Vessel enhancement and segmentation visualizer

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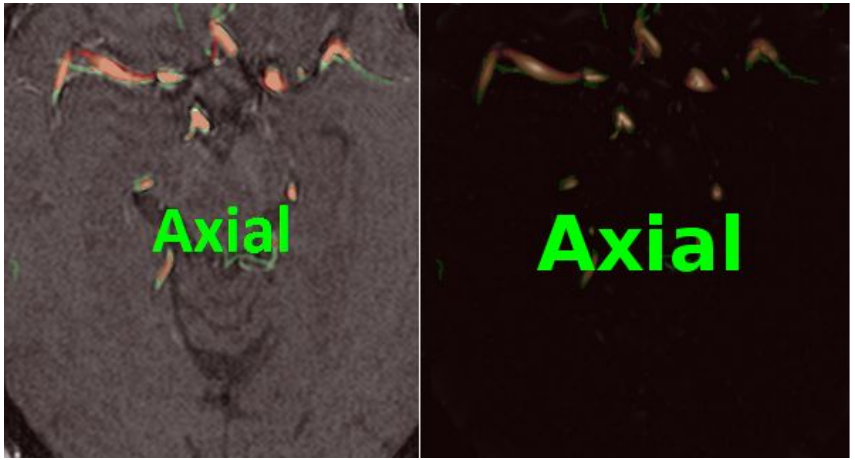
What did I develop?

An application addressed to **analyze and compare** three dimensional **medical images of the brain** and their corresponding **segmentations after vessel enhancement.**



Assumptions

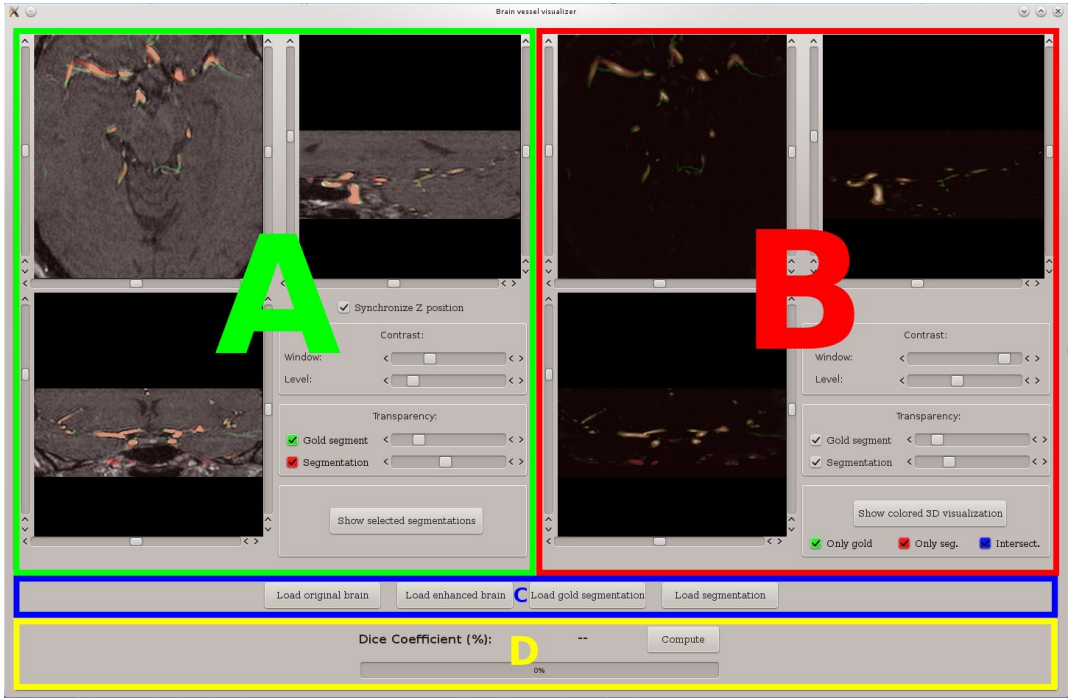
You have **4 images**:

- 3D grayscale image of the **original** brain.
- 3D grayscale image of the **enhanced** brain.
- **Segmentation** of vessels corresponding to **original** brain. It can be manual or ground-truth segmentation.
- **Segmentation** of vessels corresponding to **enhanced** brain. It is a result of automatic segmentation.

