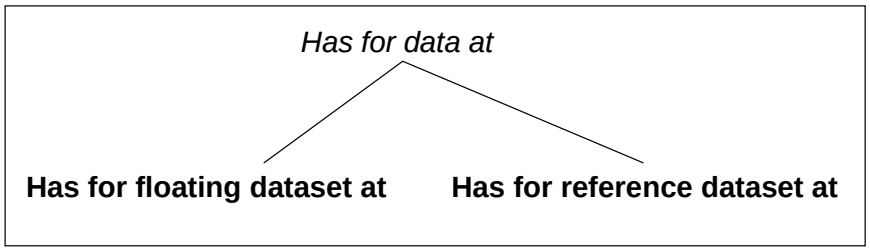
Dataset processing-OS

// Metadata

Name	Dataset processing-0S
Keywords	Segmentation, Reconstruction, Registration, Resampling, Dataset arithmetical operation, Mesh generation, Filtering, Dataset transformation, Restoration, Statistical analysis, Calibration model application, Quantitative parameter estimation
Creation date	October 16th, 2008
Last modification date	November 20th, 2009
Revisions made in v1.1	The concept 'Magnetization transfer ratio calculation' has been added
Has contributor	Farooq Ahmad (v1.0), Michel Dojat (v1.0 + v1.1), Bernard Gibaud (v1.0 + v1.1), Gilles Kassel (v1.0 + v1.1), Lynda Temal (v1.0)
Used ontology engineering methodology	OntoSpec
Is of type	Domain ontology
Natural language	English
Has ontology language	OntoSpec
Has formality level	Semi-informal
Ressource locator	http://www.laria.u-picardie.fr/IC/site/IMG/pdf/Dataset_processing-OS.pdf
Has reference	- Ji, Q., Glass, J.O. & Reddick, W.E. (2007). A novel, fast entropy-minimization algorithm for bias field correction in MR images. *Magnetic Resonance Imaging*. 25(2):259-264. - Suri, J.S., Singh, S. & Reden, L. (2002a). Computer vision and pattern recognition techniques for 2-D and 3-D MR cerebral cortical segmentation (Part I): a state-of-the-art review. *Pattern Analysis & Applications*, 5 :46-76. - Suri, J.S., Singh, S. & Reden, L. (2002b). Fusion of region and boundary/surface-based computer vision and pattern recognition techniques for 2-D and 3-D MR cerebral cortical segmentation (Part II): a state-of-the-art review. *Pattern Analysis & Applications*, 5 :77-98. - Temal, L., Lando, P., Gibaud, B., Dojat, M., Kassel, G. & Lapujade, A. (2006). OntoNeuroBase: a multi-layered application ontology in neuroimaging. In *Second Workshop: Formal Ontologies Meet Industry*

	(FOMI 2006), Trento (Italy), 2006. - Tofts, P. (2004), *Quantitative MRI of the brain*, John Wiley.
Version	1.1
Number of concepts (classes)	86
Number of relations (properties)	2

//Relations



Has for floating dataset at

Properties

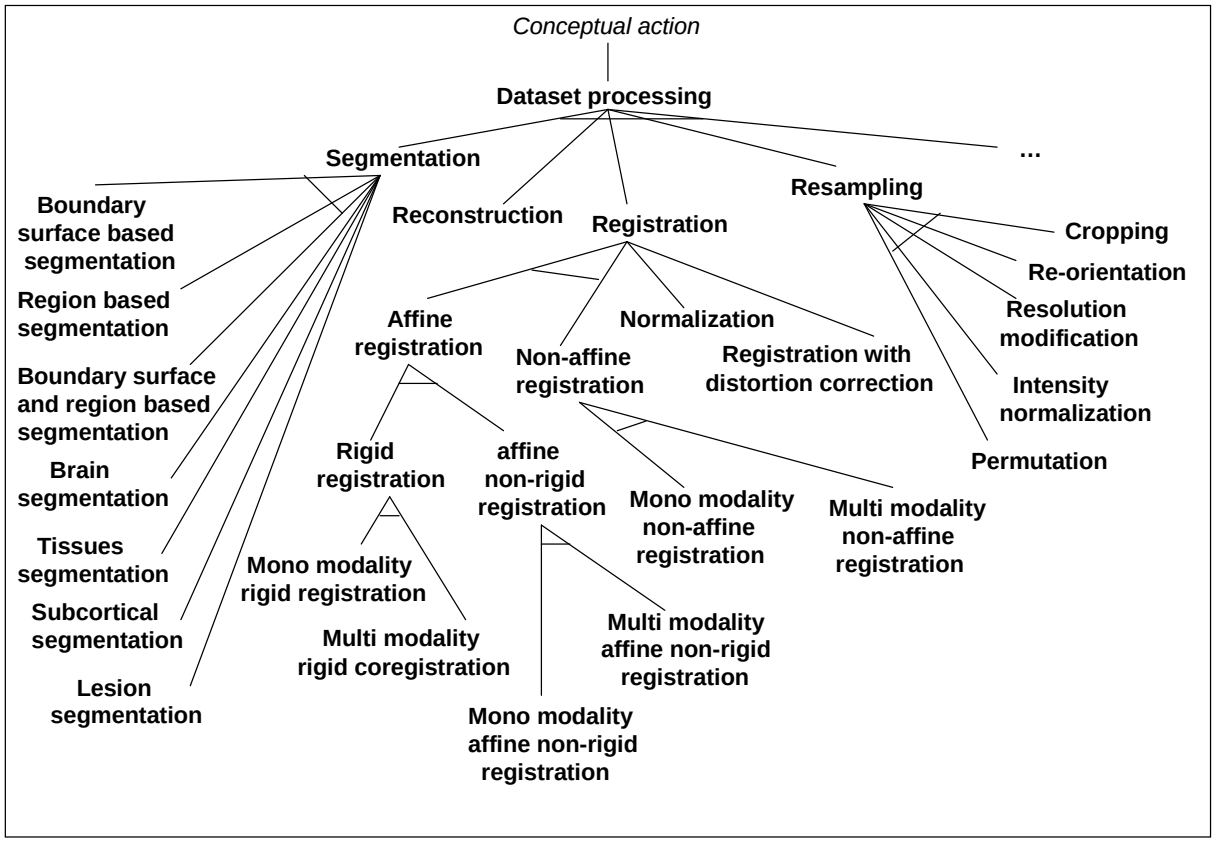
[EP/R1 & R2 & R3] A REGISTRATION *has for floating dataset* a FLOATING DATASET *at* a TIME INTERVAL. [EP/SL] x *has for floating dataset* y *at* z implies that x *has for data* y *at* z.

Has for reference dataset at

Properties

[EP/R1 & R2 & R3] A REGISTRATION *has for reference dataset* a REFERENCE DATASET *at* a TIME INTERVAL. [EP/SL] x *has for reference dataset* y *at* z implies that x *has for data* y *at* z.

// Concepts



Dataset processing

Meta-properties

DATASET PROCESSING is RIGID (+**R**). DATASET PROCESSING is EXTERNALLY-DEPENDENT (+**D**). SEGMENTATION, RECONSTRUCTION, REGISTRATION, RESAMPLING, DATASET ARITHMETICAL OPERATION, MESH GENERATION, FILTERING, DATASET TRANSFORMATION, and STATISTICAL ANALYSIS *is a disjunctive sub-division of* DATASET PROCESSING.

Properties

[EP/SL] A DATASET PROCESSING is a CONCEPTUAL ACTION. [EP/ER] Every DATASET PROCESSING *has for data* at least one DATASET *at* a TIME INTERVAL. [EP/ER] Every DATASET PROCESSING *has for result* at least one DATASET *at* a TIME INTERVAL. [EP/ER] Every DATASET PROCESSING *has for instrument* at least one DATASET PROCESSING TOOL *at* a TIME INTERVAL.

Segmentation

Meta-properties

SEGMENTATION is RIGID (+**R**). SEGMENTATION is EXTERNALLY-DEPENDENT (+**D**). BOUNDARY SURFACE BASED SEGMENTATION, REGION BASED SEGMENTATION, and BOUNDARY SURFACE AND REGION BASED SEGMENTATION *is a disjunctive sub-division of* SEGMENTATION.

Properties

[EP/SL] A SEGMENTATION is a DATASET PROCESSING. [EP/ER] Every SEGMENTATION *has for result* at least one SEGMENTATION DATASET *at* a TIME INTERVAL. [CP/EVR] No SEGMENTATION *has for data* an EEG DATASET or a MEG DATASET or a NON-RECONSTRUCTED DATASET or a REGISTRATION DATASET or a MESH DATASET or a SEGMENTATION DATASET or a CALIBRATION DATASET *at* a TIME INTERVAL.

Comment

[DEF & CIT] “Segmentation refers to the process of partitioning a digital image into multiple regions (sets of pixels). The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. The result of image segmentation is a set of regions that collectively cover the entire image, or a set of contours extracted from the image (see edge detection). Each of the pixels in a region are similar with respect to some characteristic or computed property, such as colour, intensity, or texture. Adjacent regions are significantly different with respect to the same characteristic(s)”. (Source: Wikipedia).

[DIV] The segmentation dataset that is the result of a segmentation *can be superimposed with* the dataset « to be segmented ». If a segmentation *has for data* several datasets, then they must all be superimposed together. Segmentations can be categorised according to several semantic axis: the first focuses on the kind of approach being used, e.g. boundary-based or region-based; the second focuses on the anatomical structures being segmented, e.g. lesions, brain etc. A third axis will be added later, focusing on the dimensionality of the Segmentation dataset produced.

