LookAt Transform Initializer and Oblique Section Image Filter
Release 1.0

Dan Mueller[1]

July 16, 2007

[1]Queensland University of Technology, Brisbane, Australia

Abstract

This paper describes the ITK implementation of a transform initializer to produce a rigid 3-D transform able to center a given point on an arbitrary plane. The resultant transform allows the user to "look at" a point from a given direction. The resultant transform can also be used to obtain an oblique section: a single arbitrary 2-D slice through a 3-D image.

Keywords: *oblique section, plane, resample, ITK*

Contents

1 Introduction

An oblique section is an arbitrary 2-D plane through a 3-D image. Such images are useful for a variety of visualization and image processing tasks. At present, ITK supports the resampling of an input image through a given coordinate transform using the `itkResampleImageFilter`. It is possible to use this filter to produce oblique sections: the trick is to specify a suitable transform.

This paper describes a helper class `itkLookAtTransformInitializer` allowing the user to specify a rigid 3-D transform for centering an object (ie. for looking at a point). The transform is initialized by specifying a centered plane: the user must provide a center point, a direction to look along, and a second vector — called the "up" vector — that indicates which input axis is mapped to the output y-axis. The initializer is based on the OpenGL `gluLooktAt(..)` function. This paper also describes `itkObliqueSectionImageFilter`: a filter encapsulating the use of the transform intializer for creating 2-D oblique sections from 3-D images.

2 Implementation

The `itkLookAtTransformInitializer` directly computes the underlying 3×3 matrix, center point, and translation. The matrix is specified by finding the axis orthogonal to the direction and up vectors. The center of the transform is the center point specified by the user. The translation is computed using the center of the image. See here for details regarding the OpenGL `gluLooktAt(..)` function.

The `itkObliqueSectionImageFilter` encapsulates the transform initializer, resampling, and extraction. The internal `itkResampleImageFilter` is configured to produce a one slice 3-D image and the internal `itkExtractImageFilter` is used to extract the final 2-D image. The default interpolation is linear, but this can be set by the user as desired.

The full source code, an example dataset, and tests are provided with this article. Some results are depicted in Figure 2.

3 Conclusion

The source code accompanying this article provides a simple addition to ITK allowing the user to initialize a transform for looking at a point from a given direction. The transform initializer was used to construct an oblique section filter. For suggestions or bugs, feel free to contact us[1].

---

[1]Corresponding author: Dan Mueller: d.mueller@qut.edu.au or dan.muel@gmail.com.

(a) Direction: 0, 0, -1   (b) Direction: 0, 0, -1

(c) Direction: 0, -0.5, -1   (d) Direction: 0, -0.5, -1

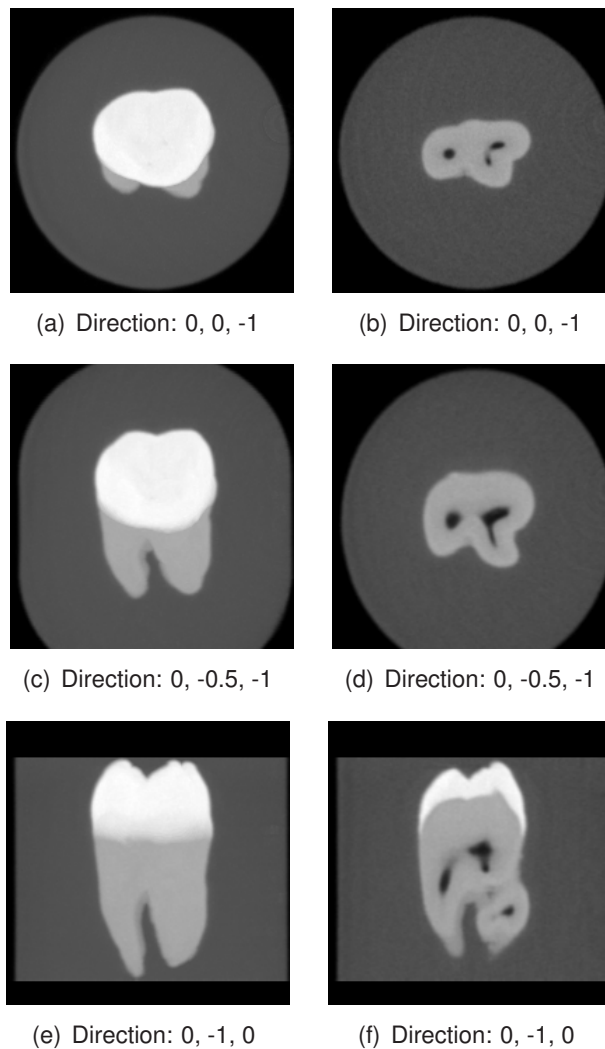(e) Direction: 0, -1, 0   (f) Direction: 0, -1, 0

Figure 1: Some resultant images using the transform initializer and oblique section filter. The first row depicts Maximum Intensity Projection (MIP) images and the second row depicts single slices.