Visual elements

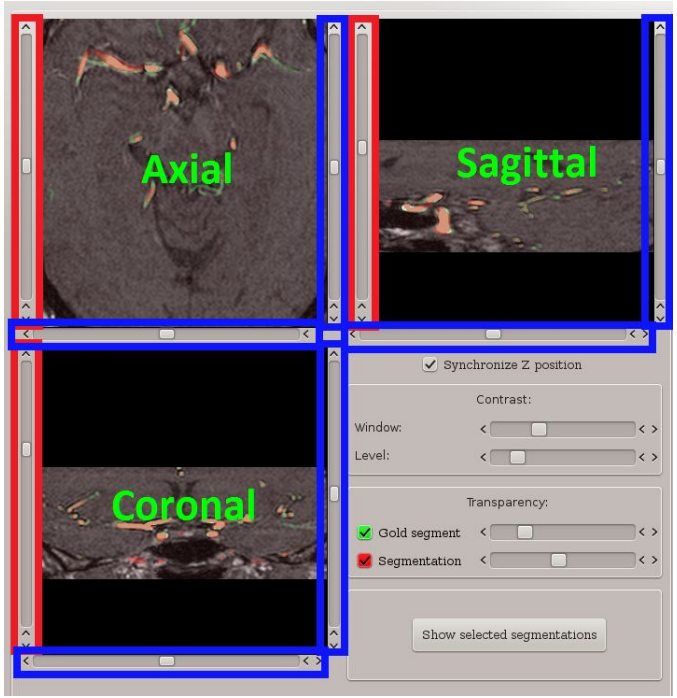
One screen - 4 sections

A. **Normal brain**
B. **Enhanced brain**
C. **Load data**
D. **Metrics**



Section A. Original Brain

- Axial, Coronal and Sagittal views.
- Red bars to navigate slices.
- Blue bars to move the image.
- Segmentations corresponding to original and enhanced brains are overlaid.
- Control panel.

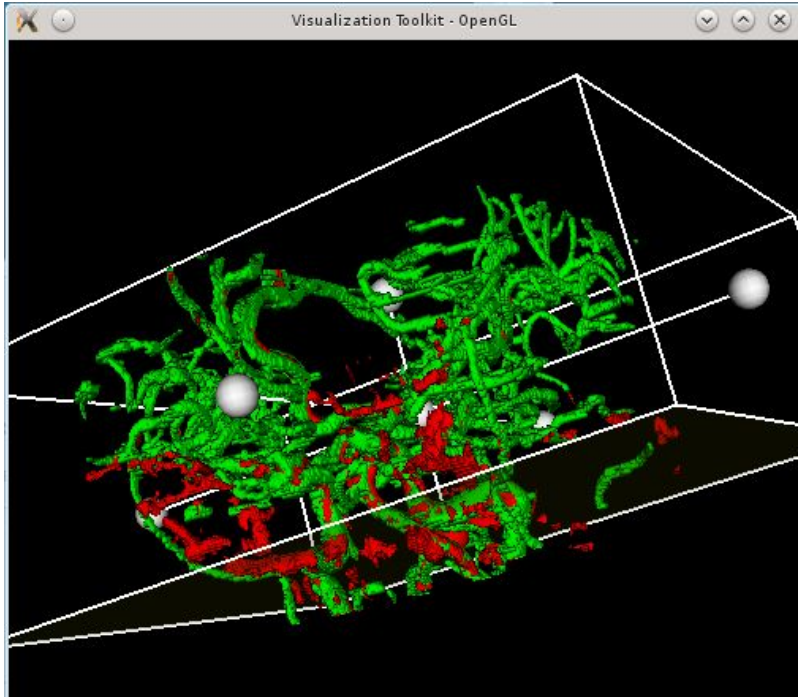


Section A. Control Panel

- Synchronize navigation in A - original and B - enhanced.
- Modify window and level.
- Check which segmentations are visible (matching colors) and control their **oppacity**.
- **Show 3D rendering.**

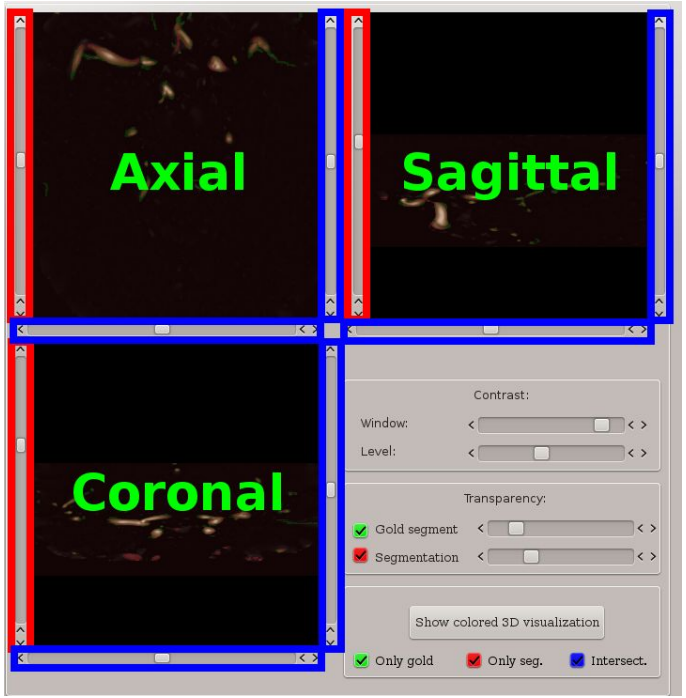
Section A. Interactive 3D rendering

Three dimensional visualization of selected segmentations, with **BoxWidget** to focus on a particular subsection.



