either or all of `SRC_NUM` (source number, which can be given via the command-line parameter `srcnum` in the single-source mode), `DETID` (meaning detection ID in the 2XMM catalogue) or `SRCID` (unique source ID in 2XMM), all of which are derived from either the input source-list or the given external catalogue.

Users can also make a fine control over the size and colour of the output GIF image, size and thickness of the hair-line cross in the image and strings of information displayed in the image.

See the following and Section 4 for detail.

3.2 Note on the processing speed

Generating GIF files itself with this task is reasonably quick. However, to read an external catalogue may not be so, in particular the given external catalogue is a large one, such as the 2XMM catalogue FITS file.

The least required (or desirable) columns for the external catalogue given to this task are listed in the following Section 2. If a user wants to give a large external catalogue as the input to this task, s/he is encouraged to trim (delete) the unnecessary columns in the catalogue before it is given to this task.

Unfortunately, it will take nevertheless 20 min or longer in the case of the catalogue based on the entire 2XMM catalogue, even if it is trimmed down to a minimised set of columns (in other words, it would take hours or longer if the raw 2XMM catalogue is given). The bottle neck is known to be in reading the column for the source names in the external catalogue. However, there is no plan that this problem will be fixed in the foreseeable future, because this problem is rooted in a technical reason in the SAS scheme for Fortran,

As the work-around for this problem, the task **ingestsrcnames** is provided in this package. With the task, users can ingest the all those parameters, which may be used in processing with this task, to the input source-list. Then, even though the process of ingesting takes as long time as this task would do, it is a one-off process, and once it is done, users can produce GIF files with this task **makethumbs** for any of the sources listed in the source list without waiting much, as the external catalogue is no longer given every time this task is run.

3.3 Detail of the process

3.3.1 Source matching

The external catalogue is used to specify the source name and some IDs of each source. The matching between the sources in the source list or user-specified source and the one in the external catalogue is based on `OBS_ID` and `SRC_NUM` (see Table 2, where the information is derived from).

Table 1: Parameters needed for source matching

Parameters	Command-line	Input image	Source	Catalogue
OBS_ID	obsidstr*	header*	—	Column
SRC_NUM (single)	srcnum	—	(Column)	Column
SRC_NUM (multiple)	—	—	Column	Column

(*): The command-line argument, if specified, has a priority over the header attribute.

Table 2: Required columns in the input source list

Columns	Data-Type	Mandatory/Optional	Note
SRC_NUM	Double	Mandatory	
RA	Double	Optional	Recommended.
DEC	Double	Optional	Recommended.

3.3.2 Determination of coordinates

The source coordinates are determined in the following order of priority, if given.

1. User-specified (only if single source)
2. Source-list
3. External catalogue

3.3.3 FITS columns used in processing

Table 2 and Table 3 tabulate the column names used by this task. Some other column names are also permitted (See Table 4 for the list of candidates).

The order of the priority, in which each source parameter (obviously except for OBS_ID and SRC_NUM) is read, is as follows:

1. Command-line argument (such as, RA and DEC)
2. External catalogue

Table 3: Required columns in the (optional) external catalogue

Columns	Data-Type	Mandatory/Optional	Note
OBS_ID	String	Mandatory	
SRC_NUM	Int32	Mandatory	
IAUNAME	String	Optional	Source name
DETID	Int32	Optional	Detection ID
SRCID	Int32	Optional	Unique source ID
RA	Double	Optional	Usually unnecessary.
DEC	Double	Optional	Usually unnecessary.

Table 4: Name of the possible column names

	Type	Names in order of priority		
Observation ID	String	OBS_ID		
Observation ID	Integer32	OBSID		
Source ID	Integer32	SRC_NUM	SUM_SRC_NUM	
Detection ID	Integer32	DETID	SRC_NUM	
Detection ID	Integer32	SRCID	SRC_ID	
Is the source **in**?	Logical	INCATFLG		
Right Ascension	Double	RA	RA_UNC	RA_CORR
Declination	Double	DEC	DEC_UNC	DEC_CORR
Source name	String	IAUNAME	XMMSRCNAME	

Note that the lower-case column names are also accepted.

3. Source list.

This may be of particular importance when an external catalogue is given as a command-line argument, where the source-list is already *ingested* with some columns, such as IAUNAME.

3.3.4 Sources out of catalogue

When an external catalogue is given, if a source listed in the source list is not included in the external catalogue, then the source is ignored in processing. The same information can be obtained from the column INCATFLG in the input source-list, that is, if the value in INCATFLG is false, the source is not processed.