Boundary surface based segmentation

Meta-properties

BOUNDARY SURFACE BASED SEGMENTATION is RIGID (+**R**). BOUNDARY SURFACE BASED SEGMENTATION is EXTERNALLY-DEPENDENT (+**D**).

Properties

[EP/SL] A BOUNDARY SURFACE BASED SEGMENTATION is a SEGMENTATION.

Comment

[DEF] Boundary based segmentations are segmentations that segment the image/volume based on edge or surfaces algorithms (Suri *et al.*, 2002a,b). Such contours or surfaces may, correspond to sulci, cortex ribbon etc...

Region based segmentation

Meta-properties

REGION BASED SEGMENTATION is RIGID (+**R**). REGION BASED SEGMENTATION is EXTERNALLY-DEPENDENT (+**D**).

Properties

[EP/SL] A REGION BASED SEGMENTATION is a SEGMENTATION.

Comment

[DEF] Region based segmentations are segmentations that segment the image/volume into different regions/sub-volumes (Suri *et al.*, 2002a,b). Such regions may, e.g., correspond to white matter, grey matter and cerebrospinal fluid. Expectation Maximization techniques are examples of such techniques.

Boundary surface and region based segmentation

Meta-properties

BOUNDARY SURFACE AND REGION BASED SEGMENTATION is RIGID (+**R**). BOUNDARY SURFACE AND REGION BASED SEGMENTATION is EXTERNALLY-DEPENDENT (+**D**).

Properties

[EP/SL] A BOUNDARY SURFACE AND REGION BASED SEGMENTATION is a SEGMENTATION.

Comment

[DEF] Boundary surface and region based segmentations are segmentations that involve a fusion of region- and boundary / surface based techniques, such as level sets fused with Bayesian classifications.

Brain segmentation, skull-stripping, brain extraction

Meta-properties

BRAIN SEGMENTATION is RIGID (**+R**). BRAIN SEGMENTATION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A BRAIN SEGMENTATION, SKULL-STRIPPING, or BRAIN EXTRACTION, is a SEGMENTATION.

Comment

[DEF] A brain segmentation (also called skull-stripping, or brain extraction) is a segmentation that separates the brain from the other tissues such as skin, fat, bone etc.

Tissues segmentation

Meta-properties

TISSUES SEGMENTATION is RIGID (**+R**). TISSUES SEGMENTATION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A TISSUES SEGMENTATION is a SEGMENTATION.

Comment

[DEF] A tissues segmentation is a segmentation that extracts the tissues such as grey matter, white matter, cerebro-spinal fluid.

Subcortical segmentation

Meta-properties

SUBCORTICAL SEGMENTATION is RIGID (**+R**). SUBCORTICAL SEGMENTATION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A SUBCORTICAL SEGMENTATION is a SEGMENTATION.

Comment

[DEF] A subcortical segmentation is a segmentation that extracts structures such as ventricles, corpus callosum, hippocampus and basal ganglia (thalamus, pallidum, caudate nucleus etc.)

Lesion segmentation

Meta-properties

LESION SEGMENTATION is RIGID (**+R**). LESION SEGMENTATION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A LESION SEGMENTATION is a SEGMENTATION.

Comment

[DEF] A lesion segmentation is a segmentation that extracts structures such as tumours, or multiple sclerosis white matter lesions.

Reconstruction

Meta-properties

RECONSTRUCTION is RIGID (**+R**). RECONSTRUCTION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A RECONSTRUCTION is a DATASET PROCESSING. [EP/ER] Every RECONSTRUCTION *has for data* exactly one NON-RECONSTRUCTED DATASET *at* a TIME INTERVAL. [EP/ER] Every RECONSTRUCTION *has for result* exactly one RECONSTRUCTED DATASET *at* a TIME INTERVAL.

Comment

[DEF] A RECONSTRUCTION is a dataset processing by which one or more images are generated, based on measurements acquired by imaging equipment. Numerous very different kinds of reconstruction exist, depending on the different imaging modalities: CT, MR, PET, SPECT, MEG etc. Some of the reconstruction problems are: reconstruction from projections (e.g. CT, PET, SPECT), reconstruction from k-space acquisitions (MR), reconstruction of sources in MEG/EEG, reconstruction from radiofrequency data in ultrasound. Reconstruction algorithms are included in data acquisition software.

Registration

Meta-properties

REGISTRATION is RIGID (**+R**). REGISTRATION is EXTERNALLY-DEPENDENT (**+D**). AFFINE REGISTRATION and NON-AFFINE REGISTRATION *is a non-trivial partition of* REGISTRATION.

Properties

[EP/SL] A REGISTRATION is a DATASET PROCESSING. [EP/ER] Every REGISTRATION *has for reference dataset* exactly one REFERENCE DATASET *at* a TIME INTERVAL. [EP/ER] Every REGISTRATION *has for floating dataset* exactly one FLOATING DATASET *at* a TIME INTERVAL. [EP/ER] Every REGISTRATION *has for result* at least one REGISTRATION DATASET *at* a TIME INTERVAL. [CP/EVR] No REGISTRATION *has for data* an EEG DATASET or a MEG DATASET or a REGISTRATION DATASET or a MESH DATASET or a NON-RECONSTRUCTED DATASET *at* a TIME INTERVAL.

Comment

[DEF & CIT] **"**A REGISTRATION is the process of transforming the different sets of data into one coordinate system. REGISTRATION is necessary in order to be able to compare or integrate the data obtained from different measurements. Medical imaging registration (e.g. for data of the same patient taken at different points in time) often additionally involves *elastic* (or *nonrigid*) registration to cope with elastic deformations of the body parts imaged. Nonrigid registration of medical images can also be used to register a patient's data to an anatomical atlas, such as the Talairach atlas for neuroimaging". (Source: Wikipedia).

"There are two steps involved in registering a pair of images together. There is the *registration* itself, whereby the set of parameters describing a transformation is estimated. Then there is a *transformation*, where one of the images is transformed according to the estimated parameters". (Tofts, 2004).

Normalization, Across-subject registration

Meta-properties

NORMALIZATION is RIGID (**+R**). NORMALIZATION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A NORMALIZATION, or ACROSS-SUBJECT REGISTRATION, is a REGISTRATION.

Comment

[DEF] A NORMALIZATION is a registration in which the reference and the floating image correspond, either to two different subjects, or to a subject and a template.

Registration with distortion correction

Meta-properties

REGISTRATION WITH DISTORTION CORRECTION is RIGID (**+R**). REGISTRATION WITH DISTORTION CORRECTION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SLD] A REGISTRATION WITH DISTORTION CORRECTION is a REGISTRATION which *has for part* a DISTORTION CORRECTION. [EP/ER] Every REGISTRATION WITH DISTORTION CORRECTION *has for data* at least one CALIBRATION DATASET or PARAMETER QUANTIFICATION DATASET *at* a TIME INTERVAL.

Comment

[DEF] A REGISTRATION WITH DISTORTION CORRECTION is a registration in which the reference or the floating image (or both) undergoes a distortion correction, prior to the registration itself (e.g. based on a voxel displacement map derived from a field map).

Affine registration, Linear registration

Meta-properties

AFFINE REGISTRATION is RIGID (**+R**). AFFINE REGISTRATION is EXTERNALLY-DEPENDENT (**+D**). RIGID REGISTRATION and AFFINE NON-RIGID REGISTRATION *is a non-trivial partition of* AFFINE REGISTRATION.

Properties

[EP/SL] An AFFINE REGISTRATION, or LINEAR REGISTRATION, is a REGISTRATION.

Comment

[DEF] An AFFINE REGISTRATION is a registration that estimates an affine geometrical transformation, usually represented by a 4 x 4 matrix.

Rigid registration

Meta-properties

RIGID REGISTRATION is RIGID (**+R**). RIGID REGISTRATION is EXTERNALLY-DEPENDENT (**+D**). MONO MODALITY RIGID REGISTRATION and MULTI MODALITY RIGID REGISTRATION *is a non-trivial partition of* RIGID REGISTRATION.

Properties

[EP/SL] A RIGID REGISTRATION is a REGISTRATION.

Comment

[DEF] A RIGID REGISTRATION estimates a particular kind of linear geometrical transformation, with 3 rotations, 3 translations only, usually represented by a 4 x 4 matrix.

Mono modality rigid registration

Meta-properties

MONO MODALITY RIGID REGISTRATION is RIGID (**+R**). MONO MODALITY RIGID REGISTRATION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A MONO MODALITY RIGID REGISTRATION is a RIGID REGISTRATION.

Comment

[DEF] A mono modality rigid registration is a rigid registration in which the reference and the floating image have the same modality, which means that they represent the same kind of information, e.g. a T1-weighted MR signal.

Multi modality rigid coregistration

Meta-properties

MULTI MODALITY RIGID COREGISTRATION is RIGID (+**R**). MULTI MODALITY RIGID COREGISTRATION is EXTERNALLY-DEPENDENT (+**D**).

Properties

[EP/SL] A MULTI MODALITY RIGID COREGISTRATION is a RIGID REGISTRATION.

Comment

[DEF] A multi modality rigid registration is a rigid registration in which the reference and the floating image have different modalities, which means that they represent different kinds of information, e.g. a T1-weighted MR signal and a T2-weighted MR signal, or a T1-weighted MR signal and a FDG tracer concentration (PET information).

Affine non-rigid registration

Meta-properties

AFFINE NON-RIGID REGISTRATION is RIGID (+**R**). AFFINE NON-RIGID REGISTRATION is EXTERNALLY-DEPENDENT (+**D**). MONO MODALITY AFFINE NON-RIGID REGISTRATION and MULTI MODALITY AFFINE NON-RIGID REGISTRATION *is a non-trivial partition of* AFFINE NON-RIGID REGISTRATION.

