The Farsight Project is a project dedicated to the development and dissemination of a next-generation toolkit of image analysis methods to enable quantitative studies of complex and dynamic tissue microenvironments that are imaged by modern optical microscopes. Examples of such microenvironments include brain tissue, stem cell niches, developing embryonic tissue, immune system components, and tumors.

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The Worm module of Farsight is a toolkit of computational methods designed to segment and track a population of C. elegans worms.

- The C. elegans worms are used as models because
- Growth is predictable
- Ability to survive in a freezer
- Unusual life cycle
- Suited for genetic studies

Materials and restrictions

In order to understand the Farsight Project a series of tutorials on the Visual toolkit (VTK), Insight Toolkit (ITK), MatLab, Python, and Microsoft Visual studio were done as well as a through study of the Farsight Wiki Page and the Worm Project wiki page. We used MatLab, Python,Microsoft visual studio, Paint, the Farsight wiki page, and the Worm project wiki page.

Research problems

We studied under Dr. BadriRoysam at Rensselaer Polytechnic Institute and one of his graduate students TenikaTurnquest. Turnquest worked on the worm project as a whole and gave us a portion of her research problems.

1. One problem was changing the colors of the worms so that we would be able to identify them in a binary picture. The pictures were already magnified a great deal so that we could see them but trying to distinguish between a portion of the petri dish, a small fragment of dirt or anything that got in the way of the lens and the actual worm itself was difficult.

2. The second problem was to find the exact location of the worm. We had to identify the pixel value and x and y coordinates of the worms in order to identify them.

Future research topic

Making sure that we identified and tracked the correct worm. However due to time restraints we were not able to use Nicolas Roussel’s algorithm for tracking and identifying the worms.

Objective Learned

- Farsight
- Broader implications
- Worm Project
- Visual Toolkit (VTK)
- C++
- Microsoft Visual Studio
- Visual Toolkit (VTK)
- Cmake
- The Wallflower Algorithm
- Image Change Detection Algorithm
- Learn to track and view objects using MatLab

Code using MatLab

This is the code for displaying worm images. It tracks, displays and locates the pixel values.

```matlab
img = imread('ACZ_2001.mat');

colormap harc;

m = (img("'color', 'red'");

m = (img("'color', 'green'");

m = (img("'levelSingleColor', 'off'");

看 = imread('ACZ_mask.tif');

a = insubtract(mask, img);

level = graythresh(a);

black = level;

white = infill(img, white);

imshow(UH]

[8.1] = imagewrite(a, 'tubes.xls');

This section of the code changes the background color. In this instance the background color will be green.

 objectively Learned

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Results

The image above is displayed once the code has been implemented. Notice the pixel values and the different colors of the worms. Each image that is displayed shows the worms in different locations.

Figure 1 Pixel Value X-Coordinate Y-Coordinate

Green Worm 0 273 3
Orange Worm 2 640 10
White Blue Worm 2 250 109
Dark Blue Worm 1 231 309
Nail Worm 5 260 77
Red Worm 4 982 78

The chart above displays the different worms and their locations.

Conclusion and Broader Implications

This research experience has been challenging yet rewarding. Many programming languages and toolkits have been introduced and studied, such as C++, MatLab, Visual Toolkit, and Insight Toolkit.

Broader Implications:
- Tracking algorithms are broadly useful and can be used to track vehicles, people, animals, ships, airplanes, etc.
- Some examples of these tracking algorithms can appear on animals via a collar or leash.

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