

RAPID AUTOMATED NEOPLASIA DETECTION IN CT COLONOGRAPHY USING A NOVEL TECHNIQUE



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Introduction:

- Computed tomography colonography (CTC) also known as virtual colonoscopy (VC) is an emerging non-invasive colon imaging technique
- Standard CTC involves examining an abdominal CT study of a suitably prepared patient
- Our interdisciplinary research group is developing enhancement techniques for CTC to facilitate computer aided diagnosis (CAD)

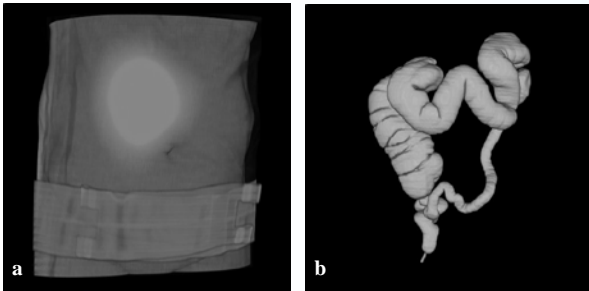


Figure 1: The segmentation process, (a) original CT dataset (b) isolated colon lumen voxels

Methods:

- CTC datasets were obtained using a Siemens Somatom 4 spiral CT scanner
- The resulting DICOM compliant CTC datasets were interpreted using custom software
- The CAD process is divided into two phases: pre-processing & automated detection
- The pre-processing stage included segmentation (Fig 1), centreline calculation (Fig 2) and sub-segmentation (Fig 3)

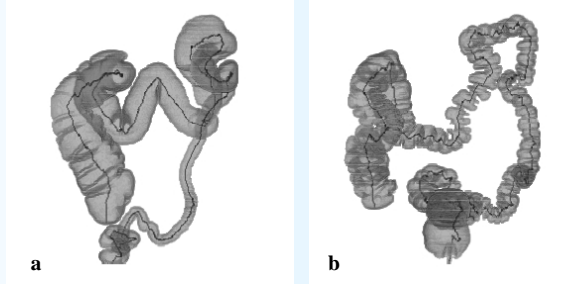


Figure 2: Automatically calculated colon centrelines superimposed on original segmented lumens

- The detection phase involved the automated identification of abnormalities projecting from the colonic mucosa
- These abnormalities were classified as either potential polyps or naturally occurring features based on a 2D shape analysis
- The detection results were presented to the user using a variety of visualisation techniques e.g. 3D volume rendering (Fig 4 (a) & (b))

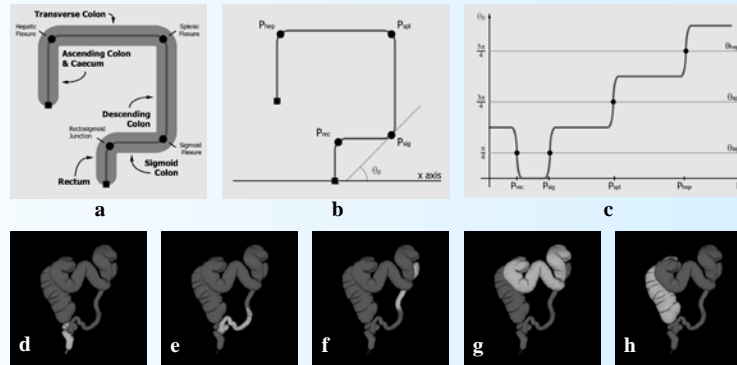


Figure 3: Sub-segmentation of the colon, Theory: (a) lumen model (b) centreline (c) flexure angles & Results: (d) – (h) automatically identified colonic regions

Results:

- The CAD software was tested using a standard PC workstation and evaluated using 5 CTC datasets.
- Phase 1 processing required under 1 minute and phase 2 required an average of 13 minutes.
- The automated analysis stage detected 65% of polyps with 34% false positive detections.
- False positives can be caused by residual material in the colon (Fig 4 (c))

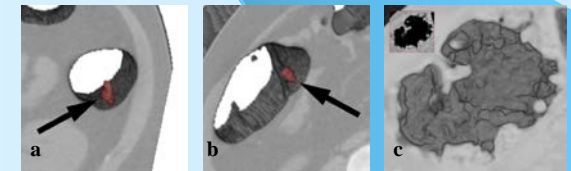


Figure 4: Automatically detected polyps in the ascending colon (a) and descending colon (b). Residual faecal material (c) which can generate false positive detections

Conclusions:

- Standard CTC can be an extremely slow process requiring specialised computer hardware
- We have developed a technique for analysing CTC datasets that is rapid, accessible and comparably inexpensive