Optimizing Volume Rendering with Octree Hierarchy and Adaptive Sampling

by

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Master of Science in Software Engineering

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Faculty of Science and Technology
University of Macau

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Approved by _____

Supervisor

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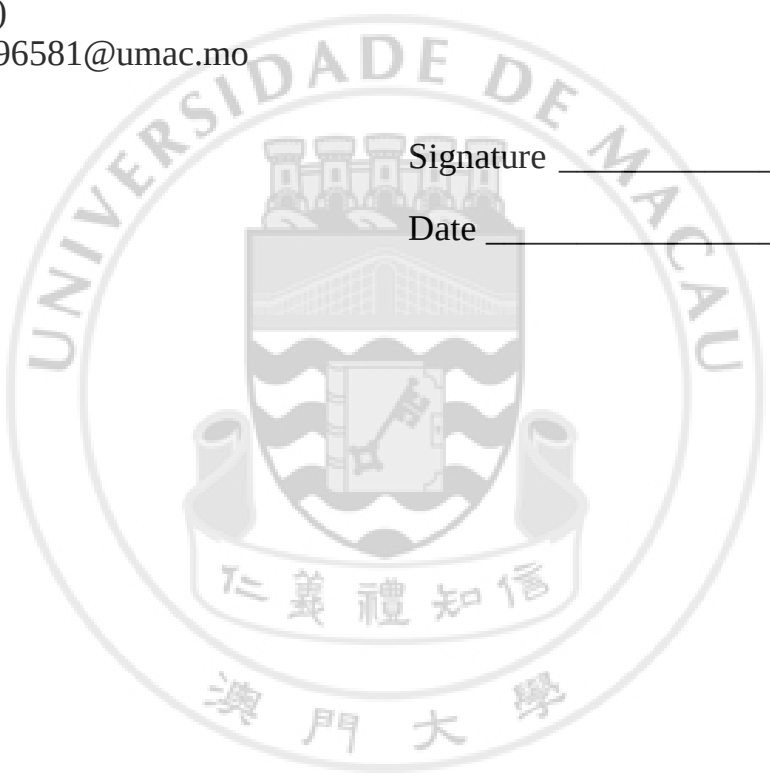

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Abstract

Optimizing Volume Rendering with Octree Hierarchy

and Adaptive Sampling

by Li Sheng

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Master of Software Engineering

Volume rendering in three dimensional medical imaging is a technique which maps CT dataset to a rendered image of 3D model in computer graphics. It aims to extract insightful information from the abstract data source. This technique is widely used in medical diagnosis, operation simulation and anatomy education.

This thesis proposes an optimizing volume rendering algorithm with octree hierarchy and adaptive sampling (short for OHAS algorithm). This algorithm stores the 3D volume dataset as a 3D texture and codes the 3D texture with octree hierarchy. Firstly, it aims to skip rendering the empty regions which contribute nothing to the final result image. Secondly, with regard to the non-empty regions, the algorithm samples them adaptively according to their inner variation. The sampling step-length is decided by the gradient of the sample point. Simply speaking, there is high sampling frequency in volatile regions but low sampling frequency in smooth regions. Finally, pre-integration technique is introduced to deal with these non-uniform sample points to form the final image. Based on the experiment results, OHAS algorithm can save volume rendering time without decreasing the image quality.

Key Words: volume rendering; octree; adaptive sampling; pre-integration technique

TABLE OF CONTENTS

LIST OF FIGURES

Number *Page*

LIST OF TABLES

Number *Page*

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The four raw datasets used in my experiments are downloaded from the website http://www.volvis.org/. They are Foot (size: 256×256×256), Skull (size: 256×256×256), Head (size: 256×256×225), Teapot (size: 256×256×178). I would like to give sincere thanks to authors for making their results publicly available.

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