On the other hand, if an external catalogue is not given, and if the input source-list is given but does not contain the column INCATFLG, then all the sources specified (a single source or all) are processed.

3.4 Examples

Here are a few simple examples of the use of this task.

1. User-specified coordinates

```
makethumbs imageset=P0123456789M1S001IMAGE_8000.FIT
  withsrclist=no outfilename=out.gif
  ra=123.45 dec=-67.89
```

2. User-specified coordinates with catalogue

```
makethumbs imageset=P0123456789M1S001IMAGE_8000.FIT
  srcnum=5 cattab='cat2xmm.fits:SRCLIST'
  withsrclist=no outfilename=out.gif
```

3. Simplest (single source)

```
makethumbs imageset=P0123456789M1S001IMAGE_8000.FIT
  srclisttab='P0123456789EPX000OBSMLI0000.FIT:SRCLIST'
  srcnum=5 gifroot='m1image_'
```

4. Simplest (multiple sources, with the catalogue input)

```
makethumbs imageset=P0123456789M1S001IMAGE_8000.FIT
  srclisttab='P0123456789EPX000OBSMLI0000.FIT:SRCLIST'
  cattab='cat2xmm.fits:SRCLIST'
  gifroot='m1image_'
```

4 Parameters

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

Parameter	Mand	Type	Default	Constraints
imageset	yes	dataset		

Input image FITS file.

withsrclist	no	boolean	true	

Whether to use the source list in the observation.

srclisttab	yes	table		

Mandatory if `withsrclist` is true. Source list (e.g., P0123456789EPX000OBSMLI0000.FIT:SRCLIST) in the observation.

withcoords	no	boolean	false	

Whether to give the coordinates in the command-line arguments. This parameter is read if `withsrclist` is false. Note that if `cattab` is also false, this has to be true.

ra	no	real		-360 <= ra <= 360

Right Ascension of the source position (aka the output GIF image centre).

dec	no	real		-90 <= dec <= 90

Declination of the source position (aka the output GIF image centre).

withcat	no	boolean	false	

Whether to use the (bigger) external catalogue set, which tabulates the source `IAUNAME` etc.

cattab	yes	table		

Mandatory if `withcat` is true. Catalogue table name (eg., 'cat2xmm.fits:SRCLIST').

withsrcnum	no	boolean	false	

Whether to specify `SRC_NUM`. This is mandatory if `withsrclist`=no and `withcat`=yes.

srcnum	no	int	0	srcnum $\geq$ 0

ID number (`SRC_NUM`) of the source in the given source list to process (0 (Default) means all the sources, which is valid only when `withsrclist`=yes).

autofname	no	boolean	true	

Whether to automatically determine the output GIF filenames (true) or use user-specified single filename (false). If no, either `withsrclist` has to be false or `srcidnumber` has to be non-zero.

outfilename	yes	file		

Mandatory if `autofname` is false. Filename of the output GIF (with suffix mandatory).

gifroot	no	string	thumb	

Read if `autofname` is true. Root of the output filenames.

fnamestyle	no	string	srcnum	srcnum – hexsrcnum – detid – srcid – srcnum_detid – srcnum_srcid – all

Read if `autofname` is true. Style in naming the output GIF files.

gifsuffix	no	string	.gif	

Read if `autofname` is true. The suffix of the output GIF filename.

fnameseparator	no	string	`‘‘ __’’`	

Read if `autofname` is true. The separators in the output GIF filenames: eg., `‘‘ROOT@@_@@-@@A@@’’` for `‘‘ _-A’’`.

srcindexstyle	no	string	detid	none – srcnum – hexsrcnum – detid – srcid

Style of the index printed in the GIF.

srcindexseparator	no	string	DEFAULT	

The separator between the source name and index displayed in the output image. Default is ‘`:`’ and ‘`/`’ for `srcindexstyle`=’`detid`’ and ’`srcnum`’, respectively.

iaunameprefix	no	string		

Prefix for the IAUNAME in case the catalogue (if given) is missing it.

obsidstr	no	string	DEFAULT	

String expression of `OBS_ID`.

erangestr	no	string		

String expression of the energy band, such as, ‘0.5-10 keV’.

instst r	no	string		

String expression of the instrument.

commlower	no	string		

Comment appearing at right-hand side in the second row in the output image.

commupper	no	string		

Comment appearing at right-hand side in the first row in the output image.

imagesize	no	angle	8	imagesize >= 0

Size of the output image in unit of arcmin.

lwidth	no	int	0	lwidth >= 0

Lwidth of the cross in the image (0 (Default) means automatically calculated).

sizeratiocross	no	real	0.0	sizeratiocross >= 0

Ratio of the size of closeness of the cross to the source (0 (Default) means automatically calculated).

fontnumber	no	int	0	fontnumber >= 0

Font number in PGPLOT used in output images (Default=0 (not specified)).

colourmapid	no	int	3	colourmapid >= 0

Colour Map ID (Default=3, heat).

printparams	no	boolean	false	

Display to STDOUT the source parameters if yes.

dryrun	no	boolean	false	

Dry-run if true.

