

SenseGraphics

Volume Haptics Toolkit

The Volume Haptics Toolkit (VHTK) for H3D API enables full haptic interaction in scientific and medical visualization of volumetric data. It provides a wide range of haptic schemes that can be selected and fine-tuned to fit the specific problem area and task at hand. The haptic feedback can emphasize various features, convey non-visual information, reinforce the visual impression and also guide the user in the exploration process.

High-Level Programming

VHTK contains a set of pre-implemented haptic modes for both scalar and vector data. By simply selecting the modes that most effectively represent the important features of a volumetric dataset, the haptic feedback can provide both guidance and extra information about the data with no C/C++ programming required.

Low-Level Programming

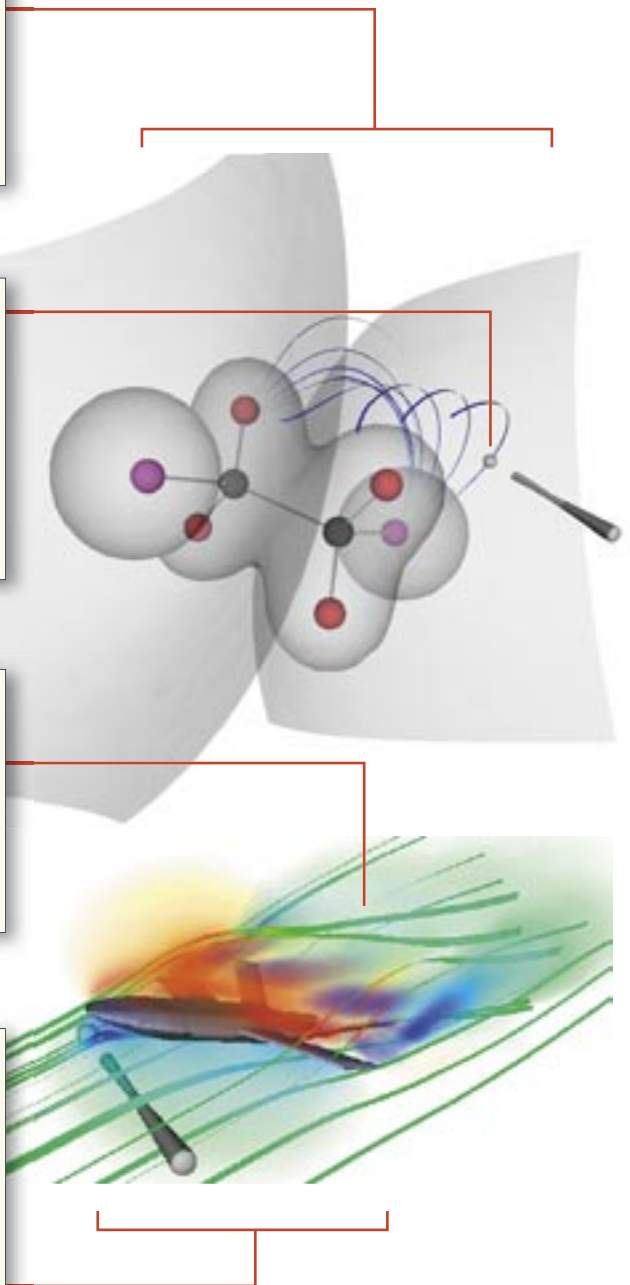
VHTK provides a low level interface to the haptic solver through a comprehensive abstraction layer constituted by haptic primitives. By combining haptic primitives and controlling their parameters from properties of the volumetric data, new advanced haptic modes can be designed without the need for complicated algorithms.

Volume Visualization

The package includes ready-to-use visualization nodes for both scalar and vector data. These are designed for interactive use and for fast deployment into haptic VR environments. A visualization using volume rendering and stream ribbons can be created in just a few minutes.

Data Handling

VHTK has a complete structure for handling of volumetric data. The volume data handlers use abstracted data loading classes to allow importing of different volumetric formats. A simple raw data loader is included in the package and more loaders can be added with little effort. The package also provides several types of transfer functions for control of both visual and haptic properties.



