Real-time cartoon rendering

Introduction

Cartoon rendering is non-photorealistic rendering (NPR). This poster approaches som issues in real-time cartoon rendering. A large part of the focus is to use the geometry shader available in the Shader Model 4.0 to achieve the desired effects. 4 different effects are presented here: Toon shading which is rather simple, bilinear key frame interpolation, silhouette and crease edge detection and extrusion and finally NPR wave simulation.
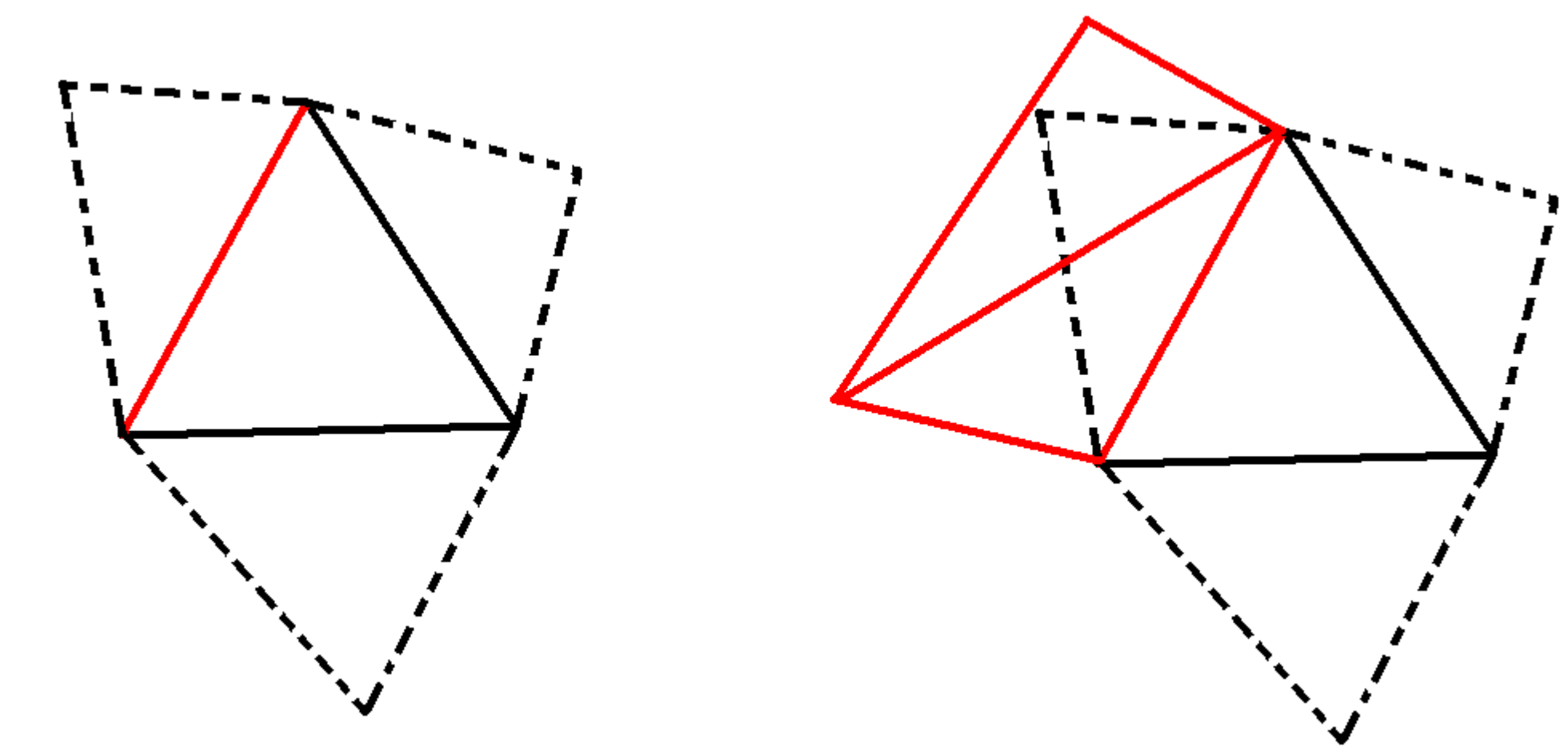
NPR wave simulation

Waves can be simulated in a stylized way using view-plane aligned billboards. Waves are placed in circles around the scene, and by using the Shader Model 4.0 and trigometric functions, the waves are continouesly revolved around the scene with different speed. The height of every wave billboard is also determined by a trigometric function of the time to make the wave go up and down. The vertex shader transforms the billboard centers from polar coordinates to cartesian coordinates, the geometry shader creates the billboard geometry and aligns them with the view plane and the fragment shader applies the wave texture.

Silhouette and crease edge detection and extrusion

Triangle adjacency lists became available with the Shader Model 4.0. With these lists, it is possible to use the information of adjacent triangles to detect silhouette and crease edges. Silhouette edges have one backfacing and one frontfacing triangle sharing that edge. Crease edges have an angle above some treshold between the normals of the triangles sharing the edge.

The geometry shader finds these edges and extrudes them to create additional geometry with a black color. The extrusion is done in the direction of the vertex normals of the vertices sharing the edge.

Toon shading

The dot product between the normal and the light vector is the shade value. The color of an object is divided into discrete color values that are determined by the shade value. Only diffuse colors are used.

Bilinear key frame interpolation

By using bilinear interpolation on four key frames every frame, the avatar can be animated whilst on the same time morphed between two models. As an example, this can be used to simulate the morphing between a "good" avatar and an "evil" avatar.