

**Optimizing Volume Rendering with Octree Hierarchy and
Adaptive Sampling**

by

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2012



**Faculty of Science and Technology
University of Macau**

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A thesis submitted in partial fulfillment of
the requirements for the degree of

Master of Science in Software Engineering

Faculty of Science and Technology
University of Macau

2012

Approved by _____
Supervisor

Date _____

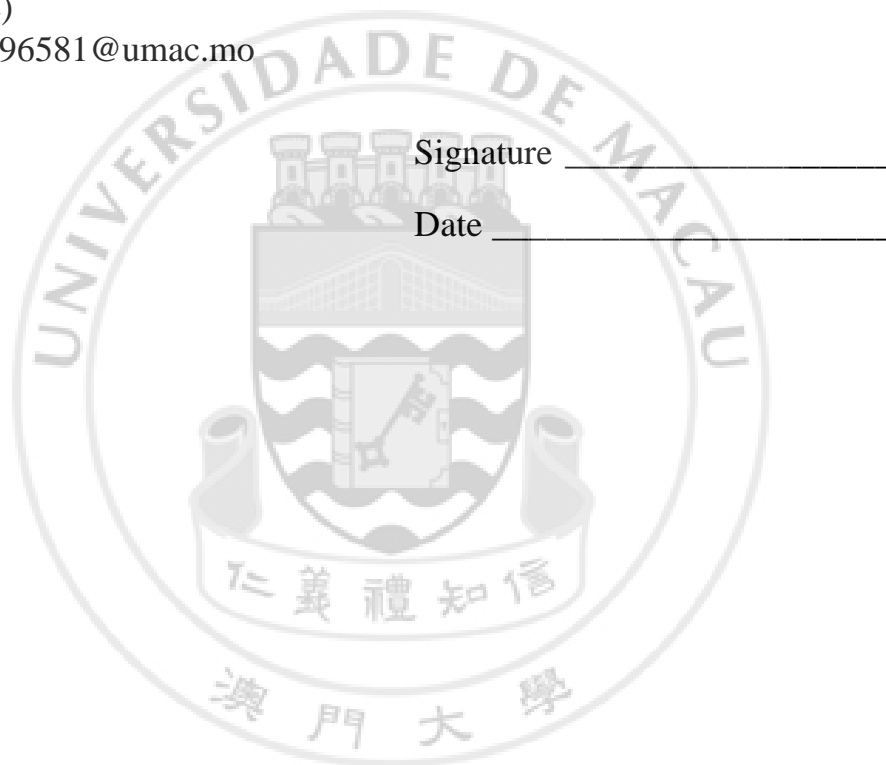
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Abstract

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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

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ACKNOWLEDGMENTS

A grateful thanks to my respectful supervisor, Professor Wu Enhua, who gives me lots of guidance to my master thesis on the scientific visualization area. I also thank him for offering me numerous discussions related to the wondrous world of computer graphics research.

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

Finally and most-importantly, I would like to express my special thanks to my family, my mother and father. I also give kind words of thanks to the whole staff in FST of UMAC, I gain more after their industrious lessons' teaching. They are Prof. Li Xiaoshan, Prof. Gong Zhiguo, Dr. Wu wen, Dr. Robert, Dr. Xu Qiwen, Dr. Wong Fai, Dr. Vong Chi Man, Dr. Lawrence. I also thank my elder schoolmates and all other people who helped me.