The stack mode review of volumetric datasets
- applications for urinary stone disease

av

Mats Lidén

Akademisk avhandling

Avhandling för medicine doktorsexamen i medicinsk vetenskap
med inriktning mot kirurgi,
som kommer att förorsvas offentligt
fredag den 4 oktober 2013 kl. 9.00,
Bohmanssonsalen, Universitetssjukhuset Örebro

Opponent: Professor Anders Magnusson
Institutionen för radiologi, onkologi och strålningsvetenskap
Uppsala universitet, Sverige
Abstract


During the last decades the acquisition and visualization of radiological images have rapidly evolved. The increasing amounts of volumetric image data particularly from modern CT systems necessitate a constant evolution of the radiological visualization techniques.

The dominating display mode for volumetric images has been the stack mode display since its introduction in computerized image review. In the increasing amounts of image data, the stack mode display needs to be analyzed so that the information content in the high resolution datasets can be transformed into clinically relevant information for the management of the individual patient. In the present thesis some aspects of the stack mode display were analyzed using for the most part the size estimation of urinary stones in unenhanced CT as a model.

The estimated size has an important correlation to the prognosis for spontaneous passage of an obstructing ureteral stone. In the present thesis the reader variations in the size estimation of urinary stones were quantified, using different visualization parameters and after an attempt to reduce the variations with a training session for the readers. The influence on the estimated stone size of CT image post processing parameters was quantified. A segmentation algorithm was developed and demonstrated to reduce the reader variability through reader independent computer aid. One limitation of the stack mode display concerns three-dimensional shapes, which was modeled by a comparison between the estimated length and width of urinary stones in two- and three-dimensional segmentation. The increasing number of image slices in the acquisitions introduces a need for efficient navigation of the image volumes. In the present thesis the navigation of CT datasets using different user interface devices was evaluated.

The rapid evolution of the MRI and CT systems necessitates a constant refinement and evaluation of the cornerstone for radiological volumetric reviewing – the stack mode display of volumetric datasets.

Keywords: Stack mode display, image visualization, image perception, computed tomography, urinary stones, urolithiasis, PACS.

Mats Lidén, School of Health and Medical Sciences
Örebro University, SE-701 82 Örebro, Sweden, matsliden@yahoo.com