ATTENTION-BASED PATHOLOGY VISUALIZATION IN HEAD AND NECK AREA

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1. Introduction

Fully automatic computer tools are not suitable for decision in diagnosis or therapy planning because of the very low error tolerance of these vital tasks. However, fully automatic systems can be interesting for visualization tools which will not take any decision, but only provide the radiologists with maps of possible pathology presence and localization.

2. Problem Description

Tumors in the head and neck region are challenging and the analysis of scanner images requires a lot of time. To reduce the inspection time and to avoid missing some small tumors, a fully automatic system is set up. It is based on the detection of surprising asymmetries which will attract computer's attention.

Many other symmetric body parts (as the brain for example) may benefit from this approach.

3. Solution Method

The proposed solution has three main steps. First, the bilateral symmetry of the grey-levels is computed for each slice of the scanner volume. *Fig. 1, right image* shows that the use of the log-polar transform provides higher weights to asymmetries located close to the fixation point (the throat) where most of the tumors are located.

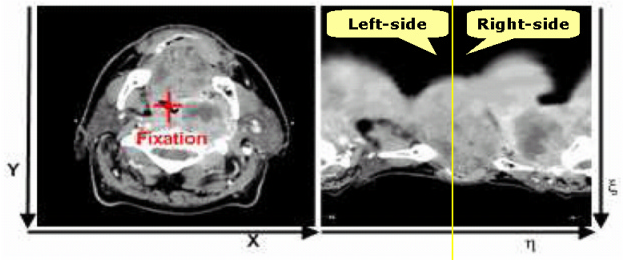

Fig 1: The symmetry is computed close to the throat

Afterwards, a symmetry transform is achieved: for each slice, its symmetry for different gray-levels is displayed. The use of an atlas of normal scanner slices and an attention-based algorithm highlights the rarest, thus the more surprising asymmetries within the scanner volume (*Fig. 2*). Finally, the localization of the most asymmetric grey-levels close

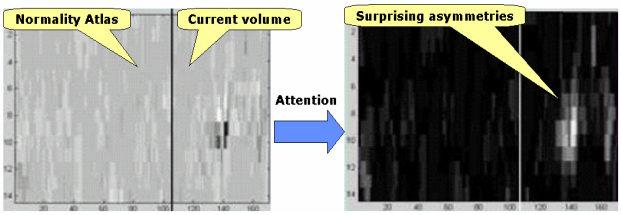

Fig 2: Left: symmetry transform, Right: attention-based surprising asymmetries detection

to the throat by using a topographical distance [1] let us localize the areas in the image where the pathology has a great chance to be located (*Fig. 3*).

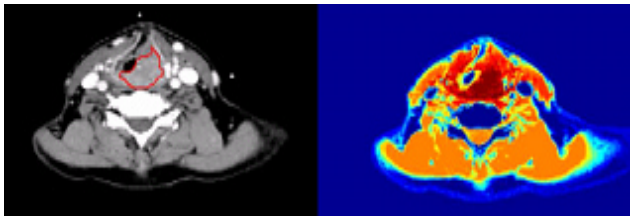

Fig 3: Left: tumor in red (manual segmentation), Right: automatic attention map: red area is suspect

4. Experimental results

A 12 patient database is used here. The detection results are very encouraging (95% of the tumoral slices detected) and only marginal tumor slices are missed. The main slices of all the tumors are thus well detected. Moreover, the localization map is quite close to the real tumor (*Fig. 3, right image*).

5. Innovative Contributions

As far as we know, this is the first time that symmetry considerations are used in the head and neck area. Moreover, this is also the first time that attention algorithm are applied to a practical medical imaging case. Finally, there are no automatic tools providing pathology detection and localization information to head and neck radiologists.

References

[1] M. Mancas, B. Gosselin, B. Macq, "Segmentation Using a Region Growing Thresholding", Proc. of SPIE/EI 2005, San Jose