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.

imageTooSmall *(error)*
ImageSize value has to be positive.

allFilesFailed *(error)*
Failed in creating every output file.

NoSrcNumSpecified *(error)*
srcnum is mandatory when `withsrclist`=no and `withcat`=yes.

NoCoordsSpecified *(error)*
`ra` and `dec` are mandatory when `withsrclist`=no and `withcat`=no.'

NotFoundDETID *(error)*
DETID is not found in the table, even though it has to be used.

NotFoundSRCID *(error)*
SRCID is not found in the table, even though it has to be used.

NoObsIdFoundInCat *(error)*
No column of `OBSID` (or alike) is found in the given catalogue.

WrongDataTypeObsId *(error)*
`OBS_ID` datatype is wrong.

noPgplotGifDevice *(error)*
Failed to open the PGPLOT GIF device. Check your PGPLOT environment.

tooManyMatches *(error)*
More than one entry match for the corresponding source in the catalogue.

fileExists *(warning)*

(warning)

corrective action:
corrective action: Output file exists and clobber is not set.NoSrcTableSource table is not found in 1st Extension or before.

smallerDimensionForSumIauname *(warning)*

(warning)

corrective action:
corrective action: The size of `IAUNAME` found may be too big, so it may be trimmed.NotFoundObsIdInPrimary`OBS_ID` attribute is not found in the primary header but in the header in one of the subsequent extentions.

typeMismatchInAttribute *(warning)*

(warning)

corrective action:
corrective action: The datatype of the attribute is different from what is supposed to be.catalogueNotRead`SRC_NUM` is not specified, hence the given catalogue is not read.

NotUseDetidInSrcList *(warning)*

(warning)

corrective action:
corrective action: Although the column `DETID` is found in the source list, that from the external catalogue is used.NotUseSrcidInSrcListAlthough the column `SRCID` is found in the source list, that from the external catalogue is used.

NotUseCatnameInSrcList *(warning)*

(warning)

corrective action:
corrective action: Although the column `IAUNAME` or alike is found in the source list, that from the external catalogue is used.srcOutOfFieldThe source location is out of the field of view of the input image, hence the output image is not created.

tooSmallLWidth *(warning)*

(warning)

corrective action:
corrective action: Lwidth for PGPLOT is set to be the minimum value, 2.noMatchingSrcNo match is found in the catalogue for the source of interest.

6 Input Files

1. Image set
2. Source list (optional)
3. External catalogue (optional)

7 Output Files

1. Thumbnail image GIFs

8 Algorithm

```
call readParameters()
call readArrayData(imageSetName, image)
Get_string_expressions_of_InstStr_ObsId
call loadSources(thumbOnes, ComArgs) ! optionally with the catalogue
Set_thumbCommon
call calcSrcImageCoords(imageSet, thumbOnes, thumbCommon)

if (withSrcList) then
  if ( srcIdNumber <= 0 ) then ! All sources
    srcBegin = 1
    srcEnd = numSources
  else ! One specified source
    srcBegin = srcIdNumber
    srcEnd = srcIdNumber
  end if
else ! Single source mode
    srcBegin = 1
    srcEnd = 1
end if

Set_srcIndexForPrint

do iSrc = srcBegin, srcEnd
  if (.not. srcInCatFlag(iSrc)) cycle

  if (isAutoFname) then
    thumbOnes(iSrc)\%filename = trim(getThumbnailName(thumbOnes(iSrc), outFilenameStyle))
```

```
  else
    thumbOnes(iSrc)\%filename = trim(outGifName)
  end if

  if (isFileExistingAndQuit(trim(thumbnailName))) cycle

  if (isDryRun) cycle ! In reality this is out of this loop.
  call makeAndSaveThumbnail(thumbOnes(iSrc), thumbCommon)
end do
```

9 Comments

- Like many other SAS tasks, `--noclobber` option is not recommended to specify when you run this task. It may always fail, if it is specified. It is rooted in one of the basic SAS libraries (`DAL`) and there is no plan of it being fixed in the foreseeable future.

References