RTI Viewer User Manual

Version 1.0

Contents

Chapter 1

Introduction

In this document we present the main features of RTI Viewer. Especially we describe how the user can interact with the GUI and the effects produced by his actions.

RTI Viewer is a tool to diplay images produced with reflection transformation techniques. The tool supports several image formats: Polynomial Texture Maps (PTM), Hemispherical Harmonics Maps (HSH) and an universal format that encodes all previous images (URTI). A feature of the viewer is the possibility to visualize both single-view and multi-view RTI images. A multi-view RTI image is a collection of single-view images and optical flow data to generate the inter-middle view.

The tool is capable to visualize an RTI image loading from a local hard disk or from a remote server through HTTP connection. The latter option is supported only for PTMs. In order to handle the remote loading, the original PTM(usually of huge resolution) has to be processed by a command line tool, called RTIBuilder (chapter 3).

The tool permits also to set some parameters of rendering such as the zoom factor, the sub-image to show in the browser, the light direction, the rendering mode to enhance the perception of shapes and details, and, only for the multi-view formats, the viewpoint around the object.

Chapter 2

GUI

RTI Viewer is composed by several widgets that permit to the user to interact using mouse and keyboard. As shown in Figure 2.1, these widgets are:

- the *Browser* to display the RTI image;
- the *Toolbar*;
- the *Light Control* to select the light direction;
- the *Rendering Dialog* to select the rendering mode to apply to the RTI image;
- the *Navigator* to pan and zoom the RTI image.

Some information about the open image (path to the file, image size and image format) is shown between the Rendering Dialog and the Navigator.

In the case of multi-view RTI images, a simple slider appears in the Rendering Dialog (Figure 2.2) to allow the user to change the viewpoint only on horizontal axis. The tick marks on the slider show the position that match with an acquired image. The checkbox permits to move the viewpoints only on the tick marks of the slider, without using the optical flow data.

2.1 Browser

The Browser permits to display the output of the rendering of the RTI image (see Figure 2.3). The user can pan the image and set the light direction

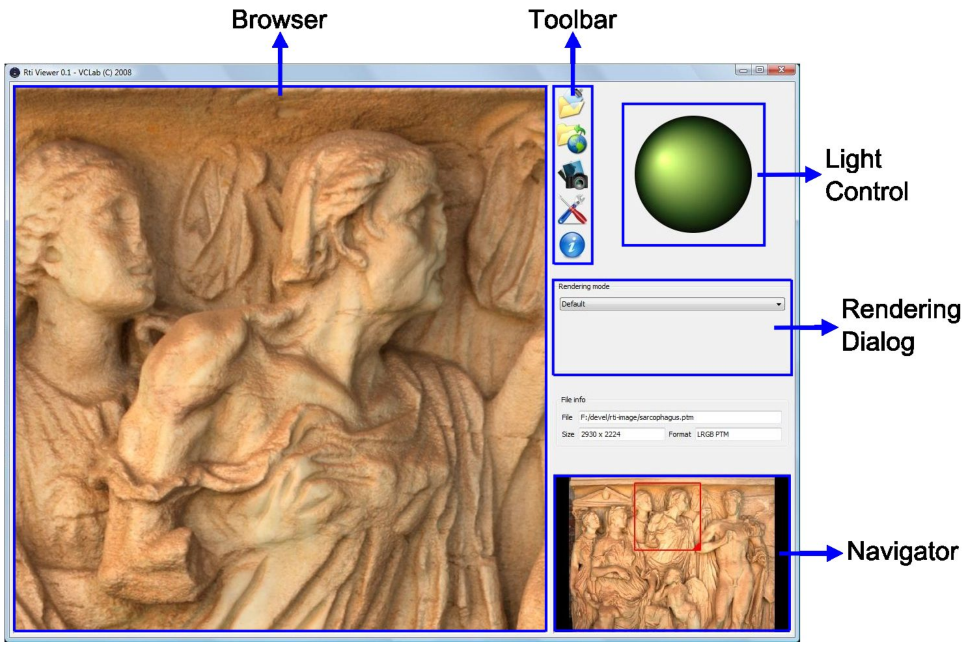

Figure 2.1: RTI Viewer GUI.

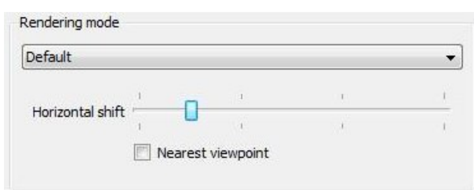

Figure 2.2: Control for multi-view RTI.

with the mouse, and can zoom the image with some keyboard shortcuts. Especially the dragging with the left button of the mouse permits to move the sub-image in the current view of the browser, while the dragging with the right button permits to move the light direction. The double-click with the left button moves the center of the browser in the point of the click and performs a zoom in operation. Finally the keyboard shortcuts CTRL + '+' and e CTRL + '-' permit respectively the zoom in and the zoom out operations.