Section B. Enhanced Brain

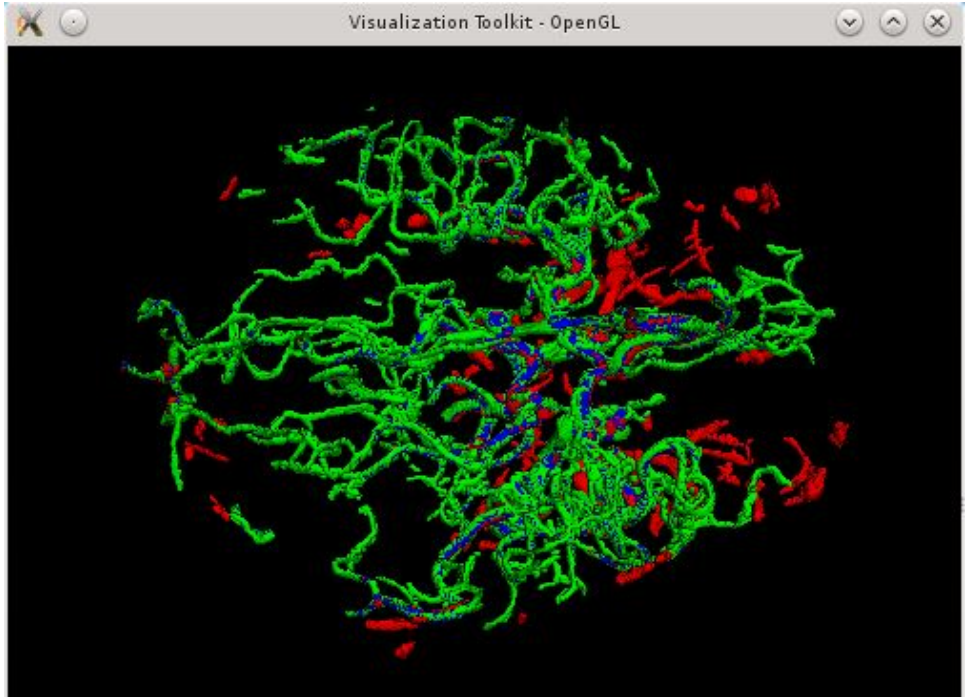
- Axial, Coronal and Sagittal views.
- Red bars to navigate slices.
- Blue bars to move the image.
- Segmentations corresponding to original and enhanced brains are overlaid.
- Control panel.



Section B. 3D rendering

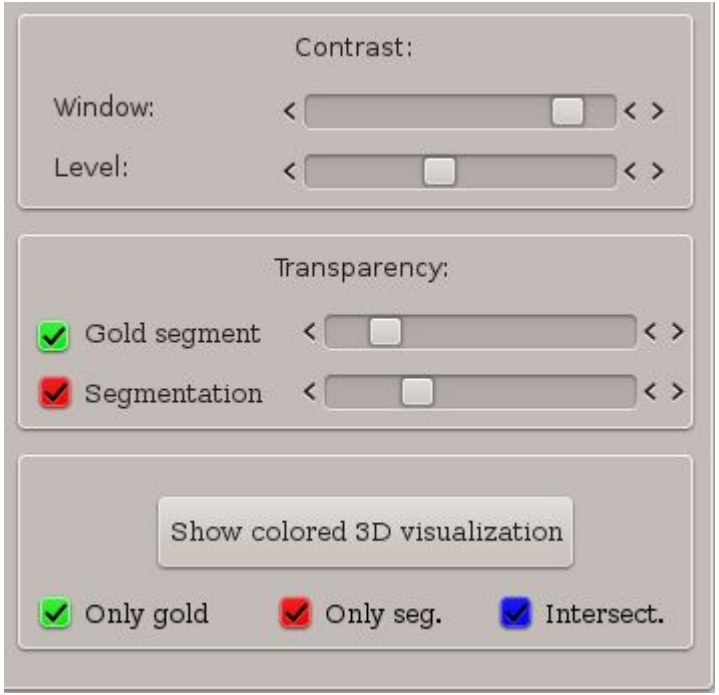
Color coded:

- Green: Only original segmentation.
- Red: Only enhanced segmentation.
- Blue: Both.

