Data file and data structure documentation for the fMRI StarPlus study.

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fMRI data is available for a number of human subjects. For each subject the full data set is stored on a file containing the subject number (e.g., the data for subject 04799 is on data-starplus-04799-v7.mat). If you are using version 7 of MATLAB, load the files ending with 'v7'; if you have version 6 then use the files ending with 'v6.'

After you load a file, you will find three variables defined: info, data, and meta. The variable 'data' contains the actual image intensity data values. The variable 'meta' contains general information about the dataset. The full time series of images in the data is partitioned into temporally contiguous segments called 'trials'. The variable 'info' describes information about each of these trials.

Detailed documentation for each variable is provided below:

META

`meta`: This variable provides information about the data set. Relevant fields are shown in the following example:

```
meta =
    study: 'data-starplus'
    subject: '05710'
    ntrials: 54
    nsnapshots: 2800
    nvoxels: 4634
    dimx: 64
    dimy: 64
    dimz: 8
    colToCoord: [4634x3 double]
    coordToCol: [64x64x8 double]
    rois: [1x25 struct]
    colToROI: {4634x1 cell}
```

- `meta.study` gives the name of the fMRI study

- `meta.subject` gives the identifier for the human subject

- `meta.ntrials` gives the number of trials in this dataset

- `meta.nsnapshots` gives the total number of images in the dataset

- `meta.nvoxels` gives the number of voxels (3D pixels) in each image

- `meta.dimx` gives the maximum x coordinate in the brain image. The minimum x coordinate is x=1.
  - `meta.dimy` and `meta.dimz` give the same information for the y and z coordinates.
- `meta.colToCoord(v,:)` gives the geometric coordinate (x,y,z) of the voxel corresponding to column v in the data
- `meta.coordToCol(x,y,z)` gives the column index (within the data) of the voxel whose coordinate is (x,y,z)
- `meta.rois` is a struct array defining a few dozen anatomically defined Regions Of Interest (ROIs) in the brain. Each element of the struct array defines on of the ROIs, and has three fields: "name" which gives the ROI name (e.g., 'LIFG'), "coords" which gives the xyz coordinates of each voxel in that ROI, and "columns" which gives the column index of each voxel in that ROI.
- `meta.colToROI{v}` gives the ROI of the voxel corresponding to column v in the data.

INFO

`info`: This variable defines the experiment in terms of a sequence of 'trials'. 'info' is a `1x54` struct array, describing the 54 time intervals, or trials. Most of these time intervals correspond to trials during which the subject views a single picture and a single sentence, and presses a button to indicate whether the sentence correctly describes the picture. Other time intervals correspond to rest periods. The relevant fields of info are illustrated in the following example:

```
info(18)
    mint: 894
    maxt: 948
    cond: 2
    firstStimulus: 'P'
    sentence: ''It is true that the star is below the plus.''
    sentenceRel: 'below'
    sentenceSym1: 'star'
    sentenceSym2: 'plus'
    img: sap
    actionAnswer: 0
    actionRT: 3613
```

- `info.mint` gives the time of the first image in the interval (the minimum time)
- `info.maxt` gives the time of the last image in the interval (the maximum time)
- `info.cond` has possible values `0,1,2,3`.
  - `cond=0` indicates the data in this segment should be ignored.
  - `cond=1` indicates the segment is a rest, or fixation interval.
  - `cond=2` indicates the interval is a sentence/picture trial in which the sentence is not negated.
  - `cond=3` indicates the interval is a sentence/picture trial in which the sentence is negated.
- `info.firstStimulus`: is either 'P' or 'S' indicating whether this trail was obtained during the session is which Pictures were presented before sentences, or during the session in which Sentences were presented before pictures. The first 27 trials have `firstStimulus='P'`, the remained have `firstStimulus='S'`. Note this value is present even for trials that are rest trials. You can pick out the trials for which sentences and pictures were presented by selecting just the trials trials with `info.cond=2` or `info.cond=3`.

- `info.sentence` gives the sentence presented during this trial. If none, the value is `''` (the empty string). The fields `info.sentenceSym1`, `info.sentenceSym2`, and `info.sentenceRel` describe the two symbols mentioned in the sentence, and the relation between them.

- `info.img` describes the image presented during this trial.

  - For example, 'sap' means the image contained a 'star above plus'. Each image has two tokens, where one is above the other. The possible tokens are star (`s`), plus (`p`), and dollar (`d`).

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- `info.actionAnswer`: has values `-1` or `0`.

  - A value of 0 indicates the subject is expected to press the answer button during this trial (either the 'yes' or 'no' button to indicate whether the sentence correctly describes the picture).
  - A value of -1 indicates it is inappropriate for the subject to press the answer button during this trial (i.e., it is a rest, or fixation trial).
- `info.actionRT`: gives the reaction time of the subject, measured as the time at which they pressed the answer button, minus the time at which the second stimulus was presented. Time is in milliseconds. If the subject did not press the button at all, the value is 0.

DATA

`data`: This variable contains the raw observed data. The fMRI data is a sequence of images collected over time, one image each 500 msec. The data structure 'data' is a `[54x1]` cell array, with one cell per 'trial' in the experiment. Each element in this cell array is an `NxV` array of observed fMRI activations. The element `data{x}(t,v)` gives the fMRI observation at voxel `v`, at time `t` within trial `x`. Here `t` is the within-trial time, ranging from 1 to `info(x).len`. The full image at time `t` within trial `x` is given by `data{x}(t,:)`.

Note the absolute time for the first image within trial x is given by `info(x).mint`.