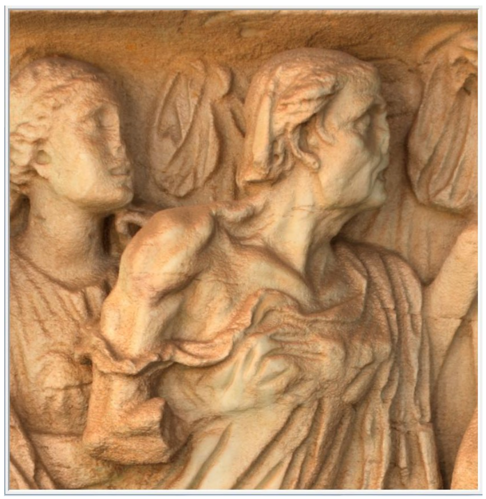

Figure 2.3: Browser.

2.2 Toolbar

The buttons in the toolbar permit, from top to bottom in Figure 2.4:

- to open an image from a local hard disk;
- to loading an image published on a remote server (the user must insert the URL of the image);
- to save a snapshot of the image displayed in current view of the browser;
- to modify the settings of the application. The user can only modify the size of the browser (see Figure 2.5);
- to show a window with information about the tool.

Figure 2.4: Toolbar.

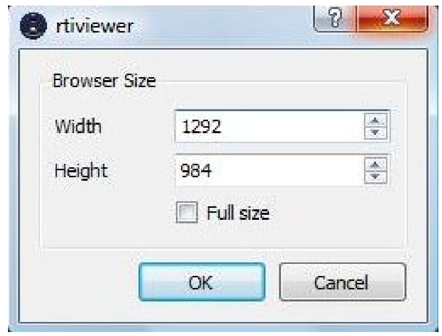

Figure 2.5: Window to set the application settings.

2.3 Light Control

The Light Control permits to the user to select the light direction to use in the rendering of the RTI image by means of the left button of the mouse. The current light direction is shown by the highlight on the sphere (see Figure 2.6).

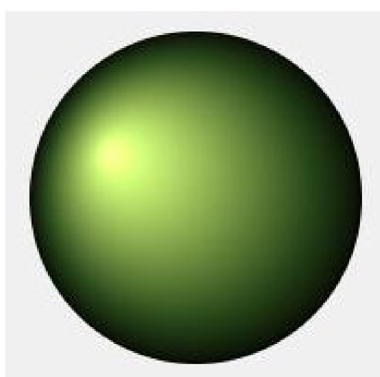

Figure 2.6: Light Control.

2.4 Rendering Dialog

The Rendering Dialog permits to select the rendering mode to apply to RTI image. For each mode the dialog displays the widget to set some characteristic parameters. The list of available rendering modes is function of the type of image. In the current version of the tool, only the PTM have other modes in addition to the standard rendering.

The available modes for the PTM are:

- Diffuse Gain;
- Specular Enhancement;
- Luminance Unsharp Masking;
- Image Unsharp Masking;
- Normal Enhancement (or Normal Unsharp Masking);
- Coefficient Enhancement (or Coefficient Unsharp Masking);
- Detail Enhancement (or Static Multi-light Detail Enhancement);
- Dynamic Detail Enhancement (or Dynamic Multi-light Detail Enhancement).

All methods permit to vary in real-time the light direction, except the Detail Enhancement that creates a static image. A more detailed description of the methods can be founded in [1] and [2].

2.4.1 Diffuse Gain

Diffuse Gain enhances the perception of the surface shape of the object. The user can modify a gain factor to fix the amount of the enhancement (see Figure 2.7).

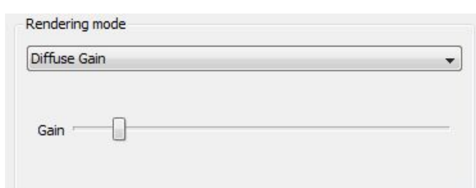

Figure 2.7: Parameters of Diffuse Gain.

2.4.2 Specular Enhancement

Specular Enhancement adds a specular effect to the surface of the object. The method uses the following lighting model:

$$I = (k_d(\vec{L} \cdot \vec{N}) + k_s(\vec{H} \cdot \vec{N})^n) \tag{2.1}$$

where $\vec{L}$ is the light vector, $\vec{N}$ is the normal and $\vec{H}$ is the halfway vector between the the light vector and the viewer. The user can modify the gain factor to fix the amount of the enhancement, the diffusive constant k_d, the specular constant k_s and the specular exponent n (see Figure 2.8).

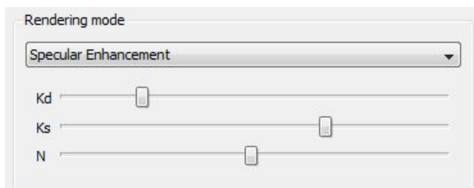

Figure 2.8: Parameters of Specular Enhancement.

