2025/10/17 14:04 1/4 rsf

Radiotherapy Support Functions (RSF)

Radiotherapy Support Functions are general radiotherapy worker functions. Most RSF functions are used in various Dose Calculation Functions and Design Task Functions and are exposed through the external API to allow users a more low level access to the system. The RSF function category encompasses the remaining functions not classified as a DTF or DCF.

Image Processing

Below is a list of some common image processing functions and a brief explanation of their intended usage (Specific details of each function, argument parameters, and return values are provided at the Dosimetry App Manifest Guide).

• override image inside structure:

 Returns a new 3D image where the value of each voxel that is more than cutoff % contained within the structure is set to the provided override value

override_image_outside_structure:

 Modifies an image where the value of each voxel that is more than cutoff % contained within the structure is set to the provided override value (values outside the structure are not modified)

• override image variant outside structure:

 Returns a new 3D image where the value of each voxel that is more than cutoff % outside the structure is set to the provided override value

• image histogram:

Creates a histogram using the specified 1D image

• combine_images_<N>d:

- Where N is the size of the image
- Combine multiple images into single image

• image bounding box <N>d:

- Where N is the size of the image
- Returns the bounding box of an image of size N

bounding box <N>d:

- Where N is the size of the image
- Returns the bounding box of an image_geometry of size N. Allows support for non equal spacing of image pixels

• image min max <N>d:

- Where N is the size of the image
- Get the minimum and maximum values in the given image

• image_list_min_max_<N>d:

- Where N is the size of the image
- Get the overall minimum and maximum values for a vector of images

create uniform image on grid <N>d:

- Where N is the size of the image
- Create an image of uniform pixel values (e.g. water phantom) over a grid of size N

See thinknode™ Examples for python for an example of using this function

Contour Modification

Below is a list of some common polygon and polyset functions and a brief explanation of their intended usage (Specific details of each function, argument parameters, and return values are provided at the Dosimetry App Manifest Guide).

polygon_centroid:

Computes the geometric center of a polygon

• scale_polygon:

Scales a polygon shape in XY (independently) based on a vector2D factor

scale_polyset:

Scales a polyset shape in XY (independently) based on a vector2D factor

polyset_expansion:

 Expands a polyset uniformly around the edges by the given amount. This function can be used to either expand or contract a polyset

polyset_combination:

 Compute a combination of two or more polysets. This function can operate as a union, intersection, difference, or exclusive or (xor)

point list bounding box <N>d:

- Where N is the size of the vector (1, 2, 3 dimensions)
- Computes the bounding box of a list of N dimensional vectors

• point_in_polygon / point_in_polyset:

Test if a point is inside a polygon / polyset

distance to polyset:

Get the distance from point to a polyset (inside < 0)

Structure Modification

Below is a list of some common structure manipulation functions and a brief explanation of their intended usage (Specific details of each function, argument parameters, and return values are provided at the Dosimetry App Manifest Guide).

• structure combination:

 Compute a combination of two or more structures. This function can operate as a union, intersection, difference, or exclusive or (xor)

structure 2d expansion:

 Compute the 2D expansion of a structure. The 2D expansion of a structure is computed by independently expanding each slice of the structure within its 2D plane. This function can be used to either expand or contract a structure

• structure 3d expansion:

 When computing the 3D expansion of a structure, the structure's slices are allowed to expand into other slices. This function can be used to either expand or contract a structure

structure_volume:

2025/10/17 14:04 3/4 rsf

Gets the volume of a structure_geometry

• structure centroid:

Gets the centroid of a structure_geometry

Geometric Primitives

Below is a list of some common creation functions for geometric primitives and a brief explanation of their intended usage (Specific details of each function, argument parameters, and return values are provided at the Dosimetry App Manifest Guide).

• make cube:

- Creates a triangle mesh representing a 3D box
- See thinknode™ Examples for python for an example of using this function

• make cylinder:

Creates a triangle mesh representing an axis aligned, right 3D cylinder

make_pyramid:

o Creates a triangle mesh representing a rectangular based, right 3D pyramid

make_sphere:

• Creates a triangle mesh representing a 3D sphere

make sliced box:

Creates a structure geometry representing a 3D box (using a sliced mesh)

make_sliced_cylinder:

Creates a structure representing an axis aligned, right 3D cylinder (using a sliced mesh)

• make sliced parallelepiped:

• Creates a structure representing a generalized 3D parallelepiped (using a sliced mesh)

• make sliced pyramid:

Creates a structure representing a rectangular based, right 3D pyramid (using a sliced mesh)

make sliced sphere:

Creates a structure representing a 3D sphere (using a sliced mesh)

Degrader Manipulation

Below is a list of some common degrader manipulation functions and a brief explanation of their intended usage (Specific details of each function, argument parameters, and return values are provided at the Dosimetry App Manifest Guide).

• make block:

Create a degrader representing a block. A block has a uniform thickness within its shape and
0 thickness outside. Note that the shape is specified at the downstream edge of the block

• make shifter:

 A block has a uniform thickness within its shape and 0 thickness outside. A range shifter is modelled as extending infinitely in the X and Y directions, so its thickness is uniform across the field

make rc:

Create a degrader representing a range compensator. A range compensator is a degrader

2025/10/17 14:04 4/4 rsf

whose thickness is specified as an image. The image is specified in the plane of the downstream edge of the RC

• make rc nurb:

 Create a degrader representing a nurbs range compensator. A nurbs range compensator is a degrader whose thickness is specified as a smooth surface. The surface is specified in the plane of the downstream edge of the RC

• truncate rc:

 Shifts a range compensator surface such that the minimum thickness is set to the specified value

make_uniform_rc:

Create a degrader representing a uniform thickness range compensator

make_linear_rc:

Create a degrader representing a linearly varying thickness range compensator

By changing the input (shape, image, etc) passed into the the degrader make functions, the resulting degrader can be manipulated as desired.

From:

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Last update: 2021/07/29 18:22

