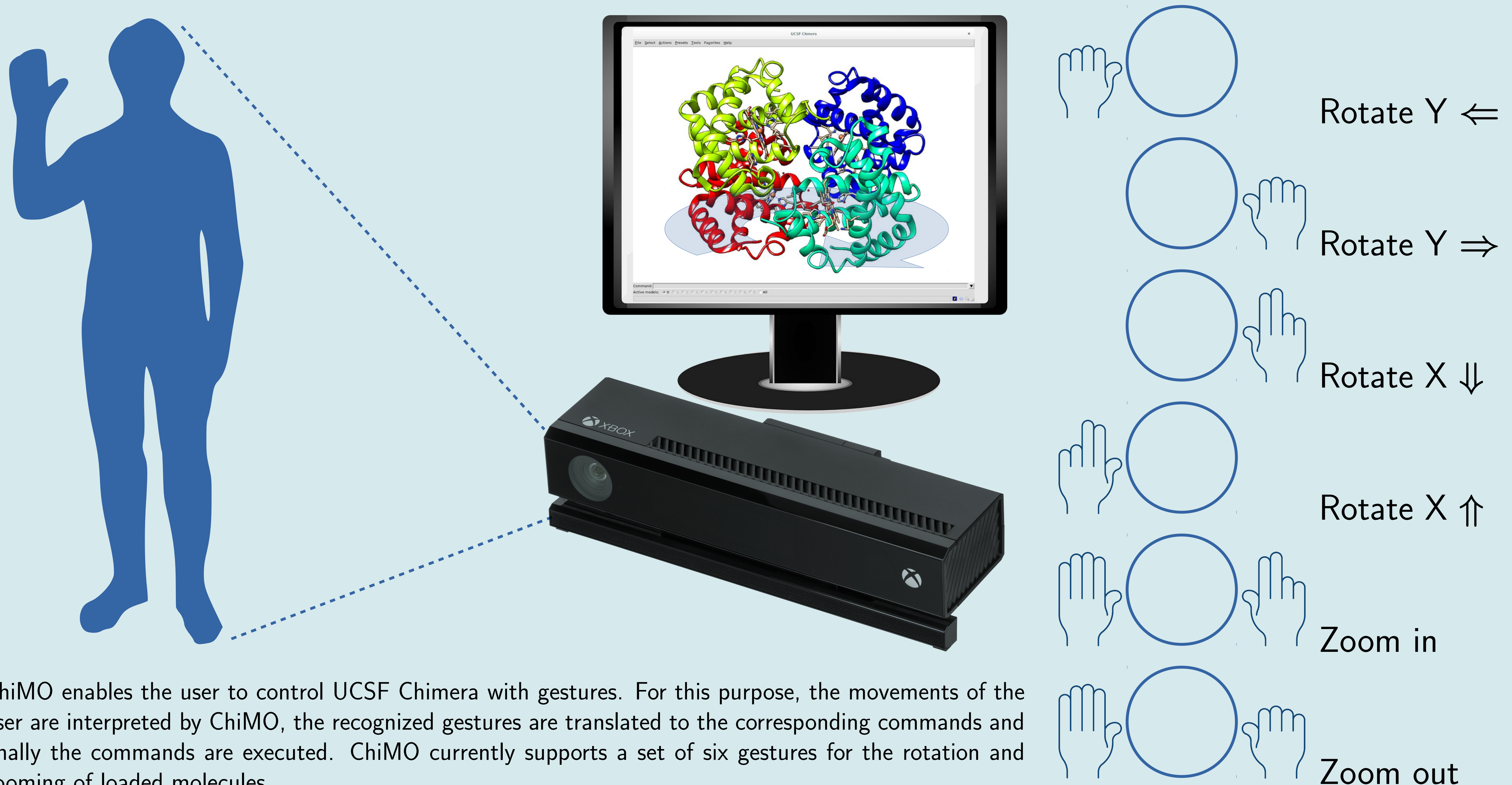


Introduction

UCSF Chimera is a widely used software tool for the visualization of protein 3D structures, usually operated via keyboard and mouse. In combination with new technologies like 3D displays and 3D projectors, this traditional way of interacting with the computer is a limitation. Luckily, besides new visualization technologies, new concepts for the human-computer interaction were developed.

