Peripheral vision implication in the search and recognition of low contrast hepatic metastasis in abdominal CT scans: preliminary study with an eye-tracker

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Rationale

While many imaging modalities are three-dimensional, few studies have examined scrolling in volumetric images through eye-tracking experiments.

CT examinations convey large amount of data and prohibits radiologists to closely scrutinize all anatomical regions with their high-resolution fovea. Therefore, radiologists process CT volumetric images at least partly with their peripheral vision.

It is highly probable that peripheral vision plays an important role when radiologists explore CT examinations composed of hundreds of slices and under time constraints. However, few is known about its implication, for example, in the search of hepatic metastases.

Peripheral vision will be characterized in terms of eccentricity, the distance between the center of the fovea and a given point on the field of vision in angular units. This preliminary study aims at answering the following question: What is the eccentricities' range of radiologists' saccades when they search for low contrast hepatic metastases in volumetric CT scans?

Methods

We designed an experiment which tracks the radiologists' visual fixations and saccades in multiple CT slices. We instructed the readers to perform a free search of multiple metastases and estimated their diagnostic performance.

Regarding the peripheral visual characterization, we estimated the range of eccentricities used during the search and the recognition processes.

Stimulus material is composed of abdominal CT scans from our local database with synthetic signals mimicking hepatic metastases.

Results

The experiment is still in progress and the results will be presented during MIPS conference. The measured distribution of eccentricities will give a quantitative assessment of radiologists peripheral processing in CT volumetric images. We also expect that the distribution of

eccentricities varies according to radiologists' search strategy in volumetric dataset (scanning or drilling).

Conclusion

These results will help to develop model observer based image quality metrics, to better predict human observer classification performance in volumetric images. Next experiment will investigate similar task and will involve more radiologists and additional parameters estimation like accuracy and scrolling patterns.