Radiotherapy Support Functions (RSF)

Radiotherapy Support Functions are, as a basic description, general radiotherapy worker functions. RSF functions are used both various Dose Calculation Functions and Design Task Functions. The RSF function category encompass 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:**
  - 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:**
  - 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 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.