ImageLinearIterator - WithIndex removed

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Abstract

ITK includes a number of iterators including the *itkImageLinearConstIteratorWithIndex* and *itkImageLinearIteratorWithIndex* that support visiting voxels along lines parallel to the image axes. This is particularly useful for separable filters. This article introduces modified versions that do not maintain location index so that filters that don't require index information can perform faster.

Preliminary tests indicate that the iteration speed is improved, but that filters such as the RecursiveSmoothingGaussianImageFilter do not change significantly.

Contents

1 Introduction

The two iterators presented here are the *itkImageLinearConstIterator* and *itkImageLinearIterator*. They are simply modifications of the *WithIndex* filters with the index tracking code removed. The start and end of line offsets are pre-computed and used to iterate along a line. The methods used to move to the next line are based on the *WithIndex* versions of the iterator.

The interface to the new iterators has the standard form.

The most recent versions of these packages can be obtained from `http://voxel.jouy.inra.fr/darcsweb/` [1].

[1] The most recent versions can be obtained using darcs [1] with the command *darcs get http://voxel.jouy.inra.fr/darcs/contrib-itk/package*, where *package* must be replace by *linearIterator*

2 Correctness testing

Functionality of the the modified iterators was validated using an extended version of *itkImageLinearIteratorTest* from the InsightToolkit distribution. The extensions were to test the iterators using lines in 3 directions, rather than the one direction of the original.

It is possible that some constructors are missing or incorrect because I don't have a feel for what is necessary or expected.

3 Performance testing

Two performance tests have been provided. The first simply visits each voxel using the new and old iterators, while the second used a version of RecursiveSmoothingGaussianImageFilter that was modified to use the new iterators. The results on an AMD Athlon(TM) XP 2000, 256Kb cache are shown in Tables 1 and 2.

Direction	WithIndex	New
0	0.659	0.29
1	0.698	0.297

Table 1: Change in iteration speed for 500 repeats of a 487×609 image.

WithIndex	New
0.0597	0.0583

Table 2: Very similar smoothing performance for a 487×609 image.

The raw iteration time is slightly better than half the original time. However the modified smoothing filter did not exhibit a significant change in performance, presumably because the proportion of time spent in the iterator is quite low. A similar result was obtained for the parabolicMorphology filters, which prompted this development.

References

[1] http://www.darcs.net. 1

[2] L. Ibanez and W. Schroeder. *The ITK Software Guide*. Kitware, Inc. ISBN 1-930934-10-6, http://www.itk.org/ItkSoftwareGuide.pdf, 2003.