Properties

[EP/SL] An AFFINE NON-RIGID REGISTRATION is an AFFINE REGISTRATION.

Comment

[DEF] An AFFINE NON-RIGID REGISTRATION is an affine registration that estimates an affine but non-rigid geometrical transformation.

Mono modality affine non-rigid registration

Meta-properties

MONO MODALITY AFFINE NON-RIGID REGISTRATION is RIGID (+**R**). MONO MODALITY AFFINE NON-RIGID REGISTRATION is EXTERNALLY-DEPENDENT (+**D**).

Properties

[EP/SL] A MONO MODALITY AFFINE NON-RIGID REGISTRATION is an AFFINE NON-RIGID REGISTRATION.

Comment

[DEF] A MONO MODALITY AFFINE NON-RIGID REGISTRATION is an affine registration which estimates an affine but non-rigid geometrical transformation, in which the reference and the floating image have the same modality, which means that they represent the same kind of information, e.g. a T1-weighted MR signal.

Multi modality affine non-rigid registration

Meta-properties

MULTI MODALITY AFFINE NON-RIGID REGISTRATION is RIGID (+**R**). MULTI MODALITY AFFINE NON-RIGID REGISTRATION is EXTERNALLY-DEPENDENT (+**D**).

Properties

[EP/SL] A MULTI MODALITY AFFINE NON-RIGID REGISTRATION is an AFFINE NON-RIGID REGISTRATION.

Comment

[DEF] A MULTI MODALITY AFFINE NON-RIGID REGISTRATION is an affine registration which estimates an affine but non-rigid geometrical transformation, in which the reference and the floating image represent different kinds of information, e.g. a T1-weighted MR signal and a T2-weighted MR signal, or a T1-weighted MR signal and a FDG tracer concentration (PET information).

Non-affine registration, Non-linear registration

Meta-properties

NON-AFFINE REGISTRATION is RIGID (+**R**). NON-AFFINE REGISTRATION is EXTERNALLY-DEPENDENT (+**D**). MONO MODALITY NON-AFFINE REGISTRATION and MULTI MODALITY NON-AFFINE REGISTRATION *is a non-trivial partition of* NON-AFFINE REGISTRATION.

Properties

[EP/SL] A NON-AFFINE REGISTRATION, or NON-LINEAR REGISTRATION, is a REGISTRATION.

Comment

[DEF] A NON-AFFINE REGISTRATION is a registration that estimates a non-affine geometrical transformation, usually represented by a 3D displacement field.

Mono modality non-affine registration

Meta-properties

MONO MODALITY NON-AFFINE REGISTRATION is RIGID (+**R**). MONO MODALITY NON-AFFINE REGISTRATION is EXTERNALLY-DEPENDENT (+**D**).

Properties

[EP/SL] A MONO MODALITY NON-AFFINE REGISTRATION is a NON-AFFINE REGISTRATION.

Comment

[DEF] A MONO MODALITY NON-AFFINE REGISTRATION is a non-affine registration, in which the reference and the floating image have the same modality, which means that they represent the same kind of information, e.g. a T1-weighted MR signal.

Multi modality non-affine registration

Meta-properties

MULTI MODALITY NON-AFFINE REGISTRATION is RIGID (+**R**). MULTI MODALITY NON-AFFINE REGISTRATION is EXTERNALLY-DEPENDENT (+**D**).

Properties

[EP/SL] A MULTI MODALITY NON-AFFINE REGISTRATION is a NON-AFFINE REGISTRATION.

Comment

[DEF] A MULTI MODALITY NON-AFFINE REGISTRATION is a non-affine registration, in which the reference and the floating image represent different kinds of information, e.g. a T1-weighted MR signal and a T2-weighted MR signal, or a T1-weighted MR signal and a FDG tracer concentration (PET information).

Resampling

Meta-properties

RESAMPLING is RIGID (**+R**). RESAMPLING is EXTERNALLY-DEPENDENT (**+D**). CROPPING, RE-ORIENTATION, RESOLUTION MODIFICATION, INTENSITY NORMALIZATION, and PERMUTATION *is a disjunctive sub-division of* RESAMPLING.

Properties

[EP/SL] A RESAMPLING is a DATASET PROCESSING. [CP/EVR] No RESAMPLING *has for data* a MESH DATASET *at* a TIME INTERVAL.

Comment

[DEF] A RESAMPLING is a dataset processing that creates a « resampled » dataset from a dataset « to be resampled », by changing the sampling grid, or the range of dataset values, or both. The characteristics of the domain of the mathematical function associated to the « resampled » dataset are derived from those of the mathematical function associated to the dataset « to be resampled ». The number of intervals and their semantics remain unchanged, while the sampling characteristics of one or several of these intervals may be changed. The values taken by the function at each point of the new domain is derived from the values taken by the function associated to the dataset to be resampled, using a transformation function (e.g. closest pixel/voxel, interpolation). Moreover an additional transformation of those values may be applied, such as a linear windowing.

A RESAMPLING does not change the nature of the information represented in the image: e.g. a T1weighted MR Dataset remains a T1-weighted MR Dataset.

Cropping

Meta-properties

CROPPING is RIGID (**+R**). CROPPING is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A CROPPING is a RESAMPLING.

Comment

[DEF] A CROPPING is a resampling that affects only the domain of the mathematical function associated to the dataset "to be cropped", by defining a subset of this domain, more precisely by reducing the number of samples and changing the upper and lower limit of one or more intervals of this domain. The values taken by the function associated to the dataset are not changed.

Re-orientation

Meta-properties

RE-ORIENTATION is RIGID (**+R**). RE-ORIENTATION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A RE-ORIENTATION is a RESAMPLING.

Comment

[DEF] A RE-ORIENTATION is a resampling that affects only the domain of the mathematical function associated to the dataset "to be re-oriented". This re-orientation can be specified in a 4x4 matrix.

Resolution modification

Meta-properties

RESOLUTION MODIFICATION is RIGID (**+R**). RESOLUTION MODIFICATION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A RESOLUTION MODIFICATION is a RESAMPLING.

Comment

[DEF] A RESOLUTION MODIFICATION is a resampling that affects only the domain of the mathematical function associated to the dataset whose resolution has to be changed. The new resolution is specified using specific parameters or using a reference dataset which will provide the required sampling characteristics.

Intensity normalization

Meta-properties

INTENSITY NORMALIZATION is RIGID (**+R**). INTENSITY NORMALIZATION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] An INTENSITY NORMALIZATION is a RESAMPLING.

Comment

[DEF] An INTENSITY MODIFICATION is a resampling that affects only the range of the values taken by the mathematical function associated to the dataset “to be intensity-normalized”.

[EX] Examples are: Bias field correction (with respect to an estimated bias); Histogram equalization; Intensity normalization (with respect to a reference); Image contrast adjustment (window / level); Image inversion.

Permutation

Meta-properties

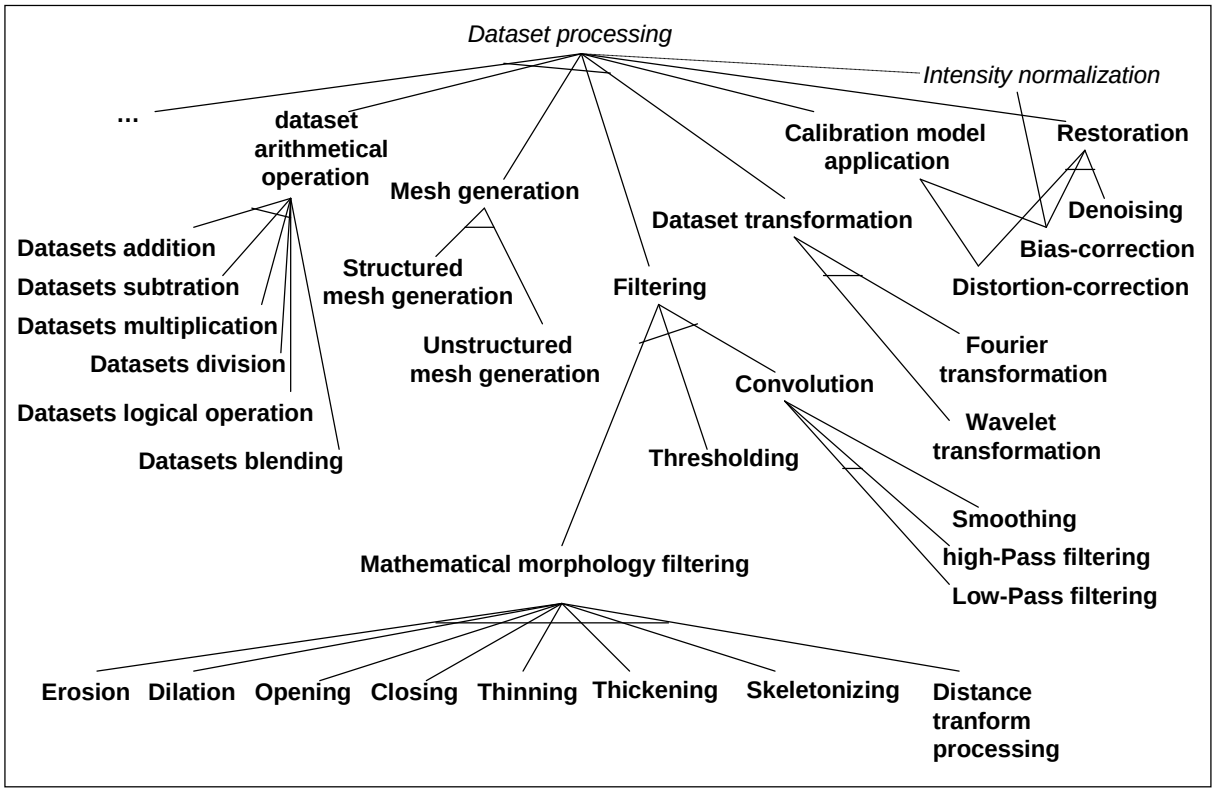
PERMUTATION is RIGID (**+R**). PERMUTATION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A PERMUTATION is a RESAMPLING.

