THE NIFTI1 DATA FORMAT

NIFTI1 can store data with different meanings. Imaging data, statistical values and other data (any vector, matrix, label set or mesh). can be saved in a nifti1 *.nii or *.hdr/*.img file. Once a data intent is chosen, the use of the nifti1 format is unambigious since the use of particular fields for a certain intent is predetermined.

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intent_code

DATASET

NIFTI_INTENT_NONE: 0

STATISTICS

NIFTI_INTENT_CORREL: 2
NIFTI_INTENT_TTEST:3
NIFTI_INTENT_FTEST: 4
NIFTI_INTENT_ZSCORE: 5
NIFTI_INTENT_CHISQ: 6
NIFTI_INTENT_BETA: 7
NIFTI_INTENT_BINOM: 8
NIFTI_INTENT_GAMMA: 9
NIFTI_INTENT_POISSON: 10
NIFTI_INTENT_NORMAL: 11
NIFTI_INTENT_FTEST_NONC: 12
NIFTI_INTENT_CHISQ_NONC: 13
NIFTI_INTENT_LOGISTIC: 14
NIFTI_INTENT_LAPLACE: 15
NIFTI_INTENT_UNIFORM: 16
NIFTI_INTENT_TTEST_NONC: 17
NIFTI_INTENT_WEIBULL: 18
NIFTI_INTENT_CHI: 19
NIFTI_INTENT_INVGAUSS: 20
NIFTI_INTENT_EXTVAL: 21
NIFTI_INTENT_PVAL: 22
NIFTI_INTENT_LOGPVAL:: 23
NIFTI_INTENT_LOG10PVAL: 24

OTHER

NIFTI_INTENT_ESTIMATE: 1001
NIFTI_INTENT_LABEL: 1002
NIFTI_INTENT_NEURONAME: 1003
NIFTI_INTENT_GENMATRIX: 1004
NIFTI_INTENT_SYMMATRIX: 1005
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NIFTI_INTENT_VECTOR: 1007
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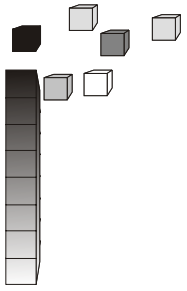
NIFTI_INTENT_TRIANGLE: 1009
NIFTI_INTENT_QUATERNION: 1010
NIFTI_INTENT_DIMLESS: 1011

To determine the position of the voxel in the dataset, method 1 is used (translation). Methods 2 and 3 serve also for reconstructing rigid body and affine transformations so that the positions of the voxels withinthe dataset in a stereotactic space can be determined.

NIFTI_INTENT: DATASETS

Locating position of voxel in dataset: how to use the nifti1 variables for datasets



(i,j,k)

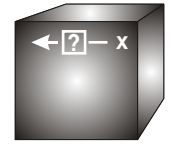
method 1 (translation):
qform_code = NIFTI_XFORM_UNKNOWN=0
x/y/z = **pixdim[**1/2/3**]** * i

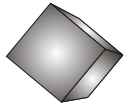
method 2 (rigid body transform):
qform_code = NIFTI_XFORM_* > 0
x/y/z = [<**quatern_b/c/d**>][qfac (=**pixdim[0]**) * **pixdim[1/2/3]** * i]+[**q_offset_x/y/z**]
NB: qfac (=**pixdim[0]**, describes coordinate system for data)

method 3 (affine transform):
sform_code > 0
x/y/z = **srow_x/y/z[0]** * i + **srow_x/y/z[1]** * j + **srow_x/y/z[2]** * k+ **srow_x/y/z[3]**

transformations

(x,y,z)



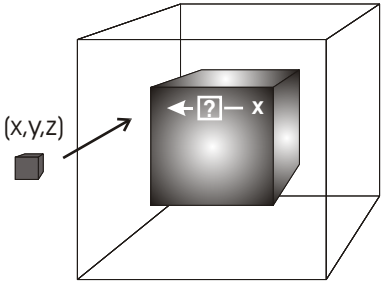


rotation

scaling
(adjust voxel size)

shearing

(x,y,z)



* used nifti1 variables are displayed bold

COORDINATE SYSTEM

arbitrary space:

NIFTI_XFORM_UNKNOWN: 0

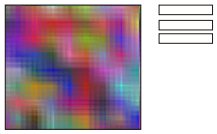
standard space:

NIFTI_XFORM_SCANNER_ANAT: 1
NIFTI_XFORM_ALIGNED_ANAT: 2
NIFTI_XFORM_TALAIRACH: 3
NIFTI_XFORM_MNI_152: 4

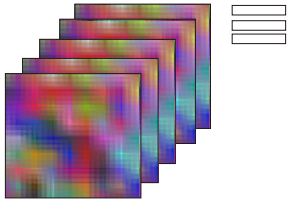
Nifti1 can also be used to store values drawn from a given distribution. For this purpose, many intent_types are dedicated to describe statistical tests Univariate and multivariate tests can be stored, including the used parameters. In nifti1, it is possible to save more than one values per voxel (even a matrix per voxel).

NIFTI_INTENT: STATISTICS

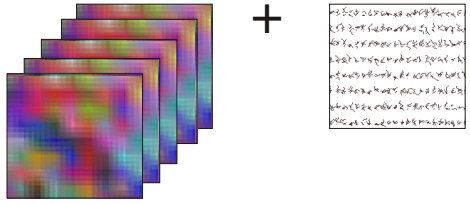
How to use the nifti1 variables for statistical values



dim[3] = 1: single slice
dim[5] = 1: statistical parameters stored in ***intent_p1/2/3*** (parameters applied to whole dataset)



dim[3] > 1: several slices
dim[5] = 1: statistical parameters stored in ***intent_p1/2/3*** (parameters applied to whole dataset)



dim[5] > 1: voxel-wise statistical parameters stored in data planes after stat value plane, for example the degrees of freedom

NIFTI_INTENT: OTHER

How to use the nifti1 variables for other intents

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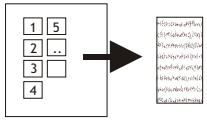
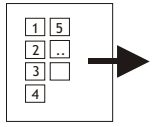
NIFTI_INTENT_ESTIMATE: 1001

parameter for estimate in **intent_name**



NIFTI_INTENT_LABEL: 1002

parameter at each voxel is index to label
defined in **aux_file**



NIFTI_INTENT_NEURONAMES: 1003

parameter at each voxel is index to label
in NeuroNames label set

[M x N]

NIFTI_INTENT_GENMATRIX: 1004

parameter at each voxel is matrix
dim[0] = 5
dim[5] > 1: M * N
intent_p1: M (float)
intent_p2: N (float)

row order:
[m][n]0→ (n-1)
0
↓
(m-1)

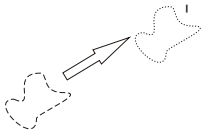
[N x N]

NIFTI_INTENT_SYMMATRIX: 1005

parameter at each voxel is symmetrical matrix

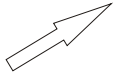
dim[0] = 5
dim[5] > 1: N * (N+ 1)/2
intent_p1: N (float))

row order:
[0][0]
[1][0] [1][1]
[2][0] [2][1] [2][2]



NIFTI_INTENT_DISPVECT: 1006

parameter at each voxel is displacement vector
dim[5] = dimensionality of displacement
(e.g. 2 = in-plane, 3 = spatial)

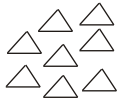


NIFTI_INTENT_VECTOR: 1007

parameter at each voxel is vector

NIFTI_INTENT_POINTSET: 1008

value at each voxel is spatial coordinate
(vertices/nodes of surface mesh)
dim[0] = 5
dim[1] = nr of points
dim[2/3/4] = 1



NIFTI_INTENT_TRIANGLE: 1009

value at each voxel is triple of indices (forming triangle)
from a pointset
dim[0] = 5
dim[1] = nr of triangles
dim[2/3/4] = 1
dim[5] = dimentionality of space
intent_name can describe the objects where points
come from ("pial", "gray/white", "EEG" etc)

[4 x 4]

NIFTI_INTENT_QUATERNION: 1010

vector value at each voxel isquaternion
dim[0] = 5
dim[5] = 4

NIFTI_INTENT_DIMLESS: 1011

dimensionless value