Medical 3D Visualization System with Gesture-based User Interface

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Contribution

We have developed a gesture-based interface for medical 3D visualization, with which surgeons are able to manipulate 3D images with intuitive gestures. Through our interface, surgeons can load patients' image data/information from an image set, translate, rotate and zoom the data, and change the window level (brightness and contrast of the image) through a set of pre-defined touchless gestures.

Background

Hygiene is important for the operating room. Currently, when surgeons need access to patient data, medical images and surgery plans during surgeries, the surgeon gives oral commands to the assistant who stands next to the computer screen at the wall of the OR, operating a conventional PC using a mouse or touchpad. However, such oral instructions are inefficient and even if the assistant eventually understands exactly the intended result from the surgeon's instructions, joint computer control may lead to error.

Method

We developed a medical visualization system that allows touchless gestures to control an interface which shows medical images. The major challenge involved in this project is how to provide surgeons with safe means of interaction without affecting the quality of operations. To ensure precise gesture detection, we use Leap motion as our tracking device. According to 3D position of the hand and fingers, we recognize the gestures which are further mapped to specific data manipulations.
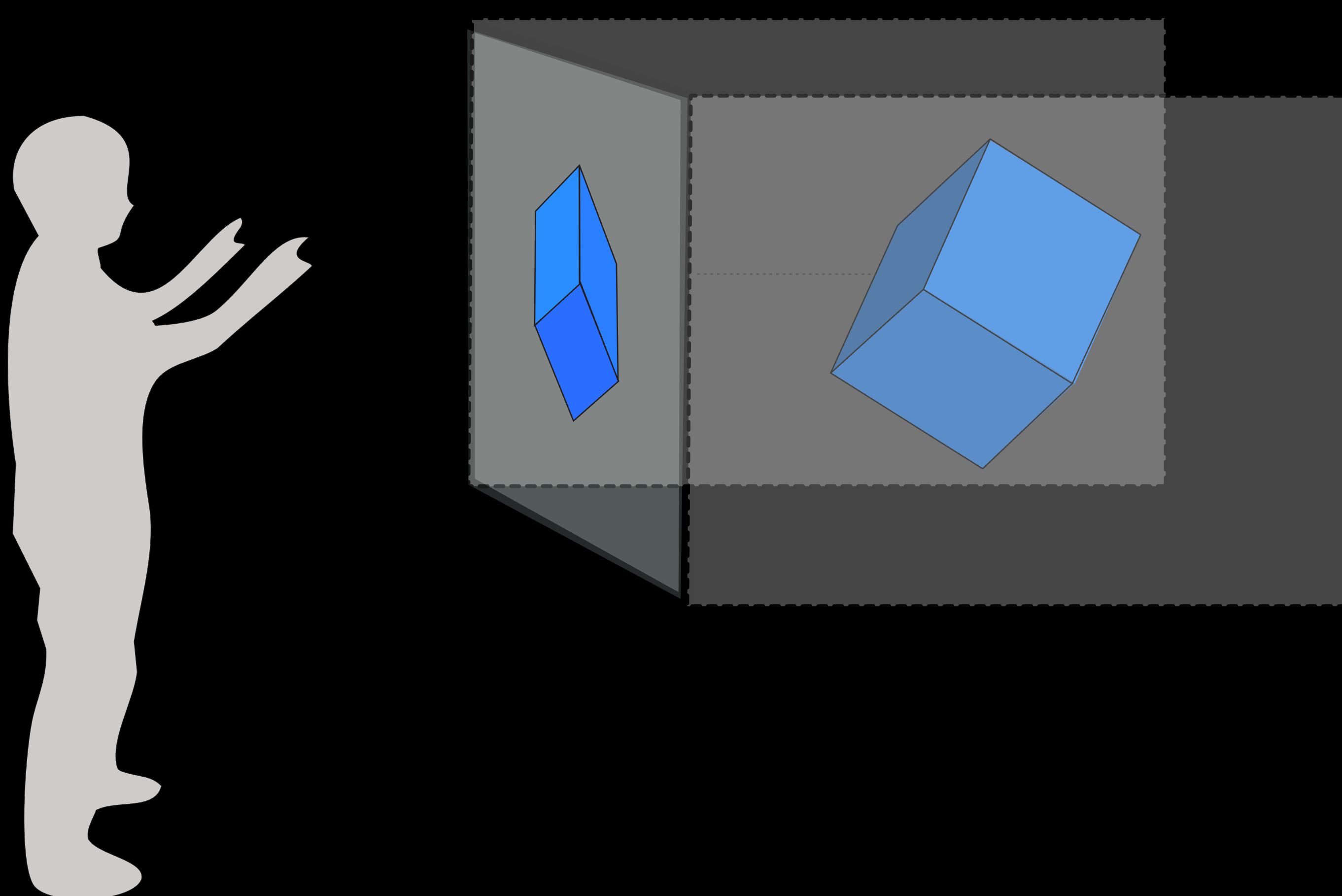
Figure 1: Touchless interaction with 3D data

