Atrophy and Growth Simulation

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1. Overview

This document describes how to simulate atrophy and growth within a spherical region of an input image. The implementation is based on:

B. Karacali, C. Davatzikos, "Simulation of Tissue Atrophy Using a Topology Preserving Transformation Model," accepted for publication in IEEE Trans. Medical Imaging, 2006.

2. How to simulate atrophy or growth?

2.1 Use Command: LinuxSimulateAtrophyV2

This command allows you to input the voxel size of the input image. The detailed usage is as follows:

LinuxSimulateAtrophyV2 Orig.Img Seg.Img X Y Z XRes YRes Zres PointX PointY PointZ Radius Rate Sim.Field Sim.Inv.Field Sim.Img Sim.Seg

Table 1. Command Line Arguments.

Orig.Img	Input image, the input image has to be raw image, with each voxel stored as an unsigned char. The intensity of background should be 0, and the background should not consist of noise.
Seg.Img	The segmentation of the input image. For brain images, the values of the segmentation labels are white matter (250), gray matter (150), and CSF (10). The background has to be 0. The format of the segmented image is the same as for the input image, i.e., raw image with voxel type unsigned char.
X Y Z	The size of input images, the size of the segmented image and the original input image should be the same. X is the size of the X dimension, which changes the fastest when storing and reading the images, and Z is the size of Z dimension, the slowest one.
XRes YRes ZRes	The voxel size of the input images. For example if the voxel size of the input image is 0.9375 mm, 0.9375 mm and 1.5 mm on X, Y, and Z dimensions, respectively.
PointX PointY PointZ	The location (or coordinate) of the center voxel of the spherical region. The point could also be out side the image. The coordinate of the very first image voxel is (0, 0, 0) and the very last voxel is (XSize - 1, YSize - 1, ZSize - 1).

Radius	The radius of the spherical region in mm which is used to simulate atrophy and growth inside.
Rate	The degree of atrophy or growth, where the given value has to be positive. Rate < 1 indicates atrophy, Rate > 1 indicates growth. Note the actual measured rate may not be the same with this desired one. It is suggested that the input Rate is within the range of (0.7~2).
Sim.Field	The simulated deformation field defined on the space of the input image. For each voxel, a three-dimensional displacement vector is stored where the type of each component is float. Hence, the layout of the raw image can be described as [dx1 dy1 dz1 dx2 dy2 dz2 …].
Sim.Inv.Field	The inverse of the simulated deformation field Sim.Field.
Sim.Img	The simulated image stored as raw image with voxel type unsigned char.
Sim.Seg	The simulated segmented image stored as raw image with voxel type unsigned char.

2.2 Use Command: LinuxSimulateAtrophy

This command is similar with the command LinuxSimulateAtrophyV2, the only difference is that you do not need to input the voxel size of input image.

LinuxSimulateAtrophy Orig.Img Seg.Img X Y Z PointX PointY PointZ Radius Rate Sim.Field Sim.Inv.Field Sim.Img Sim.Seg

Please refer to Table 1 for detailed explanation of the inputs.

After simulation, please check the results Sim.Img and Sim.Seg. If you have any problem or find any bug please contact us.

Important Notes: Please do not execute multiple simulations in the same folder simultaneously.

3. Contact

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