Compressed Data - Vectors and Geometry

Introduction

Computer graphics applications are using more and more complex geometric models which contain millions or even billions of triangles. It is imperative that good compression schemes be found to compress the polygonal models in order to reduce the storage space.

In addition, with the rapid development of the Internet, more and more graphics applications are running across the Internet, such as distributed collaborated modeling and multi-user games. It is essential for such distributed applications to be able to transmit geometry efficiently, which in turn require good geometry compression schemes.

Furthermore, the speed gap between CPU and memory is becoming even larger. Interactive animation of geomtric models require that large amount of triangles be efficiently loaded into the on-chip cache across the bus. Current bottleneck is the memory bandwidth, which also craves for good geometry compression algorithms to reduce the traffic to the slow memory.

This web page collects some information on Geometry Compression, including some important papers, well-known researchers, useful web links, and other relevant information.

Problem Description

Input:

Geometry: Vertex positions.
Connectivity: Specifies the triangles.
Properties: Colors, normals, etc.

Output:

Compressed form of the three components in the input.

Rough Classification

Single Resolution Compression: Michael Deering, Mike Chow, Taubin and Rossignac. Vertex positions are dealth with by performing an initial quantization followed by predictive coding induced by the traversal order of the connectivity encoding.
The state of the art is at around 2-6 bits per vertex to encode the connectivity.

Multiresolution Progressive Compression: Hoppe, Taubin, et al., Khodakovsky, et al. Prediction of vertex positions is performed in a hierarchical fashion. Connectivity bits are around 4-10bits per vertex.

Lossless vs. Lossy Compression.
Arbitrary Meshes vs. Canonical Meshes.
Static Meshes vs. Dynamic Meshes.

Important Papers

1. Michael Deering: "Geometry Compression", Computer Graphics, 1995, 13-20. This is the seminal paper in this field. Deering is probably the first person to introduce the term, "Geometry Compression". In this paper, Deering motivates the field, and introduces generalized triangle mesh, that achieves compression rate of a factor of 6 to 10.

2. Mike Chow, "Optimized Geometry compression for real-time rendering", Proceedings on the IEEE Visualization'97.
Mike Chow presents an algorithm to efficiently produce generalized triangle meshes. Their meshifying algorithms and the variable compression method achieve compression ratios of 30 and 37 to one over ASCII encoded formats and 10 and 15 to one over binary encoded triangle strips. Their experimental results show a dramatically lowered memory bandwidth required for real-time visualization of complex datasets.