

A QUALITATIVE EXPERT KNOWLEDGE APPROACH TO RENDERING OPTIMIZATION

D. Vallejo-Fernandez, C. Gonzalez-Morcillo, L. Jimenez-Linares

Escuela Superior de Informatica, Universidad de Castilla-La Mancha, Paseo de la Universidad 4, Ciudad Real, Spain

David.Vallejo@alu.uclm.es, {Carlos.Gonzalez, Luis.Jimenez}@uclm.es

Keywords: Rendering, Qualitative Expert Knowledge, Fuzzy Systems, Fuzzy Sets, Multi-Agent Systems.

Abstract: The rendering process allows the developer to obtain a raster 2D image from the definition of a 3D scene. This process is computationally intensive if the source scene has a certain complexity or high-quality images are required. Therefore, a lot of time is spent and many computational resources are needed.

In this paper, a novel approach called QUEKARO (standing for a QUalitative Expert Knowledge Approach to Rendering Optimization) is presented for adjusting some relevant parameters involved in the rendering process by using expert systems. This way, the developer can obtain optimized results which reduce the time spent in the rendering process and, in most cases, do not affect the final quality of the raster 2D image. These results will be exposed on the result section, in which different optimizations will be studied.

As we discuss on the final section of this paper, the use of expert systems in the rendering process involves a novel approach which reduces drastically the resources used and provides us with a high-scalable system. Using these arguments, we will justify the inclusion of expert systems in this area and will study future works.

1 INTRODUCTION

Fotorrealistic image synthesis can be interpreted as the process which pursues the creation of synthetic images which cannot be distinguished from the images obtained from the real world. This process is divided into several phases such as modelling, setting materials and textures, placing the virtual light sources, and, finally, rendering.

The latter lies basically in generating a 2D image from an abstract description, involving the geometry of the scene, the definition of lights, the camera positions, and the use of materials. Rendering is usually the most computationally intensive phase of the whole process and, therefore, it takes a long time to be done. In addition, if the scene to be rendered is complex or high-quality realistic images are required, such process involves a lot of time.

To overcome this problem, the rendering phase has experimented an important evolution. First, researchs tried very hard to solve basic problems, such as the detection of visible surfaces or the basic shading. Time passed and different rendering algorithms

were developed, ranging from simple and fast to more complex and accurate, which simulate the light behaviour faithfully. Such methods are usually classified into two main categories: local and global illumination algorithms. Kajiya pointed out all rendering algorithms aim to model the light behaviour over various types of surfaces and try to solve the rendering equation (Kajiya, 1986), which forms the mathematical basis of all rendering algorithms.

As a result of the huge amount of time spent in the rendering phase, it is often considered a bottleneck in photorealistic projects. In fact, the generation of a single high-quality image may take several hours up to several days, even on fast computers. In addition, the user normally sets the rendering parameters so that the final rendering time increases without obtaining substantial quality improvements, that is, the user tends to optimize this process excessively.

This paper presents a novel approach called QUEKARO based on the use of fuzzy systems to optimize the rendering phase. This way, final results can be improved by entities which use qualitative expert knowledge over a distributed platform. With this de-