MD-Cave: An Immersive Visualization Workbench for Radiologists

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Abstract—The *MD-Cave* is an immersive analytics system that provides enhanced stereoscopic visualizations to support visual diagnoses performed by radiologists. The system harnesses contemporary paradigms in immersive visualization and 3D interaction, which are better suited for investigating 3D volumetric data. We retain practicality through efficient utilization of desk space and comfort for radiologists in terms of frequent long duration use. *MD-Cave* is general and incorporates: (1) high resolution stereoscopic visualizations through a surround triple-monitor setup, (2) 3D interactions through head and hand tracking, (3) and a general framework that supports 3D visualization of deep-seated anatomical structures without the need for explicit segmentation algorithms. Such a general framework expands the utility of our system to many diagnostic scenarios. We have developed *MD-Cave* through close collaboration and feedback from two expert radiologists who evaluated the utility of *MD-Cave* and the 3D interactions in the context of radiological examinations. We also provide evaluation of *MD-Cave* through case studies performed by an expert radiologist and concrete examples on multiple real-world diagnostic scenarios, such as pancreatic cancer, shoulder-CT, and COVID-19 Chest CT examination.

Index Terms—Immersive diagnosis, stereoscopic visualization, volume rendering, 3D selection

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1 INTRODUCTION

Three-dimensional visualization systems have started to make their way into the conventional radiology workflow of 2D axis-aligned view planes. However, many 3D systems do not use the contemporary immersive display and 3D interaction paradigms. is deliberately simple and straightforward and therefore, has the potential to increase adoption of 3D stereoscopic visualizations in daily practice. Additionally, our hardware setup includes an integrated hands and head tracking using infrared (IR) devices to