Comment

[DEF] A PERMUTATION is a RESAMPLING that affects only the domain of the mathematical function associated to the dataset “to be re-permutated”. This permutation consists in applying a re-ordering of the samples along a specific interval, e.g.: x1, x2, …, x255 being re-ordered as x’1, x’2,…, x’255 based on the transformation x’1 = 256-x1.



Dataset arithmetical operation

Meta-properties

DATASET ARITHMETICAL OPERATION is RIGID (+**R**). DATASET ARITHMETICAL OPERATION is EXTERNALLY-DEPENDENT (+**D**). DATASETS ADDITION, DATASETS SUBTRACTION, DATASETS MULTIPLICATION, DATASETS DIVISION, DATASETS LOGICAL OPERATION, and DATASETS BLENDING *is a disjunctive sub-division of* DATASET ARITHMETICAL OPERATION.

Properties

[EP/SL] A DATASET ARITHMETICAL OPERATION is a DATASET PROCESSING. [CP/EVR] No DATASET ARITHMETICAL OPERATION *has for data* a MESH DATASET or a REGISTRATION DATASET *at* a TIME INTERVAL.

Comment

[DEF] A DATASET ARITHMETICAL OPERATION is a DATASET PROCESSING is which the values taken by the mathematical function associated to the output dataset are calculated using an arithmetic operation applied to the values taken by the functions associated to the input dataset(s), e.g. sum, subtraction, etc. When the arithmetic operation has several operands, the datasets associated with each operand must be associated with mathematical functions sharing the same domain.

Datasets addition

Meta-properties

DATASETS ADDITION is RIGID (+**R**). DATASETS ADDITION is EXTERNALLY-DEPENDENT (+**D**).

Properties

[EP/SL] A DATASETS ADDITION is a DATASET ARITHMETICAL OPERATION.

Comment

[DEF] A DATASETS ADDITION is a DATASET ARITHMETICAL OPERATION in which the arithmetic operation to be applied to the input datasets is an addition.

Datasets subtraction

Meta-properties

DATASETS SUBTRACTION is RIGID (**+R**). DATASETS SUBTRACTION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A DATASETS SUBTRACTION is a DATASET ARITHMETICAL OPERATION.

Comment

[DEF] A DATASETS SUBTRACTION is a DATASET ARITHMETICAL OPERATION in which the arithmetic operation to be applied to the input datasets (namely a “A DATASET”, and a “B DATASET TO BE SUBTRACTED FROM A”), is a subtraction.

Datasets multiplication

Meta-properties

DATASETS MULTIPLICATION is RIGID (**+R**). DATASETS MULTIPLICATION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A DATASETS MULTIPLICATION is a DATASET ARITHMETICAL OPERATION.

Comment

[DEF] A DATASETS MULTIPLICATION is a DATASET ARITHMETICAL OPERATION in which the arithmetic operation to be applied to the input datasets is a multiplication.

Datasets division

Meta-properties

DATASETS DIVISION is RIGID (**+R**). DATASETS DIVISION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A DATASETS DIVISION is a DATASET ARITHMETICAL OPERATION.

Comment

[DEF] A DATASETS DIVISION is a DATASET ARITHMETICAL OPERATION in which the arithmetic operation to be applied to the input datasets (namely a “DIVIDEND DATASET”, and a “DIVISOR DATASET”), is a division.

Datasets logical operation

Meta-properties

DATASETS LOGICAL OPERATION is RIGID (**+R**). DATASETS LOGICAL OPERATION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A DATASETS LOGICAL OPERATION is a DATASET ARITHMETICAL OPERATION.

Comment

[DEF] A DATASETS LOGICAL OPERATION is a DATASET ARITHMETICAL OPERATION in which the arithmetic operation to be applied to the input datasets is a logical operation.

Datasets blending

Meta-properties

DATASETS BLENDING is RIGID (**+R**). DATASETS BLENDING is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A DATASETS BLENDING is a DATASET ARITHMETICAL OPERATION.

Comment

[DEF] A DATASETS BLENDING is a DATASET ARITHMETICAL OPERATION in which the arithmetic operation to be applied to the input datasets is a blending operation (usually a linear combination of the input operands).

Mesh generation

Meta-properties

MESH GENERATION is RIGID (**+R**). MESH GENERATION is EXTERNALLY-DEPENDENT (**+D**). STRUCTURED MESH GENERATION and UNSTRUCTURED MESH GENERATION *is a non-trivial partition of* MESH GENERATION.

Properties

[EP/SL] A MESH GENERATION is a DATASET PROCESSING. [CP/EVR] Every MESH GENERATION *has for data* only SEGMENTATION DATASETS *at* a TIME INTERVAL.

Comment

[DEF] A MESH GENERATION IS A DATASET PROCESSING that transforms a list of points in 2D or 3D space into a MESH, e.g. a list of polygons (resp. tetrahedrons) modelling the contour, or the surface, or the volume of the objects represented by these points. The input list of points may be specified as a particular ROI of a SEGMENTATION DATASET.

Structured mesh generation

Meta-properties

STRUCTURED MESH GENERATION is RIGID (**+R**). STRUCTURED MESH GENERATION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A STRUCTURED MESH GENERATION is a MESH GENERATION.

Comment

[DEF] A STRUCTURED MESH GENERATION is a MESH GENERATION in which the resulting MESH is a structured mesh.

Unstructured mesh generation

Meta-properties

UNSTRUCTURED MESH GENERATION is RIGID (**+R**). UNSTRUCTURED MESH GENERATION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] An UNSTRUCTURED MESH GENERATION is a MESH GENERATION.

Comment

[DEF] AN UNSTRUCTURED MESH GENERATION is a MESH GENERATION in which the resulting MESH is an unstructured mesh.

Filtering

Meta-properties

FILTERING is RIGID (**+R**). FILTERING is EXTERNALLY-DEPENDENT (**+D**). MATHEMATICAL MORPHOLOGY FILTERING, THRESHOLDING, and CONVOLUTION *is a disjunctive sub-division of* FILTERING.

Properties

[EP/SL] A FILTERING is a DATASET PROCESSING. [CP/EVR] No FILTERING *has for data* a MESH DATASET *at* a TIME INTERVAL.

Comment

[DEF] A FILTERING is a DATASET PROCESSING applied to a "dataset to be filtered" and resulting in a "filtered dataset". The transformation applied may be linear or non-linear. The domain of the mathematical functions associated to the "dataset to be filtered" and "filtered dataset" coincide.

Thresholding

Meta-properties

THRESHOLDING is RIGID (+**R**). THRESHOLDING is EXTERNALLY-DEPENDENT (+**D**).

Properties

[EP/SL] A THRESHOLDING is a FILTERING.

Comment

[DEF] A THRESHOLDING consist on marking Individual pixels in a grey scale image as "object" pixels if their value is greater than some threshold value (assuming an object to be brighter than the background) and as "background" pixels otherwise. Typically, an object pixel is given a value of "1" while a background pixel is given a value of "0." The key parameter in thresholding is obviously the choice of the threshold. (Source: Wikipedia).

[DIV] Bernard Gibaud: This definition concerns a special kind of segmentation (rather than a filtering), based on thresholding; I would prefer to have a more strict definition, based on a Min and Max value,

If I(x,y) < Min → O(x,y) = Min

If I(x,y) > Max → O(x,y) = Max

If I(x,y) >= Min and I(x,y) <= Max → O(x,y) = I(x,y)

[DIV] In some cases the threshold can be adaptable to each voxel.

Convolution

Meta-properties

CONVOLUTION is RIGID (+**R**). CONVOLUTION is EXTERNALLY-DEPENDENT (+**D**). HIGH-PASS FILTERING and LOW-PASS FILTERING *is a disjunctive sub-division of* CONVOLUTION.

Properties

[EP/SL] A CONVOLUTION is a FILTERING.

Comment

[DEF] A CONVOLUTION is a FILTERING in which the "Filtered dataset" is obtained by convolution of the "dataset to be filtered" by a convolution kernel.

Smoothing

Meta-properties

SMOOTHING is RIGID (+**R**). SMOOTHING is EXTERNALLY-DEPENDENT (+**D**).

Properties

[EP/SL] A SMOOTHING is a CONVOLUTION.

Comment

[DEF] In statistics and image processing, to smooth a data set is to create a function that attempts to capture important patterns in the data, while leaving out noise. (Source: Wikipedia).

High-Pass filtering

Meta-properties

HIGH-PASS FILTERING is RIGID (+**R**). HIGH-PASS FILTERING is EXTERNALLY-DEPENDENT (+**D**).

Properties

[EP/SL] A HIGH-PASS FILTERING is a CONVOLUTION.

Comment

[DEF] A HIGH-PASS FILTERING is a CONVOLUTION "that passes high-frequency signals but attenuates (reduces the amplitude of) signals with frequencies lower than the cutoff frequency". (Source: Wikipedia).

Low-Pass filtering

Meta-properties

LOW-PASS FILTERING is RIGID (+**R**). LOW-PASS FILTERING is EXTERNALLY-DEPENDENT (+**D**).