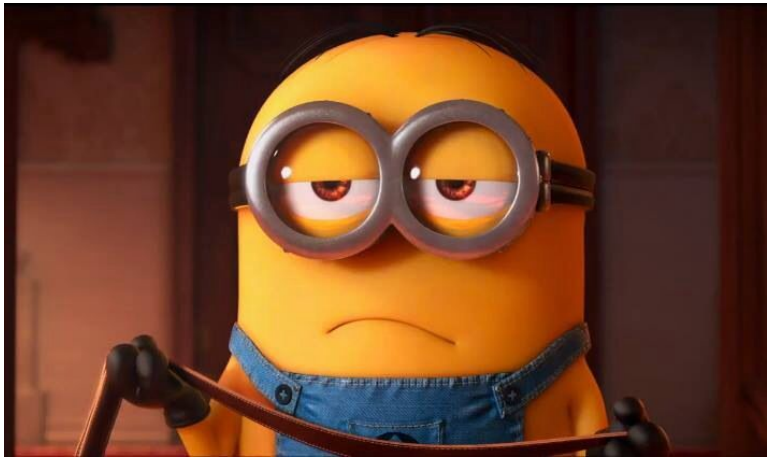


Section B. Control Panel

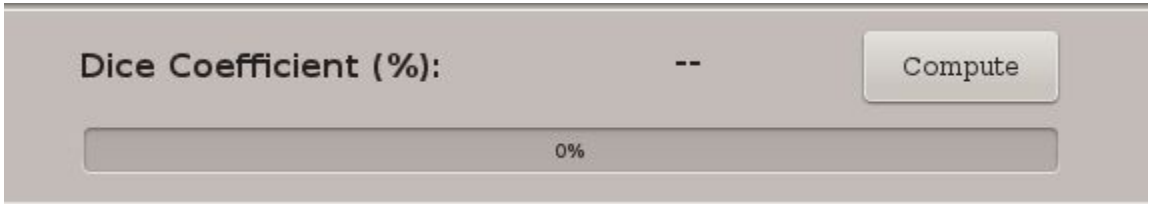
- Modify window and level.
- Check which segmentations are visible (matching colors) and control their oppacity.
- **Show 3D rendering with: voxels that belong only to original, only to enhanced, and to both**.



Section C. Load Data.



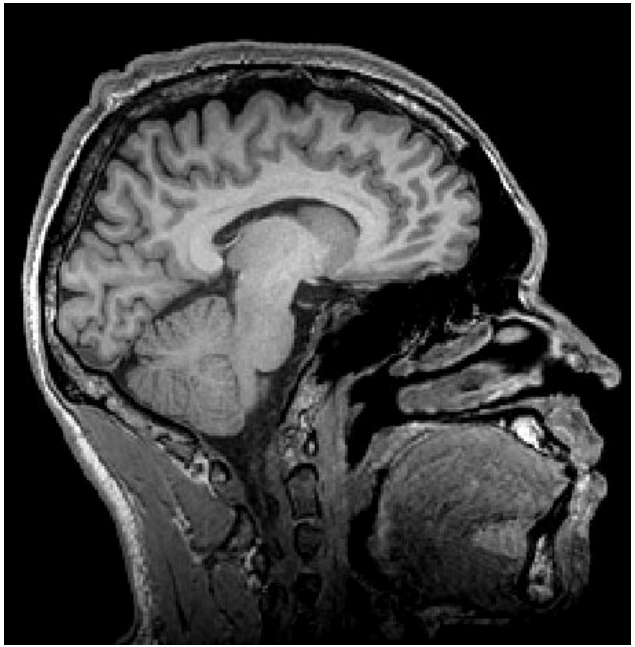
Section D. Metrics



Dice Coefficient to measure overlapping between segmentations.

1945: Lee Raymond Dice “Measures of the Amount of Ecologic Association Between Species “

Summarizing ...



Technology

Software	Version	Function
Nibabel [17]	2.0.2	To read Niftii images.
PyQt [18]	4.11.2	To program interfaces in Qt and handle them with Python.
Python [19]	2.7.9	Programming language.
Pyuic [20]	4.0	To translate the Qt code of QtDesigner into Python code.
Qt [21]	4.8.6	The programming language for user interfaces.
QtDesigner [22]	4.8	A graphical interface designing tool based in Qt.
VTK [23]	5.8.0	Image processing and visualization algorithms.

Improvements

-Adding more characteristics to the interface: Zoom, Personalize colors.

-New metrics can be added to Section D.

-Detailed renderings with computationally expensive algorithms and GPU.

*In this application, rendering is done by using the Marching Cubes algorithm, followed by a Decimation step to reduce the number of triangles generated by Marching Cubes algorithm and accelerate the response of the application to user interaction.