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Abstract

STUDY OF DEPTH IMAGE BASED REAL TIME RENDERING AND IMAGE ENHANCEMENT

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For a long time, real time rendering of highly realistic scene has been a goal pursued by computer graphics researchers. The parallelism of programmable hardware provides us a way to speed up, and image-based rendering techniques provide us a way to produce realistic images.

In chapter 3 of this thesis, we present a GPU accelerated real-time depth image based rendering algorithm. By the algorithm, we uniformly sample an object in all directions in a polar coordinates system, to construct a *Spherical Depth Image*. With two deduced Warping Equations, we then pre-warp the image onto a view-dependent tangent plane of the bounding sphere of the object to get an intermediate image, which can be further rendered onto the target image plane using standard texture mapping. By exploiting the inherent parallelism of modern programmable GPU, we transport the pre-warping process into Vertex Shader. Furthermore, the hardware pipeline's rasterization function is utilized to conduct the image re-sampling efficiently to generate hole-free rendering results. Besides, Per-pixel lighting and Environment mapping effect is implemented in Pixel Shader to get high quality lighting effect. Finally, we solve the problem of limited field of view, and it is suitable for massive real-time walkthrough system.

Human eye is mostly sensitive to local contrast and not so much to absolute luminance. Artists tend to emphasize a contour along the objects boundaries and alter the local contrast, and are therefore able to visually encode the spatial relationships between the objects, so as to support the perception of objects in an image.

In chapter 4 of this thesis, inspired by artists' work, we presented an image processing method for enhancing images that contain depth information. A kind of Laplacian Operator-based edge detector, which has been proved to be able to detect edges and at the same time suppress noises, is firstly applied to depth image, in order to find *spatially important areas*, which are actually the boundaries between different background and foreground objects in the image. This information is then utilized to locally enhance the contrast of the corresponding input color image, and thus, to improve the whole perceptual quality. Besides, we additionally consider the color information of the input image by integrating the Histogram Equalization technique into the proposed method. As a result, the contrast of the resulting image is not only globally enhanced by Histogram Equalization, but also locally enhanced along the detected object boundaries.

Keywords: Real time rendering, Depth image, Image based rendering, Hardware acceleration, Pre-warping, Image enhancement, Laplacian operator, Edge detection, Histogram equalization