The UCSF Chimera extension **ChiMO** enables the user to control Chimera with gestures instead of keyboard and mouse. For this, it utilizes Microsoft's Kinect v2 sensor, which originally was developed as motion controller for the gaming console XBOX one.

Result



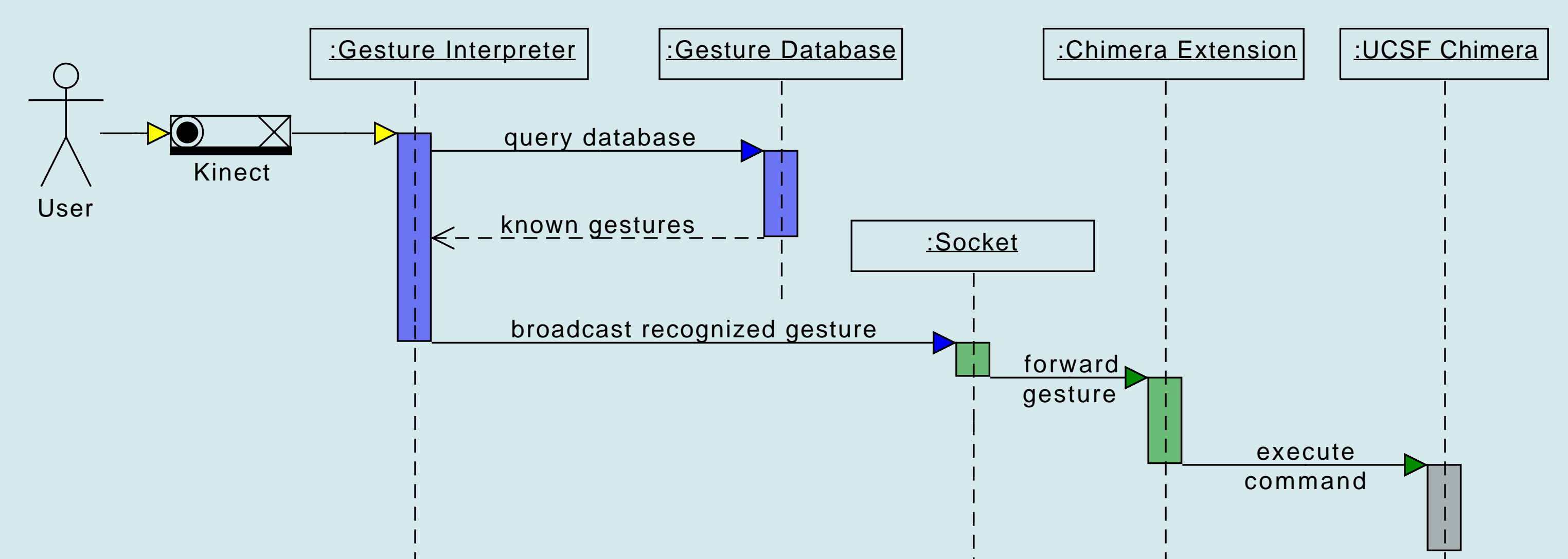
Implementation

Microsoft provides a hardware adapter for Windows to connect the Kinect v2 sensor to a PC (Windows 8 or newer), as well as a corresponding software development kit (SDK) for the .NET framework. UCSF Chimera provides a Python interface for extensions, but no possibility for the direct use of Microsoft's SDK. For this reason, ChiMO is divided into three modules: (i) a gesture interpretation module, (ii) a UCSF Chimera extension, and (iii) a socket which acts as central communication interface.

Gesture Interpretation Module. The module is implemented in C# and interprets the user's movements, based on a beforehand generated gesture database. The database was compiled in two steps. First a set of gestures was defined and recorded to set of video clips for a number of individuals. Then, the videos were analyzed by Microsoft's Visual Gesture Builder. The result is provided as gesture database.

UCSF Chimera Extension. The extension is implemented in Python and translates the recognized gestures into the corresponding commands. The **socket** is implemented as part of the UCSF Chimera extension.

Module Interaction



Conclusion and Outlook

ChiMO provides a new user experience for UCSF Chimera and the analysis of protein 3D structures, especially in combination with 3D displays or 3D projectors, respectively. The presented version of ChiMO provides gestures for the rotation of loaded molecules. In ongoing work we will extend ChiMO by gestures for further frequently used commands. In addition a Linux version of ChiMO is planned. The final version of ChiMO will be freely provided to the scientific community.