Properties

[EP/SL] A LOW-PASS FILTERING is a CONVOLUTION.

Comment

[DEF] A LOW-PASS FILTERING is a DATASET CONVOLUTION "that passes low-frequency signals but attenuates (reduces the amplitude of) signals with frequencies higher than the cutoff frequency". (Source: Wikipedia).

Mathematical morphology filtering

Meta-properties

MATHEMATICAL MORPHOLOGY FILTERING is RIGID (+**R**). MATHEMATICAL MORPHOLOGY FILTERING is EXTERNALLY-DEPENDENT (+**D**). EROSION, DILATION, OPENING, CLOSING, THINNING, THICKENING, SKELETONIZING, and DISTANCE TRANSFORM PROCESSING *is a disjunctive sub-division of* MATHEMATICAL MORPHOLOGY FILTERING.

Properties

[EP/SL] A MATHEMATICAL MORPHOLOGY FILTERING is a FILTERING.

Comment

[DEF] Morphological image processing is a collection of techniques for digital image processing based on mathematical morphology. Since these techniques rely only on the relative ordering of pixel values, not on their numerical values, they are especially suited to the processing of binary images and greyscale images whose light transfer function is not known. (Source: Wikipedia).

Erosion

Meta-properties

EROSION is RIGID (+**R**). EROSION is EXTERNALLY-DEPENDENT (+**D**).

Properties

[EP/SL] An EROSION is a MATHEMATICAL MORPHOLOGY FILTERING.

Comment

[DEF] *Erosion*, in general, causes objects to shrink. The amount and the way that they shrink depend upon the choice of the structuring element. Erosion is defined as a minimum operator, which assigns to every image pixel a minimum value from among their neighbors. The neighborhood is defined in mathematical morphology using a structuring element.

Dilation

Meta-properties

DILATION is RIGID (+**R**). DILATION is EXTERNALLY-DEPENDENT (+**D**).

Properties

[EP/SL] A DILATION is a MATHEMATICAL MORPHOLOGY FILTERING.

Comment

[DEF] *Dilation*, in general, causes objects to dilate or grow in size. The amount and the way that they grow depend upon the choice of the structuring element. The operation of dilation is based on the maximum value among the neighboring pixels.

Opening

Meta-properties

OPENING is RIGID (**+R**). OPENING is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] An OPENING is a MATHEMATICAL MORPHOLOGY FILTERING.

Comment

[DEF] An OPENING is A MATHEMATICAL MORPHOLOGY FILTERING, in which "the opening of A by B is obtained by the erosion of A by B, followed by dilation of the resulting image by B". (Source: Wikipedia).

Closing

Meta-properties

CLOSING is RIGID (**+R**). CLOSING is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A CLOSING is a MATHEMATICAL MORPHOLOGY FILTERING.

Comment

[DEF] A CLOSING is A MATHEMATICAL MORPHOLOGY FILTERING, in which the closing of A by B is obtained by the dilation of A by B, followed by erosion of the resulting structure by B. (Source: Wikipedia).

Thinning

Meta-properties

THINNING is RIGID (**+R**). THINNING is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A THINNING is a MATHEMATICAL MORPHOLOGY FILTERING.

Comment

[DEF] A THINNING is A MATHEMATICAL MORPHOLOGY FILTERING, which "transforms the input image into a simplified, but topologically equivalent image". (Source: Wikipedia).

Thickening

Meta-properties

THICKENING is RIGID (**+R**). THICKENING is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A THICKENING is a MATHEMATICAL MORPHOLOGY FILTERING.

Comment

[DEF] A Thickening is a MATHEMATICAL MORPHOLOGY FILTERING used to *grow* selected regions of foreground pixels in binary images. Thickening is normally only applied to binary images, and it produces another binary image as output.

Skeletonizing

Meta-properties

SKELETONIZING is RIGID (**+R**). SKELETONIZING is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A SKELETONIZING is a MATHEMATICAL MORPHOLOGY FILTERING.

Comment

[DEF] A SKELETONIZING is a MATHEMATICAL MORPHOLOGY FILTERING transforming a binary image into another binary image that highlights "the skeleton of the shape represented in the input binary image. The skeleton of a shape is a thin version of that shape that is equidistant to its boundaries". (Source: Wikipedia).

Distance transform processing

Meta-properties

DISTANCE TRANSFORM PROCESSING is RIGID (**+R**). DISTANCE TRANSFORM PROCESSING is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A DISTANCE TRANSFORM PROCESSING is a MATHEMATICAL MORPHOLOGY FILTERING.

Comment

[DEF] A DISTANCE TRANSFORM PROCESSING is a MATHEMATICAL MORPHOLOGY FILTERING transforming a binary image into a non-binary image that "highlights at each pixel of the image the distance to the nearest obstacle pixel. A most common type "obstacle pixel" is a boundary pixel in a binary image". (Source: Wikipedia).

Dataset transformation

Meta-properties

DATASET TRANSFORMATION is RIGID (**+R**). DATASET TRANSFORMATION is EXTERNALLY-DEPENDENT (**+D**). FOURIER TRANSFORMATION and WAVELET TRANSFORMATION *is a disjunctive sub-division of* DATASET TRANSFORMATION.

Properties

[EP/SL] A DATASET TRANSFORMATION is a DATASET PROCESSING. [CP/EVR] No DATASET TRANSFORMATION *has for data* a MESH DATASET or a REGISTRATION DATASET *at* a TIME INTERVAL.

Comment

[DEF] A DATASET TRANSFORMATION is a DATASET PROCESSING that creates a "transformed dataset" from a "to be transformed dataset" (e.g. a Fourier Transform). The mathematical function associated to the "transformed dataset" is derived from the mathematical function associated to the "to be transformed dataset": especially, its domain intervals are defined in the transformed space, i.e. the frequency domain.

"In mathematics, transform theory is the study of transforms. The essence of transform theory is that by a suitable choice of basis for a vector space a problem may be simplified — or diagonalized as in spectral theory". (Source: Wikipedia).

Fourier transformation

Meta-properties

FOURIER TRANSFORMATION is RIGID (**+R**). FOURIER TRANSFORMATION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A FOURIER TRANSFORMATION is a DATASET TRANSFORMATION.

Comment

[DEF] A FOURIER TRANSFORMATION is a DATASET TRANSFORMATION based on the Fourier Transform.

Wavelet transformation

Meta-properties

WAVELET TRANSFORMATION is RIGID (**+R**). WAVELET TRANSFORMATION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A WAVELET TRANSFORMATION is a DATASET TRANSFORMATION.

Comment

[DEF] A WAVELET TRANSFORMATION is a DATASET TRANSFORMATION based on the Wavelet Transform.

Calibration model application

Meta-properties

CALIBRATION MODEL APPLICATION is RIGID (**+R**). CALIBRATION MODEL APPLICATION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A CALIBRATION MODEL APPLICATION is a DATASET PROCESSING. [EP/ER] Every CALIBRATION MODEL APPLICATION *has for data* at least one CALIBRATION DATASET *at* a TIME INTERVAL.

Comment

[DEF] A Calibration model application is the final stage of a calibration process, by which non-calibrated data are transformed into calibrated data by means of a calibration model, usually derived from calibration measurements obtained, e.g. from a phantom.

Restoration

Meta-properties

RESTORATION is RIGID (**+R**). RESTORATION is EXTERNALLY-DEPENDENT (**+D**). DENOISING, BIAS-CORRECTION, and DISTORTION-CORRECTION *is a disjunctive sub-division of* RESTORATION.

Properties

[EP/SL] A RESTORATION is a DATASET PROCESSING. [CP/EVR] No RESTORATION *has for data* a STATISTICAL DATASET or a REGISTRATION DATASET or a MESH DATASET or a SEGMENTATION DATASET or a CALIBRATION DATASET *at* a TIME INTERVAL.

Comment

[DEF] A RESTORATION is a DATASET PROCESSING that consists is generating a “restored dataset” from a “to be restored dataset”, by compensating defects which degrade an image. Degradation comes in many forms such as motion blur, noise, and other specific acquisition equipment-related defects. The domain and range of the mathematical functions associated to the “restored dataset” and “to be restored dataset” coincide.

Denoising

Meta-properties

DENOISING is RIGID (**+R**). DENOISING is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A DENOISING is a RESTORATION.

Comment

[DEF] A DENOISING is a RESTORATION that focuses on the compensation of noise.

Bias-correction

Meta-properties

BIAS-CORRECTION is RIGID (+**R**). BIAS-CORRECTION is EXTERNALLY-DEPENDENT (+**D**).

Properties

[EP/SL] A BIAS-CORRECTION is a RESTORATION. [EP/SL] Every BIAS-CORRECTION is an INTENSITY NORMALIZATION. [EP/SL] Every BIAS-CORRECTION is a CALIBRATION MODEL APPLICATION. [EP/ER] Every BIAS-CORRECTION *has for data* exactly one BIAS FIELD DATASET *at* a TIME INTERVAL.

Comment

[DEF] A BIAS-CORRECTION is a RESTORATION that focuses on the compensation of bias.

