Geometry Compression of 3-D Mesh Models Using A Joint Prediction

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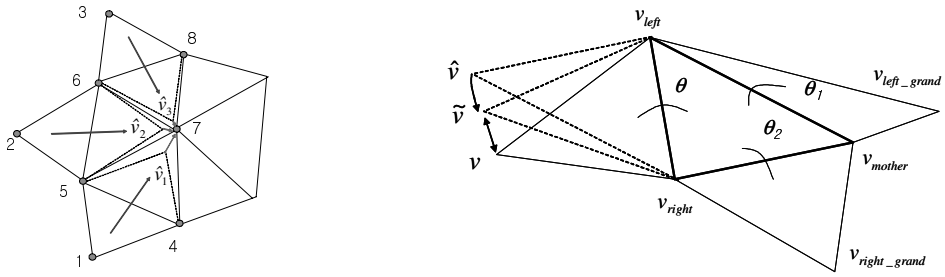
In this paper, we address geometry coding of 3-D models. Conventional geometry coding schemes quantize vertex positions using a bounding box before coding it by an entropy coder. However, in the proposed scheme, we first predict vertex positions and then quantize them differentially. Our geometry encoder consists of four stages: preprocessing, prediction, quantization, and entropy coding. Using a joint prediction, the encoder predicts vertex positions in a layer traversal order. Although the joint prediction is based on the parallelogram prediction [1], we use every possible preceding triangle to approximate the predicted vertex as shown in Fig.1(a). Since the triangle is generally creased along the shared edge, we approximate the dihedral angle θ as the average of the other dihedral angles θ_1 and θ_2 between two sets of adjacent triangles and then project the predicted vertex $\hat{v}$ into the new position $\tilde{v}$, as shown in Fig.1(b). After we estimate the current vertex position based on observations of the previously coded vertex positions, the residual coordinate values are uniformly quantized. Since we normalize the vertex position in the preprocessing stage, the dynamic range of prediction errors is limited to [-1.0, 1.0]. Thus, we can design a uniform quantizer with a tight bound of prediction errors. The quantizer index is encoded by a QM entropy coder. The proposed scheme demonstrates improved coding efficiency than the MPEG-4 SNCH standard [2] for selected VRML test data.



(a) Average Parallelogram Prediction (b) Angle Prediction

Fig 1. Joint Prediction

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References

[1] C. Touma and C. Gotsman, "Triangle mesh compression," *Proc. Graphics Interfac '98*, pp. 26-34, 1998.

[2] "Description of core experiments on 3-D model coding" ISO/IEC JTC1/SC29/WG11 MPEG98/N244rev1, Atlantic City, Oct. 1998.