Visualisation and analysis of large microscopy images in virtual reality

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KEY WORDS: light sheet microscopy, virtual reality, cloud computation, inference

Recently, the progress in volumetric imaging such as in confocal or light sheet microscopy have led to high resolution images acquired for single biological organelles and covering full organisms. This increase in the size of the volumetric data and in the complexity of structures within a diversity of organisms, have led to challenges in visualizing and analyzing 3D raw data. Specific actions like segmentation and selections in 3D images are laborious on a 2D screen. The problem is especially challenging when multiple structures with different characteristics and contrasts are visualized together.

We recently introduced a software, DIVA [1], for analyzing and visualizing any type of 3D images in virtual reality (VR) without pre-treatment. Based on a dual desktop-VR interface (Figure 1), the software allows a complete immersion inside the volumetric data, performs rendering through optimized ray-tracing and enables live modification of data appearance with a user-friendly transfer function interface.

Yet, while VR shows the promise to strongly enhance visualizations and understanding of microscopy images, what is really needed is a mix of visualization and treatment of the data. This creates a computational challenge, since VR is very demanding. Hence, a highly optimized algorithm is required. We recently showed that VR based analysis was possible for single-molecule data with fluid interactions [2].

We introduce here a new software, DIVA cloud, combining the DIVA VR visualization with cloud computing allowing both visualization and live data treatment within this environment. We will demonstrate the possibilities of live inference of neuronal data while interacting with them in a one shot learning segmentation task, i.e. segmentation without training on a database [3], and discuss constraints in analyzing data in VR.