Distortion-correction

Meta-properties

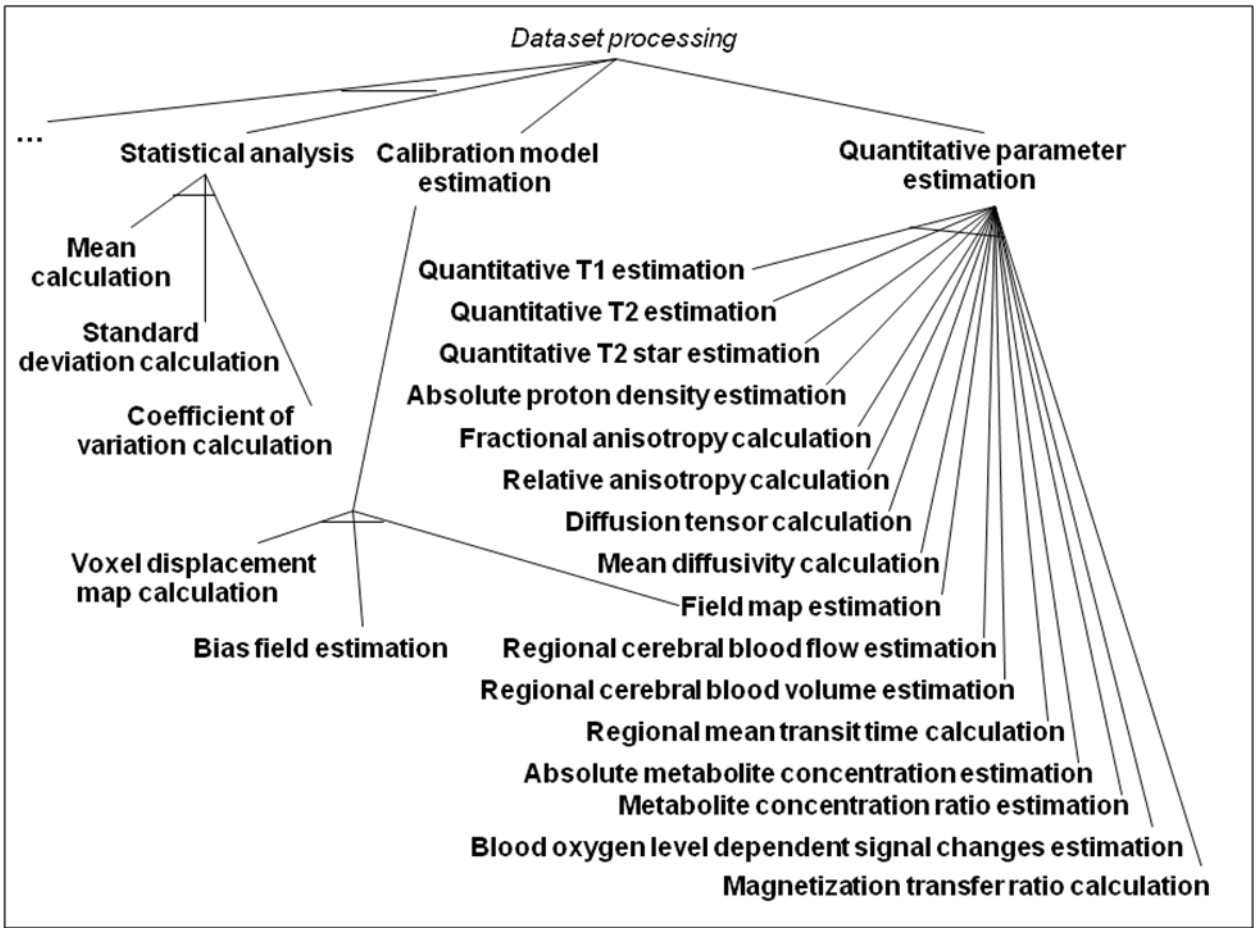
DISTORTION-CORRECTION is RIGID (+**R**). DISTORTION-CORRECTION is EXTERNALLY-DEPENDENT (+**D**).

Properties

[EP/SL] A DISTORTION-CORRECTION is a RESTORATION. [EP/SL] Every DISTORTION-CORRECTION is a CALIBRATION MODEL APPLICATION.

Comment

[DEF] A DISTORTION-CORRECTION is a RESTORATION that focuses on the compensation of a distortion, based on a calibration model.



Statistical analysis

Meta-properties

STATISTICAL ANALYSIS is RIGID (**+R**). STATISTICAL ANALYSIS is EXTERNALLY-DEPENDENT (**+D**). MEAN CALCULATION, STANDARD DEVIATION CALCULATION, and COEFFICIENT OF VARIATION CALCULATION *is a disjunctive sub-division of* STATISTICAL ANALYSIS.

Properties

[EP/SL] A STATISTICAL ANALYSIS is a DATASET PROCESSING.

Comment

[DEF] A STATISTICAL ANALYSIS consists on producing statistical information from one or several datasets obtained from one or more individuals (e.g. functional brain maps derived from MRI data). (Source: [Temal *et al.*, 2006]).

Mean calculation

Meta-properties

MEAN CALCULATION is RIGID (**+R**). MEAN CALCULATION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A MEAN CALCULATION is a STATISTICAL ANALYSIS.

Comment

[DEF] A MEAN CALCULATION is a STATISTICAL ANALYSIS in which the values taken by the mathematical function associated to the output dataset are calculated using an arithmetic mean of the values taken by the functions associated to the input dataset(s). The input datasets ("to be averaged") must be associated with mathematical functions sharing the same domain and range.

[DIV] MEAN CALCULATION is used for building templates for inter-subject registration, i.e. datasets used to perform spatial normalization (alignment with respect to a common spatial reference, provided by a specific subject) by averaging image data obtained (using the same kind of imaging equipment) from a population of subjects. (Source: [Temal *et al.*, 2006]).

Standard deviation calculation

Meta-properties

STANDARD DEVIATION CALCULATION is RIGID (**+R**). STANDARD DEVIATION CALCULATION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A STANDARD DEVIATION CALCULATION is a STATISTICAL ANALYSIS.

Comment

[DEF] A STANDARD DEVIATION CALCULATION is a STATISTICAL ANALYSIS in which the values taken by the mathematical function associated to the output dataset are calculated as the standard deviation of the values taken by the functions associated to the input dataset(s). The input datasets ("to be averaged") must be associated with mathematical functions sharing the same domain and range.

Coefficient of variation calculation

Meta-properties

COEFFICIENT OF VARIATION CALCULATION is RIGID (**+R**). COEFFICIENT OF VARIATION CALCULATION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A COEFFICIENT OF VARIATION CALCULATION is a STATISTICAL ANALYSIS.

Comment

[DEF] A COEFFICIENT OF VARIATION CALCULATION is a STATISTICAL ANALYSIS in which the values taken by the mathematical function associated to the output dataset are calculated as the coefficient of variation of the values taken by the functions associated to the input dataset(s). The input datasets ("to be averaged") must be associated with mathematical functions sharing the same domain and range. The COEFFICIENT OF VARIATION (CV) is a normalized measure of dispersion. It is defined as the ratio of the standard deviation to the mean.

Calibration model estimation

Meta-properties

CALIBRATION MODEL ESTIMATION is RIGID (+**R**). CALIBRATION MODEL ESTIMATION is EXTERNALLY-DEPENDENT (+**D**). BIAS FIELD ESTIMATION, VOXEL DISPLACEMENT MAP CALCULATION, and FIELD MAP ESTIMATION *is a disjunctive sub-division of* CALIBRATION MODEL APPLICATION.

Properties

[EP/SL] A CALIBRATION MODEL ESTIMATION is a DATASET PROCESSING. [EP/ER] Every CALIBRATION MODEL ESTIMATION *has for data* at least one QUALITY PROCEDURE DATASET *at* a TIME INTERVAL. [EP/ER] Every CALIBRATION MODEL ESTIMATION *has for result* at least one CALIBRATION DATASET *at* a TIME INTERVAL.

Comment

[DEF] "Calibration is measuring the response of the instrument to a stimulus of known value, with the purpose of then being able to apply that knowledge to in vivo measurements." (Tofts, 2004). Calibration measurements may be carried out in phantoms and in subjects. Calibration can be performed by measuring the response of the instrument in a specific situation (e.g. "resting state") without a specific stimulation as input.

Bias field estimation

Meta-properties

BIAS FIELD ESTIMATION is RIGID (+**R**). BIAS FIELD ESTIMATION is EXTERNALLY-DEPENDENT (+**D**).

Properties

[EP/SL] A BIAS FIELD ESTIMATION is a CALIBRATION MODEL ESTIMATION. [EP/ER] Every BIAS FIELD ESTIMATION *has for result* exactly one BIAS FIELD DATASET *at* a TIME INTERVAL.

Comment

[DEF] The measured magnetic resonance image is usually degraded by a bias field or intensity inhomogeneity (nonuniformity), which is induced primarily by the sensitivity profile of the radio frequency coil. The bias field is characterized by multiplicative smooth spatial variations that modulate the intensity of the true image data. (…) Because independent measurement of the bias field is very difficult and time-consuming, most of the reported correction techniques are postprocessing or retrospective methods, in which the bias field is estimated from the image itself after acquisition. Source: [Ji *et al.*, 2007]. The estimation of a bias field may concern any kind of MR data.

Voxel displacement map calculation

Meta-properties

VOXEL DISPLACEMENT MAP CALCULATION is RIGID (+**R**). VOXEL DISPLACEMENT MAP CALCULATION is EXTERNALLY-DEPENDENT (+**D**).

Properties

[EP/SL] A VOXEL DISPLACEMENT MAP CALCULATION is a CALIBRATION MODEL ESTIMATION. [CP/EER] Every VOXEL DISPLACEMENT MAP CALCULATION *has for data* exactly one FIELD MAP DATASET *at* a TIME INTERVAL. [EP/ER] Every VOXEL DISPLACEMENT MAP CALCULATION *has for result* a VOXEL DISPLACEMENT MAP DATASET *at* a TIME INTERVAL.