Gesture Interactions

Rotation *Constrained Rotation* *Scaling*

Moving cutting planes *Brightness and Contrast*

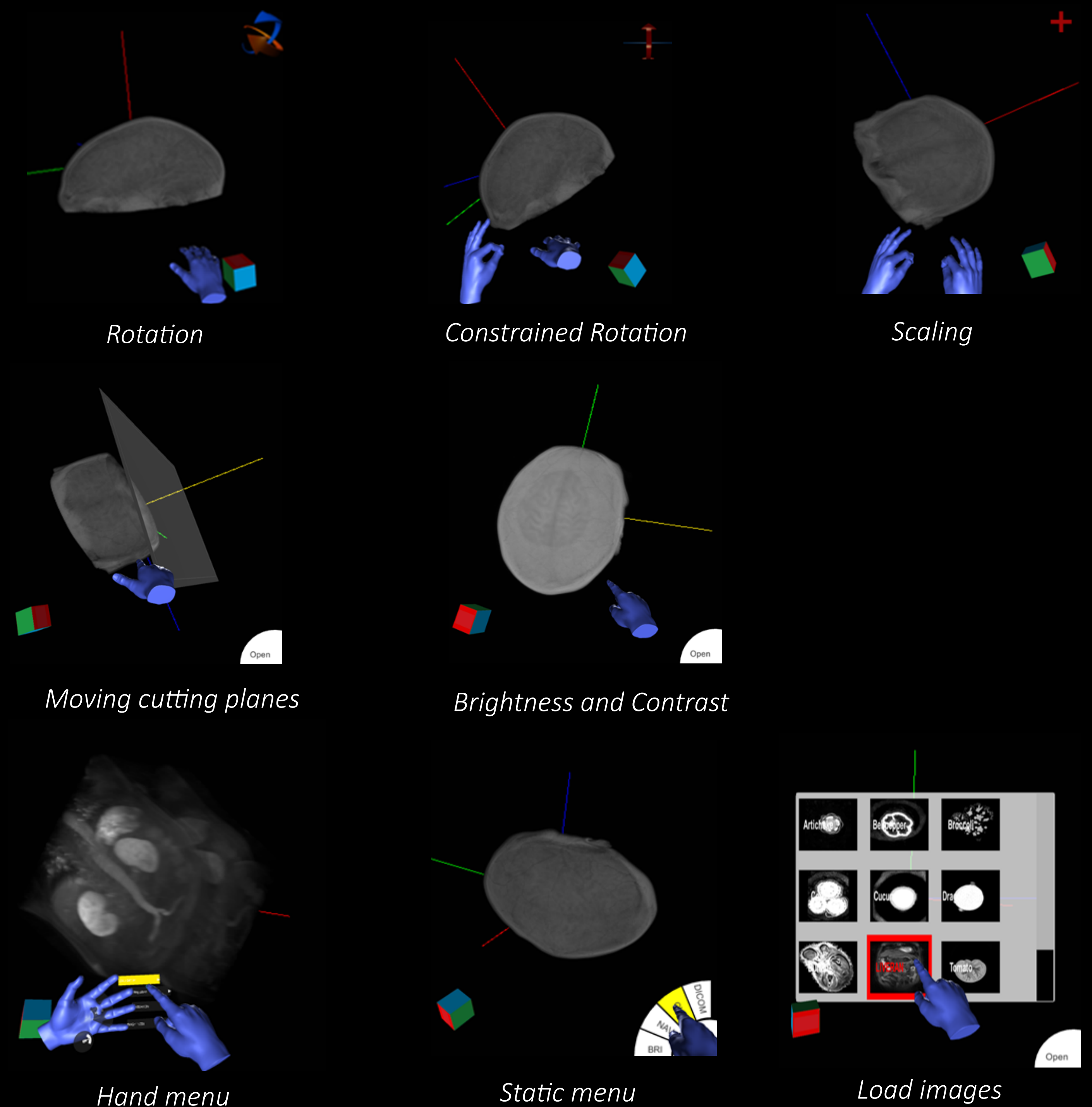*Hand menu* *Static menu* *Load images*

Figure 2: Gesture-based interactions

Results

Response to the interaction and the 3D projection of medical data is very positive. Doctors can understand and remember gestures after a short introduction and can precisely control the interface and manipulate 3D data with intuitive gestures. If the