**Persistent\_lifetime\_image**

**Environment**

* MATLAB 2023a

**Usage**

The “Cal\_PLTImage” function performs computation of persistent lifetime (PLT) images

[PLTImg, PLTMap, CentPlot] = Cal\_PLTImage(img, roi, qbit, k, sigma)

<Input variables>

img : 2D matrix of a preprocessed 2D image

roi : Mask image of a region of interest on the img

qbit : bit depth of input image

k : Dimension of topological components (k = 0 : connected component; k = 1 : hole component)

sigma : Sigma of Gaussian filter (Weight of scalarization)

<Output variables>

PLTImg : Persistent lifetime image array for k-th topological component

PLTMap : Persistent lifetime map array for k-th topological component

CentPlot : Centroid plot array for k-th topological component

**Demonstration** **of “Example.m”**

“Example.m” performs the PLT image calculation for a sample image (“sample.mat”)

1. Sample images

“sample.mat”

“img” : 2D 8-bit mediastinal CT image

“roi” : Segmentation of a tumoral region

|  |  |
| --- | --- |
| A close-up of an ultrasound  Description automatically generated | A white outline of a map  Description automatically generated |
| “img” | “roi” |

2. Run “Example.m” at a directory “~/Persistent\_lifetime\_image”

%Example.m

addpath(genpath('programs'))

%%Load samples of integer image and binary mask

load('sample.mat');

qbit = 8;

sigma = 1;

%%PLT image for connected components (k=0)

k = 0;

[PLTImg\_cc, PLTMap\_cc, CentPlot\_cc] = Cal\_PLTImage(img, roi, qbit, k, sigma);

%%PLT image for hole components (k=1)

qbit = 8; k = 1; sigma = 1;

[PLTImg\_hc, PLTMap\_hc, CentPlot\_hc] = Cal\_PLTImage(img, roi, qbit, k, sigma);

%%Display

fig = figure('visible','off');

tiledlayout(2,3);

nexttile;

VOXview(PLTImg\_cc,'alpha\_def','diff','threshold',1e-5,'colormap',jet);

colorbar;

view([-45 20]);

xlabel('x');

ylabel('y');

zlabel('t');

title("PLT image (CC)");

nexttile;

VOXview(PLTMap\_cc,'alpha\_def','diff','threshold',1e-5,'colormap',jet);

colorbar;

view([-45 20]);

title("PLT map (CC)");

nexttile;

VOXview(CentPlot\_cc,'colormap',jet);

view([-45 20]);

title("Centroid plot (CC)");

nexttile;

VOXview(PLTImg\_hc,'alpha\_def','diff','threshold',1e-5,'colormap',jet);

colorbar;

view([-45 20]);

title("PLT image (HC)");

nexttile;

VOXview(PLTMap\_hc,'alpha\_def','diff','threshold',1e-5,'colormap',jet);

colorbar;

view([-45 20]);

title("PLT map (HC)");

nexttile;

VOXview(CentPlot\_hc,'colormap',jet);

view([-45 20]);

title("Centroid plot (HC)");

print('-dpng', fullfile('PLTImages.png'));

close(fig);

3. Output

“PLTImages.png”

|  |
| --- |
| A group of graphs showing different colors  Description automatically generated with medium confidence |
| “PLTImages.png” |