Combining Desktop and Virtual Realities to Address Demands of a Real-life Clinical Environment

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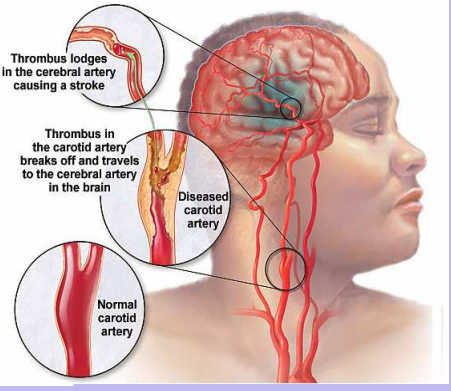
"Atherosclerotic arterial disease is among the leading causes of death and disability all over the world, especially in developed countries. Thus, for a 40 year old, the risk of having this kind of disease at some point in time in their future life is 1 in 2 for men and 1 in 3 for women. The total burden of vascular diseases is expected to increase over the coming decades due to the growing number of elderly people, among whom these diseases are most common" [1].

To identify patients at an early stage of atherosclerosis and to timely start their appropriate treatment reducing the risk of stroke, it is of great importance to obtain images of the arterial system of these patients. In this project, we focus on the development of novel image analysis methods for 3D vascular datasets (MRI, MRA, CTA) augmented by advanced user interaction techniques.

Analysis

(1) detection and quantification of lumen anomalies

(2) assessment of plaque characteristics in the vessel wall



Quick task-switching is required

Image resolution is crucial (anatomical details)

Performance is vital (real-time user interaction)

DR

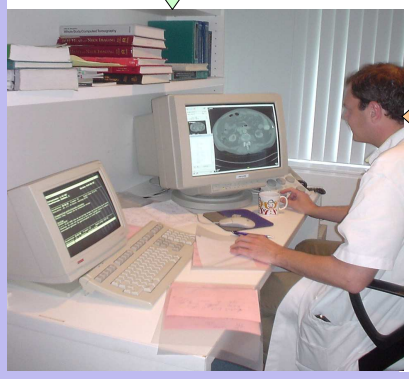
'Sense of immersion' is important

3D stereoscopic representation adds to understanding/performance

Insight view is more vital than performance

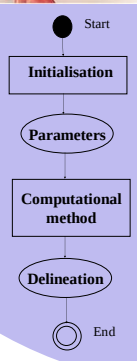
Support of collaborative work is required

VR



Via contextual analysis [3] we indicated some of task-dependent preferences of medical specialists for desktop (DR) and virtual reality (VR) systems. 7 radiologists and 7 vascular surgeons have been interviewed.

Image segmentation techniques provide objective quantitative data characterising a vascular abnormality. Based on the center lumen line detection approach [2], the semi-automated segmentation software developed at the Leiden University Medical Center allows to assess the luminal stenosis/aneurism and to characterise the vessel wall.



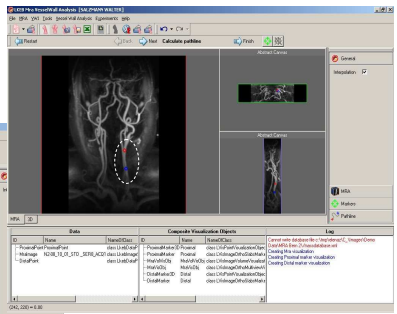
User Interaction

(1) initialisation

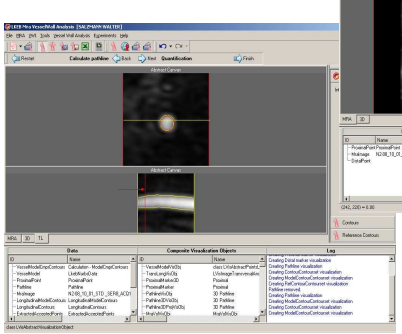
(2) steering

(3) composition of results

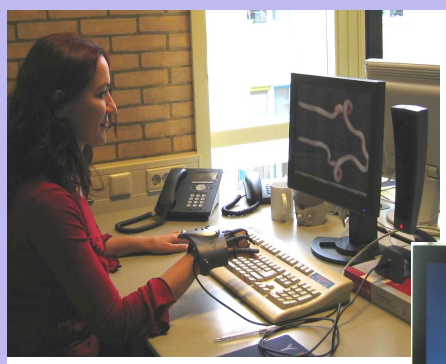
(4) validation of results



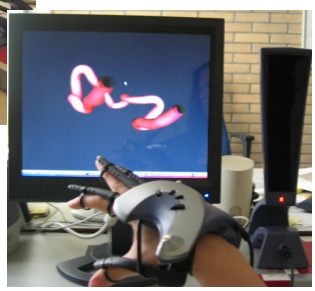
Initialisation: placement of seed points using MIP (maximum intensity projection)



Validation: contour checking



The experimental setup developed at the University of Amsterdam provides sequential support of DR and VR and allows users to manually alternate realities when required [4].



The setup consists of the Sharp LL-151-3D 2D/3D switchable auto-stereoscopic monitor and the Essential Reality P5 controller (a glove-like input device). This configuration will be used to evaluate empirically user performance and behavior in VR/DR for a limited set of exploration and steering tasks related to medical segmentation.

References:

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3. H.S.M. Cramer, V. Evers, E.V. Zudilova and P.M.A. Sloot: Context Analysis to Support Development of Virtual Reality Applications, Virtual Reality, 7(3), 177-186 (2004)
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