system works in an effective way, we hypothesize that surgeons should be able to check and manipulate patients' data in a more precise way, compared to asking assistants to interact with data by using traditional inputs.
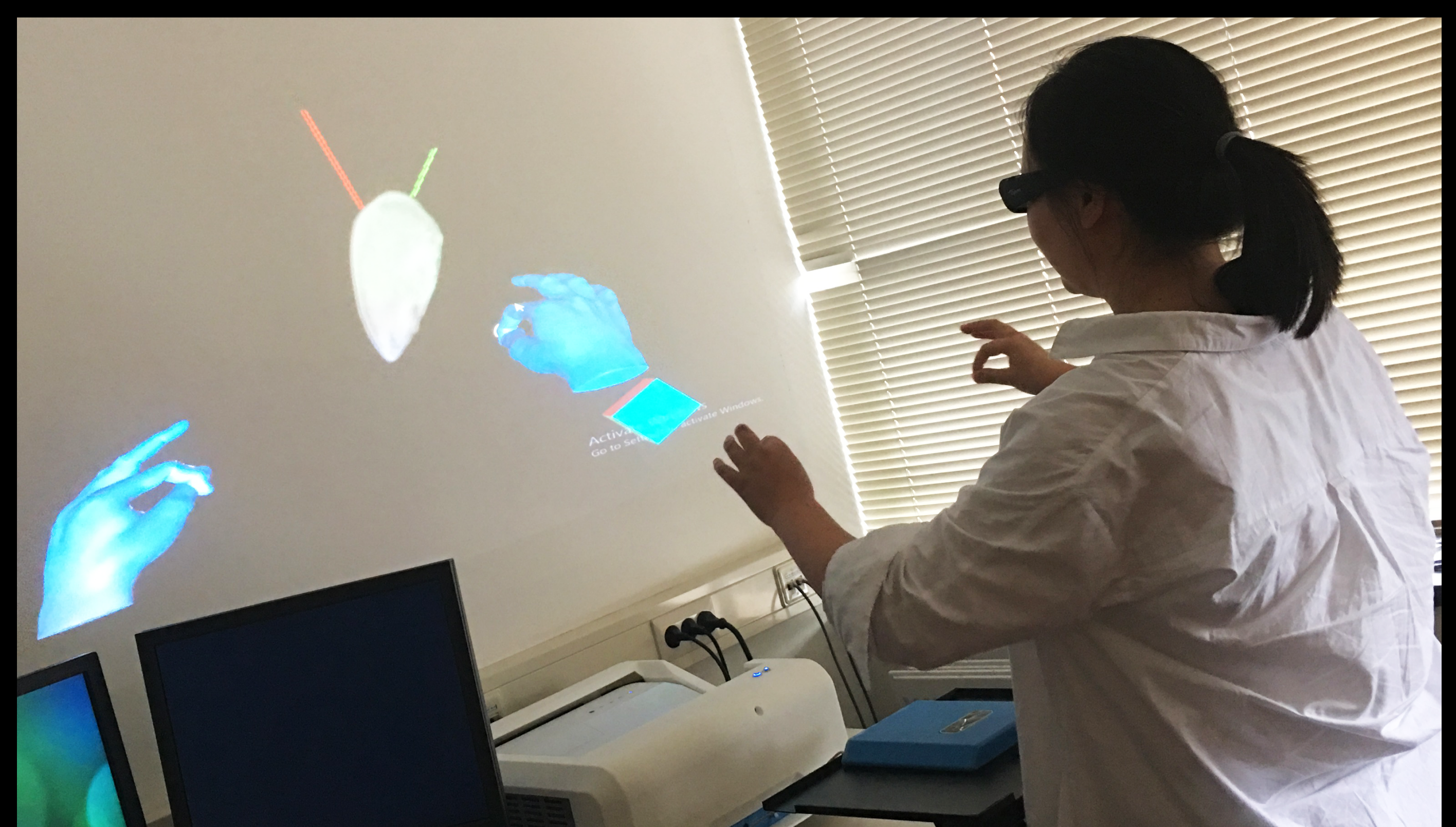
Figure 3: A user is manipulating 3D medical data with our gesture-based interface

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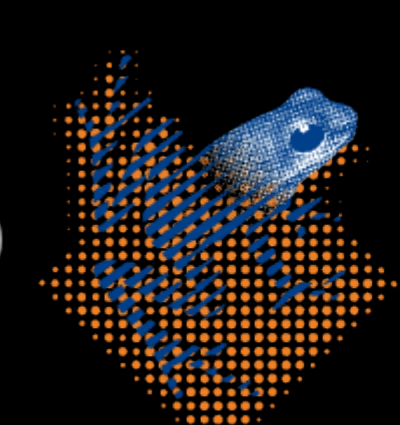
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