

AUTOMATIC CLEANSING FOR CT COLONOGRAPHY USING A THREE MATERIAL TRANSITION MODEL

Authors: I.W.O. Serlie¹, R. Truyen², J. Florie², F.H. Post¹, L.J. van Vliet¹, J. Stoker³, F.M. Vos^{1,3}

Institutions ¹ Delft University of Technology, Delft, The Netherlands, ² Philips Medical Systems, Best, The Netherlands, ³ Academic Medical Centre, Amsterdam, The Netherlands

Purpose

Automatic cleansing amounts to removing contrast enhanced stool from CT colonography volumes. Existing methods often produce artifacts at locations where gas, colon wall and contrast enhanced stool meet. Our objective was to develop a method that solves the cleansing problem at such three material transitions.

Materials and Methods

A voxel was modeled to contain three materials: air, tagged material, gas. The material percentages were estimated by a method presented previously [1]. 3D endoluminal views of the tissue percentage volume were made by iso-surface volume rendering. The visualization rendered opaque voxels over the 50% tissue level.

The performance of the method was tested retrospectively. Five patients with 9 polyps larger than 5 mm were selected from an ongoing study. Each patient took a low-fiber diet that included an oral contrast agent prior to the CT examination. Colonoscopy served as the gold standard.

The polyps were examined by one radiologist on the original 2D CT images and subsequently in a 3D display after automatic cleansing. Each polyp was classified into four classes: (1) clearly visible, (2) visible but can be missed, (3) retrospectively clearly visible, but can be missed prospectively and (4) not retrospectively visible.

Results

On the original 2D CT images 5 of 9 polyps were 'clearly visible' in both supine *and* prone position; 2 out of 9 polyps were annotated 'clearly visible' in one position and 'visible retrospectively, but can be missed prospectively' in the other; the remaining 2/9 polyps were 'clearly visible' in one position and 'invisible' in the other.

The cleansed data yielded 5 of 9 polyps 'clearly visible' in both supine *and* prone position; 2 polyps were annotated 'clearly visible' in one position and 'visible, but can be missed' in the other; the remaining 2/9 were 'clearly visible' in one position and 'invisible' in the other.

Conclusion

The cleansing method effectively removed fecal remains from the data even at three material junctions. Inspection of the 'cleaned' colon wall was possible using common surface visualization techniques.

References

- [1] I.W.O. Serlie, R. Truyen, J. Florie, F.H. Post, L.J. van Vliet, and F.M. Vos. Computed Cleansing for Virtual Colonoscopy Using a Three-Material Transition Model, in: T.M. Peters, R.E. Ellis (eds.), Medical Image Computing and Computer-Assisted Intervention - MICCAI 2003 (Proc. 6th Int. Conf. Montreal, Canada, Nov.15-18), Part 2, Lecture Notes in Computer Science, vol. 2879, Springer Verlag, Berlin, 2003, 175-183.

Contact Information:

F.M. Vos, M.D.
Pattern Recognition Group
Department of Imaging Science and Technology
Delft University of Technology
Lorentzweg 1
2628 CJ Delft
The Netherlands
T. 015 278 7133
F. 015 278 6740
Email: frans@ph.tn.tudelft.nl