Comment

[DEF] The principle of MR image acquisition is to encode the space by controlled frequency variations using the application of additional gradients of magnetic field. Then, not mastered variations in frequency due to B0 inhomogeneity lead to spatial distortions. These spatial distortions can be corrected if frequency variations are known. The voxel displacement calculation, to correct for spatial distortions, is based on the estimation of the field map.

Quantitative parameter estimation

Meta-properties

QUANTITATIVE PARAMETER ESTIMATION is RIGID (**+R**). QUANTITATIVE PARAMETER ESTIMATION is EXTERNALLY-DEPENDENT (**+D**). QUANTITATIVE T1 ESTIMATION, QUANTITATIVE T2 ESTIMATION, QUANTITATIVE T2 STAR ESTIMATION, ABSOLUTE PROTON DENSITY ESTIMATION, FRACTIONAL ANISOTROPY CALCULATION, RELATIVE ANISOTROPY CALCULATION, DIFFUSION TENSOR CALCULATION, MEAN DIFFUSIVITY CALCULATION, MEAN DIFFUSIVITY CALCULATION, FIELD MAP ESTIMATION, REGIONAL CEREBRAL BLOOD FLOW ESTIMATION, REGIONAL CEREBRAL BLOOD VOLUME ESTIMATION, REGIONAL MEAN TRANSIT TIME CALCULATION, ABSOLUTE METABOLITE CONCENTRATION ESTIMATION, METABOLITE CONCENTRATION RATIO ESTIMATION, BLOOD OXYGEN LEVEL DEPENDENT SIGNAL CHANGES ESTIMATION, and MAGNETIZATION TRANSFER RATIO CALCULATION *is a disjunctive sub-division of* QUANTITATIVE PARAMETER ESTIMATION.

Properties

[EP/SL] A QUANTITATIVE PARAMETER ESTIMATION is a DATASET PROCESSING. [EP/ER] Every QUANTITATIVE PARAMETER ESTIMATION *has for result* a PARAMETER QUANTIFICATION DATASET *at* a TIME INTERVAL.

Comment

[DEF] Quantitative parameter estimation is the procedure that leads to the quantitative estimation of a specific physiological parameter.

Quantitative T1 estimation

Meta-properties

QUANTITATIVE T1 ESTIMATION is RIGID (**+R**). QUANTITATIVE T1 ESTIMATION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A QUANTITATIVE T1 ESTIMATION is a QUANTITATIVE PARAMETER ESTIMATION. [EP/ER] Every QUANTITATIVE T1 ESTIMATION *has for data* at least two T1 WEIGHTED MR DATASET *at* a TIME INTERVAL. [EP/ER] Every QUANTITATIVE T1 ESTIMATION *has for result* a QUANTITATIVE T1 DATASET *at* a TIME INTERVAL.

Comment

[DEF] Several methods can be used for the quantitative estimation of T1 in a defined tissue or structure. The most common method is based of the inversion of the MR signal (using a 180° pulse) and the acquisition of several T1-weighted images at different echo time during the recovery of the longitudinal magnetic component.

Quantitative T2 estimation

Meta-properties

QUANTITATIVE T2 ESTIMATION is RIGID (**+R**). QUANTITATIVE T2 ESTIMATION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A QUANTITATIVE T2 ESTIMATION is a QUANTITATIVE PARAMETER ESTIMATION. [EP/ER] Every QUANTITATIVE T2 ESTIMATION *has for data* at least two T2 WEIGHTED MR DATASET *at* a TIME INTERVAL. [EP/ER] Every QUANTITATIVE T2 ESTIMATION *has for result* a QUANTITATIVE T2 DATASET *at* a TIME INTERVAL.

Comment

[DEF] Several methods can be used for the quantitative estimation of T2 in a defined tissue or structure. based on the use of a spin echo sequence and the acquisition of several T2-weighted images at different echo time during the recovery of the transverse magnetic component.

Quantitative T2 star estimation

Meta-properties

QUANTITATIVE T2 STAR ESTIMATION is RIGID (**+R**). QUANTITATIVE T2 STAR ESTIMATION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A QUANTITATIVE T2 STAR CALCULATION is a QUANTITATIVE PARAMETER ESTIMATION. [EP/ER] Every QUANTITATIVE T2 STAR ESTIMATION *has for data* at least two T2 STAR WEIGHTED MR DATASET *at* a TIME INTERVAL. [EP/ER] Every QUANTITATIVE T2 STAR ESTIMATION *has for result* a QUANTITATIVE T2 STAR DATASET *at* a TIME INTERVAL.

Comment

[DEF] Several methods can be used for the quantitative estimation of T2star in a defined tissue or structure. The most common method is based on the use of a gradient echo sequence and the acquisition of several T2star-weighted images at different echo time during the recovery of the transverse magnetic component.

Absolute proton density estimation

Meta-properties

ABSOLUTE PROTON DENSITY ESTIMATION is RIGID (**+R**). ABSOLUTE PROTON DENSITY ESTIMATION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] An ABSOLUTE PROTON DENSITY ESTIMATION is a QUANTITATIVE PARAMETER ESTIMATION. [EP/ER] Every ABSOLUTE PROTON DENSITY ESTIMATION *has for data* at least two PROTON DENSITY WEIGHTED MR DATASET *at* a TIME INTERVAL. [EP/ER] Every ABSOLUTE PROTON DENSITY ESTIMATION *has for result* an ABSOLUTE PROTON DENSITY DATASET *at* a TIME INTERVAL.

Comment

[DEF] The specific procedure that leads to the quantitative estimation of the proton density defined tissue or structure.

Fractional anisotropy calculation

Meta-properties

FRACTIONAL ANISOTROPY CALCULATION is RIGID (**+R**). FRACTIONAL ANISOTROPY CALCULATION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A FRACTIONAL ANISOTROPY CALCULATION is a QUANTITATIVE PARAMETER ESTIMATION. [CP/EVR] Every FRACTIONAL ANISOTROPY CALCULATION *has for data* only a DIFFUSION TENSOR DATASET *at* a TIME INTERVAL. [EP/ER] Every FRACTIONAL ANISOTROPY CALCULATION *has for result* a FRACTIONAL ANISOTROPY DATASET *at* a TIME INTERVAL.

Comment

[DEF] $FA = SQRT ((\lambda1 - MD)^2 + (\lambda2 - MD)^2 + (\lambda3 - MD)^2) / SQRT (\lambda1^2 + \lambda2^2 + \lambda3^2)$

With MD: Mean diffusivity

$\lambda1, \lambda2, \lambda3$ are the eigenvalues of the diffusion tensor

(Tofts, 2004)

Relative anisotropy calculation

Meta-properties

RELATIVE ANISOTROPY CALCULATION is RIGID (**+R**). RELATIVE ANISOTROPY CALCULATION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A RELATIVE ANISOTROPY CALCULATION is a QUANTITATIVE PARAMETER ESTIMATION. [CP/EVR] Every RELATIVE ANISOTROPY CALCULATION *has for data* only a DIFFUSION TENSOR DATASET *at* a TIME INTERVAL. [EP/ER] Every RELATIVE ANISOTROPY CALCULATION *has for result* a RELATIVE ANISOTROPY DATASET *at* a TIME INTERVAL.

Comment

[DEF] The relative anisotropy is a normalized standard deviation representing the ratio of the anisotropic part of the tensor to its isotropic part.

Diffusion tensor calculation

Meta-properties

DIFFUSION TENSOR CALCULATION is RIGID (**+R**). DIFFUSION TENSOR CALCULATION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A DIFFUSION TENSOR CALCULATION is a QUANTITATIVE PARAMETER ESTIMATION. [CP/EVR] Every DIFFUSION TENSOR CALCULATION *has for data* only a DIFFUSION WEIGHTED MR DATASET *at* a TIME INTERVAL. [EP/ER] Every DIFFUSION TENSOR CALCULATION *has for result* a DIFFUSION TENSOR DATASET *at* a TIME INTERVAL.

Comment

[DEF] A DIFFUSION TENSOR is calculated from a nondiffusion-weighted image plus six or more diffusion-weighted measurements along noncollinear directions. (Tofts, 2004)

Mean diffusivity calculation

Meta-properties

MEAN DIFFUSIVITY CALCULATION is RIGID (**+R**). MEAN DIFFUSIVITY CALCULATION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A MEAN DIFFUSIVITY CALCULATION is a QUANTITATIVE PARAMETER ESTIMATION. [CP/EVR] Every MEAN DIFFUSITY CALCULATION *has for data* only a DIFFUSION TENSOR DATASET *at* a TIME INTERVAL. [EP/ER] Every MEAN DIFFUSIVITY CALCULATION *has for result* a MEAN DIFFUSIVITY DATASET *at* a TIME INTERVAL.

Comment

[DEF] “The most robust estimate of the diffusion properties of a voxel is given by the average of the eigenvectors of the Diffusion Tensor”.
$MD = (\lambda 1 + \lambda 2 + \lambda 3) / 3$
(Tofts, 2004)

Field map estimation

Meta-properties

FIELD MAP ESTIMATION is RIGID (+**R**). FIELD MAP ESTIMATION is EXTERNALLY-DEPENDENT (+**D**).

Properties

[EP/SL] A FIELD MAP ESTIMATION is a QUANTITATIVE PARAMETER ESTIMATION. [EP/SL] A FIELD MAP ESTIMATION is a CALIBRATION MODEL ESTIMATION. [CP/ER] Every FIELD MAP ESTIMATION *has for data* exactly one MAGNETIC FIELD QUALITY DATASET LONG ECHO TIME *at* a TIME INTERVAL. [CP/ER] Every FIELD MAP ESTIMATION *has for data* exactly one MAGNETIC FIELD QUALITY DATASET SHORT ECHO TIME *at* a TIME INTERVAL. [EP/ER] Every FIELD MAP ESTIMATION *has for result* a FIELD MAP DATASET *at* a TIME INTERVAL.