2.4.3 Luminance Unsharp Masking

Luminance Unsharp Masking applies the classic unsharp masking to the luminance component of LRGB PTM. It can not be applied to the RGB PTM. The user can modify a gain factor to fix the amount of the enhancement (see Figure 2.9).

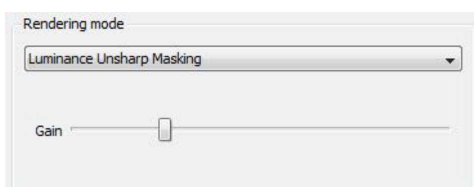

Figure 2.9: Parameters of Luminance Unsharp Masking.

2.4.4 Image Unsharp Masking

Image Unsharp Masking applies the classic unsharp masking to the Y channel of the color space YUV. The user can modify a gain factor to fix the amount of the enhancement (see Figure 2.10).

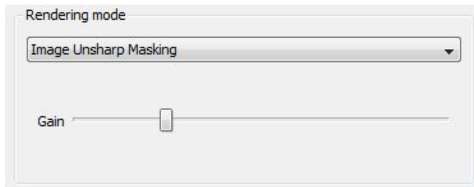

Figure 2.10: Parameters of Image Unsharp Masking.

2.4.5 Normal Enhancement

Normal Enhancement applies the classic unsharp masking to the surface normals. The method uses the following lighting model:

$$I = \vec{N} \cdot \vec{L} + k_a \tag{2.2}$$

where $\vec{N}$ is the normal, $\vec{L}$ is the light vector and k_a is a term to preserve the amount of light received by the surface through inter-reflection and ambient lighting. The user can modify a gain factor to fix the amount of the enhancement and the term k_a (see Figure 2.11).

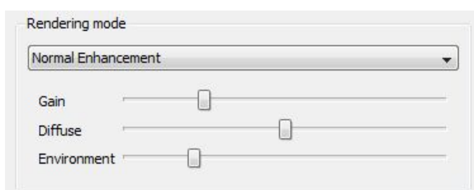

Figure 2.11: Parameters of Normal Enhancement.

2.4.6 Coefficient Enhancement

Coefficient Enhancement applies the classic unsharp masking to the coefficients of the polynomial of the PTM. The user can modify a gain factor to fix the amount of the enhancement (see Figure 2.12).

2.4.7 Detail Enhancement

Detail Enhancement produces automatically an high-contrast, well-illuminated static image for stand-alone presentation, high-quality printing, or similar purposes. The method has several advanced settings that require a good knowledge of its basis algorithm.

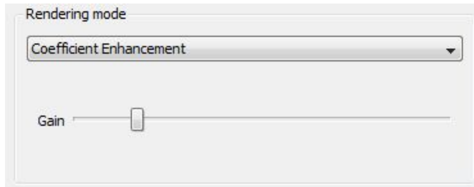

Figure 2.12: Parameters of Coefficient Enhancement.

2.4.8 Dynamic Detail Enhancement

Dynamic Detail Enhancement adapts locally the current light direction to improve the perception of the details on the surface. The user can modify the size of the tile and the maximum offset in degree from the current light direction (see Figure 2.13). The method has several advanced settings that require a good knowledge of its basis algorithm.

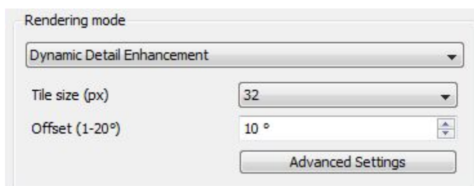

Figure 2.13: Parameters of Dynamic Detail Enhancement.

2.5 Navigator

The Navigator permits to the user to move and resize the sub-image in the current view of the browser. The sub-image is shown in the widget into a red rectangle. The user can move the rectangle with the left button of the mouse or can resize the rectangle with the dragging of the triangle in the bottom-right corner (see Figure 2.14).

Figure 2.14: Navigator.

Chapter 3

RTIBuilder

RTIBuider is a command line tool to convert a PTM images into a more compact format that permits the remote loading through HTTP connection. The tool gets two arguments: the filepath of the image, and the number of resolution level in which the images has to be decomposed. For example:

```
>RTIBuilder ..\rtiImage\prova.ptm 3
```

The output of the tool is a folder that can be copy on the server. The URL of the image is the URL of the folder followed by the extension *.ptm*.

Bibliography

[1] T. Malzbender, D. Gelb, H. Wolters, *Polynomial texture maps*, Siggraph 2001.

[2] G. Palma, M. Corsini, P. Cignoni, R. Scopigno, M. Mudge, *Dynamic Shading Enhancement for Reflection Transformation Imaging*, submitted to the ACM Journal of Computing and Cultural Heritage.