Confidence Connected Segmentation With ITK

Release 0.10

Thomas Piekos[1]

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[1]Rensselaer Polytechnic Institute, Troy, NY

Abstract

This document describes a simple method of performing confidence connected segmentation using the Insight toolkit (www.itk.org) on data retrieved from the Designed Database of MR Brain Images of Healthy Volunteers from MIDAS

Contents

1 Experiment Information

This has been written and documented as an assignment for the course Open Source Software Practice (listed CSCI-4968) at Rensselaer Polytechnic Institute, Fall 2007.

Data utilized for this process was made available from (http://casilab.med.unc.edu/index.html)

The purpose of this is to provide exposure to the concepts of open data, open source, as well as open access. In addition, it demonstrates the characteristics of medical image segmentation and how it may be applied to clinical problems.

2 Method

Confidence connected segmentation calculates the segmentation based on simple statistics calculated on a given region. Using these calculations in combination with user supplied parameters, we are able to define which pixels fall within the segmentation. The following parameters have been defined within the source :

confidenceConnected->SetMultiplier(2.5);

confidenceConnected->SetNumberOfIterations(5);

confidenceConnected->SetReplaceValue(255);

confidenceConnected->SetInitialNeighborhoodRadius(2);

The multiplier is what multiplies the standard deviation, and defines a range around the median. Iterations refers to the number of times the mean and standard deviation are recalculated and then the filter is rerun. The replace value is the value which the filter uses for each segment when it is storing data, and the initial neighborhood defines how initially how far the filter searches for valid neighbors in the segment.

3 Reproduction Steps

Download and use cmake to compile ConfidenceConnectedSegmentation.cxx with the included CmakeLists.txt file, while being sure to link appropriately to ITK.

In addition, the data must be downloaded manually as it is not distributed with this code. It is available at

http://insight-journal.org/midas/view_item.php?itemid=1409

Then, execution of the following command will output the segmented file --

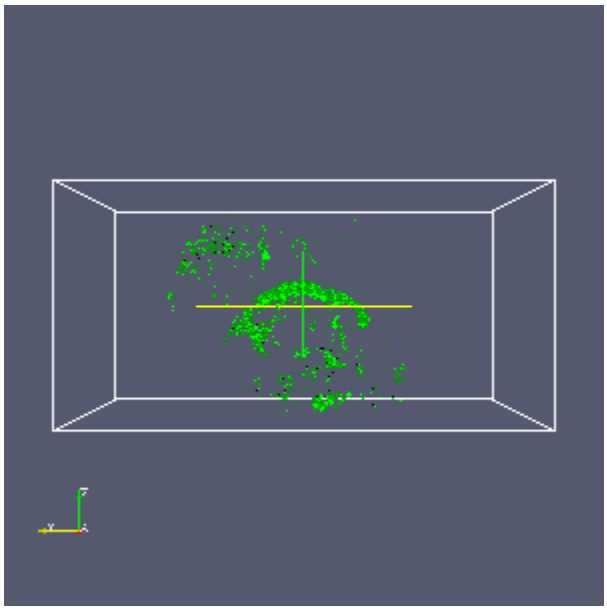
./ConfidenceConnectedSegmentation Normal012-T2.mha SegNormal012-T2.mha 103.5 125.5 71.0

[103.5, 125.5, 71.0] references the seed point which the Confidence Connected algorithm uses to seed the segmentation.

A file has been included, BaseSegNormal012-T2.mha. This represents my own execution of this program – comparison of the two will show if the reproduction instructions have been clear enough.

4 Results

Execution of this results in a very reasonable set of data. The ventricles are visible as one scrolls through on the Z-axis.



5 Software Requirements

You need to have the following software installed:

- Insight Toolkit 2.4.
- CMake 2.4

Recommended Software:

- ImageViewer

Reference

[1] Bullitt E, Zeng D, Gerig G, Aylward S, Joshi S, Smith JK, Lin W, Ewend MG (2005) Vessel tortuosity and brain tumor malignancy: A blinded study. Academic Radiology 12:1232-1240

[2] L. Ibanez, W. Schroeder, L. Ng, and J. Cates. The ITK Software Guide. Kitware, Inc. http://www.itk.org/ItkSoftwareGuide.pdf, first edition, 2003.