Comment

[DEF] Variations in the main magnetic field B0, due to inhomogeneity, the presence of a body in the magnetic field etc…, provoke corresponding proton frequency variations (following the dependence of the proton precession frequency and the strength of the magnetic field, $f0= \gamma B0/2\pi$ where γ the gyromagnetic ratio egal 42.58 Mhz/T for H at B0=1T). These frequency variations can be estimated via a specific calibration procedure (including the measurement of two long and short time images), the field map estimation. Knowing the variations, corresponding spatial displacement i.e spatial image distortion can be corrected.

Regional cerebral blood flow estimation

Meta-properties

REGIONAL CEREBRAL BLOOD FLOW ESTIMATION is RIGID (+**R**). REGIONAL CEREBRAL BLOOD FLOW ESTIMATION is EXTERNALLY-DEPENDENT (+**D**).

Properties

[EP/SL] A REGIONAL CEREBRAL BLOOD FLOW ESTIMATION is a QUANTITATIVE PARAMETER ESTIMATION. [CP/EER] Every REGIONAL CEREBRAL BLOOD FLOW ESTIMATION *has for data* a T2 WEIGHTED DCE MR DATASET or a T2 STAR WEIGHTED DCE MR DATASET or a SPIN TAGGING PERFUSION MR DATASET *at* a TIME INTERVAL. [EP/ER] Every REGIONAL CEREBRAL BLOOD FLOW ESTIMATION *has for result* a REGIONAL CEREBRAL BLOOD FLOW DATASET *at* a TIME INTERVAL.

Comment

[DEF] Regional cerebral blood flow is estimated from specific MR sequences using invasive method (a tracer plus a T2star sequence) or non-invasive method via a spin tagging sequence. The principle of this measurement depends of the method used. For instance, the invasive method currently used in clinic determines the blood flow from the estimation of the cerebral blood volume divided by the estimation of the mean transit time. Cerebral blood volume and mean transit time are obtained from the gamma-fit on the T2* signal as a function of time.

Regional cerebral blood volume estimation

Meta-properties

REGIONAL CEREBRAL BLOOD VOLUME ESTIMATION is RIGID (**+R**). REGIONAL CEREBRAL BLOOD VOLUME ESTIMATION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A REGIONAL CEREBRAL BLOOD VOLUME ESTIMATION is a QUANTITATIVE PARAMETER ESTIMATION. [CP/EER] Every REGIONAL CEREBRAL BLOOD VOLUME ESTIMATION *has for data* a T2 WEIGHTED DCE MR DATASET or a T2 STAR WEIGHTED DCE MR *at* a TIME INTERVAL. [EP/ER] Every REGIONAL CEREBRAL BLOOD VOLUME ESTIMATION *has for result* a REGIONAL CEREBRAL BLOOD VOLUME DATASET *at* a TIME INTERVAL.

Comment

[DEF] Regional cerebral blood volume is estimated from specific MR sequences using invasive method (a tracer plus a T2star sequence). The cerebral blood volume corresponds to area under the curve of the signal evolution during the bolus of the contrast agent.

Regional mean transit time calculation

Meta-properties

REGIONAL MEAN TRANSIT TIME CALCULATION is RIGID (**+R**). REGIONAL MEAN TRANSIT TIME CALCULATION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] A REGIONAL MEAN TRANSIT TIME CALCULATION is a QUANTITATIVE PARAMETER ESTIMATION. [CP/ER] Every REGIONAL MEAN TRANSIT TIME CALCULATION *has for data* exactly one REGIONAL CEREBRAL BLOOD VOLUME DATASET *at* a TIME INTERVAL. [CP/EVR] Every REGIONAL MEAN TRANSIT TIME CALCULATION *has for data* exactly one REGIONAL CEREBRAL BLOOD FLOW DATASET *at* a TIME INTERVAL. [EP/ER] Every REGIONAL MEAN TRANSIT TIME CALCULATION *has for result* a REGIONAL MEAN TRANSIT TIME DATASET *at* a TIME INTERVAL.

Comment

[DEF] The transit time is classically estimated from specific MR sequences using invasive method (a tracer plus a T2star sequence). The method currently used in clinic determines the mean transit time by measuring the FWHM of the gamma-variate fit on the T2star signal measured during the injection.

Absolute metabolite concentration estimation

Meta-properties

ABSOLUTE METABOLITE CONCENTRATION ESTIMATION is RIGID (**+R**). ABSOLUTE METABOLITE CONCENTRATION ESTIMATION is EXTERNALLY-DEPENDENT (**+D**).

Properties

[EP/SL] An ABSOLUTE METABOLITE CONCENTRATION ESTIMATION is a QUANTITATIVE PARAMETER ESTIMATION. [CP/EVR] Every ABSOLUTE METABOLITE CONCENTRATION ESTIMATION *has for data* only a H1 CHEMICAL SHIFT IMAGING DATASET *at* a TIME INTERVAL. [EP/ER] Every ABSOLUTE METABOLITE CONCENTRATION ESTIMATION *has for result* an ABSOLUTE METABOLITE CONCENTRATION DATASET *at* a TIME INTERVAL.

Comment

[DEF] Based on a spectrum measured in a single voxel or set of voxels, the absolute concentration of metabolite is estimated from the peak at the corresponding Lamor frequency ($f0= \gamma B0/2\pi$) where g the gyromagnetic ratio depends of the considered metabolite (11.27 MHz/T for Na, 11.25 Mhz/T for P, and 40.08 fro F for B0=1T). The absolute metabolite concentration ratio is estimated by a specific fitting of the spectrum

data relative to the considered metabolite. A calibration or the use of a model is required to access to the absolute value of the metabolite concentration.

Metabolite concentration ratio estimation

Meta-properties

METABOLITE CONCENTRATION RATIO ESTIMATION is RIGID (+**R**). METABOLITE CONCENTRATION RATIO ESTIMATION is EXTERNALLY-DEPENDENT (+**D**).

Properties

[EP/SL] A METABOLITE CONCENTRATION RATIO ESTIMATION is a QUANTITATIVE PARAMETER ESTIMATION. [CP/EVR] Every METABOLITE CONCENTRATION RATIO ESTIMATION *has for data* only a SPECTROSCOPIC IMAGING DATASET *at* a TIME INTERVAL. [EP/ER] Every METABOLITE CONCENTRATION RATIO ESTIMATION *has for result* a METABOLITE CONCENTRATION RATIO DATASET *at* a TIME INTERVAL.

Comment

[DEF] Based on a spectrum measured in a single voxel or set of voxels, the absolute concentration of metabolite is estimated from the peak at the corresponding Lamor frequency ($f0= \gamma B0/2\pi$) where g the gyromagnetic ratio depends of the considered metabolite (11.27 MHz/T for Na, 11.25 Mhz/T for P, and 40.08 fro F for B0=1T). The metabolite concentration ratio is estimated by a specific fitting of the spectrum data relative to the considered metabolites (lactate, choline ect …).

Blood oxygen level dependent signal changes estimation

Meta-properties

BLOOD OXYGEN LEVEL DEPENDENT SIGNAL CHANGES ESTIMATION is RIGID (+**R**). BLOOD OXYGEN LEVEL DEPENDENT SIGNAL CHANGES ESTIMATION is EXTERNALLY-DEPENDENT (+**D**).

Properties

[EP/SL] A BLOOD OXYGEN LEVEL DEPENDENT SIGNAL CHANGES ESTIMATION is a QUANTITATIVE PARAMETER ESTIMATION. [CP/EVR] Every BLOOD OXYGEN LEVEL DEPENDENT SIGNAL CHANGES ESTIMATION *has for data* only a T2 STAR WEIGHTED MR DATASET *at* a TIME INTERVAL. [EP/ER] Every BLOOD OXYGEN LEVEL DEPENDENT SIGNAL CHANGES ESTIMATION *has for result* a BOLD DATASET *at* a TIME INTERVAL.

Comment

[DEF] BLOOD OXYGEN LEVEL DEPENDENT SIGNAL CHANGES ESTIMATION is a method for determining which areas of brain are active under varying neurological stimulus conditions based on the magnetic property of the de-oxygenation of blood haemoglobin. The concentration variations of deoxyhaemoglobin due to neuron activation locally modifies the magnetic field.

Magnetization transfer ratio calculation

Meta-properties

MAGNETIZATION TRANSFER RATIO CALCULATION is RIGID (+**R**). MAGNETIZATION TRANSFER RATIO CALCULATION is EXTERNALLY-DEPENDENT (+**D**).

Properties

[EP/SL] A MAGNETIZATION TRANSFER RATIO CALCULATION is a QUANTITATIVE PARAMETER ESTIMATION. [CP/EVR] Every MAGNETIZATION TRANSFER RATIO CALCULATION *has for data* only T1 WEIGHTED MR DATASETS or T2 WEIGHTED MR DATASETS or T2 STAR WEIGHTED MR

DATASETS *at* a TIME INTERVAL. [EP/ER] Every MAGNETIZATION TRANSFER RATIO CALCULATION *has for result* a MAGNETIZATION TRANSFER RATIO DATASET *at* a TIME INTERVAL.

Comment

[DEF & CIT] “The Magnetization Transfer Ratio may be defined as MTR=100x(M0-Ms)/M0 pu, where M0 represents the signal measured in absence of saturation, and Ms the signal in the presence of saturation applied to the bound proton pool. It is expressed as percentage units (pu). “ (Tofts, 2004).