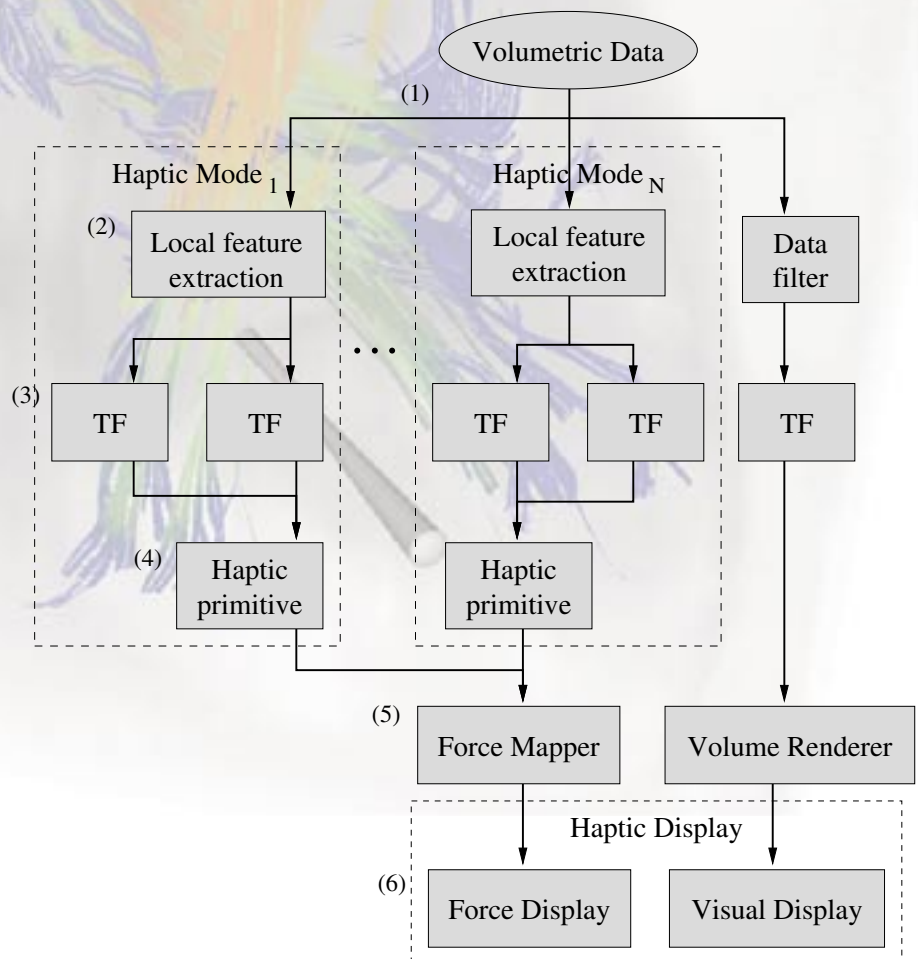
The Volume Haptics Toolkit provides X3D nodes needed to both generate advanced haptic feedback from volumetric data and for producing scientific visual rendering. All components can be controlled from X3D, Python and C++, allowing advanced haptic visualization to be implemented using solely X3D if needed. Primarily the haptic algorithms provided by the toolkit are designed to convey information from scientific volumetric data and to provide guidance in the exploration process. The methods are, however, very general and can also be used for other purposes, for example to generate guidance fields in games or alternative tasks.

The toolkit is based on the results from four years of research at Norrköping Visualization and Interaction Studio (NVIS) into haptics for scientific visualization. These results include the development of haptic primitives that are used in the toolkit both as the abstraction layer for programming haptic interaction and the means for stable calculation of the haptic feedback. The research has also identified important aspects and outlined the guidelines needed for successful implementation of effective haptic interaction in scientific data exploration. These aspects and guidelines have been carefully adhered to in the development of VHTK to make it effective for implementing both prototypes and advanced applications.

VHTK is built upon the concept of a configurable data flow pipeline which allows interactive construction of the haptic environment, leading to rapid and effective design of visualisation applications. In this model, shown in the diagram, the features of interest are extracted from the data at real-time. Haptic transfer functions are used to extract material informa-

tion from the data, such as friction or hardness. The feature and material information are used to control haptic primitives that define the form and nature of the haptic feedback. These are collected by a *force mapper* that calculates the final force feedback that is to be sent to the haptic device, typically at a rate of 1 kHz.

The feature extraction, transfer functions and haptic primitives together form a haptic mode. The toolkit provides both pre-implemented haptic modes for scalar and vector data, as well as the means for implementing new haptic modes to fit user-specific data and tasks. Modes can be used individually or be combined to provide more advanced feedback, for example from multi field data. The haptic, as well as visual, components can be interactively manipulated at run-time using the event handling system of H3D.



Head Office

SenseGraphics AB
Electrum Q. Office
Isafjordsgatan 22 C5
SE 164 40 Kista
SWEDEN

Telephone

+46 – 8 750 8070
+46 – 707 788 410

Web

www.sensegraphics.com

Sales

sales@sensegraphics.com

Customer Support

support@sensegraphics.com

Company Information

info@sensegraphics.com