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E. Grinspun, B. Bickel, and Y. Dobashi
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Progressive compression of arbitrary textured meshes - Supplementary Materials

F. Caillaud[1,2], V. Vidal[1,3], F. Dupont[1,3] and G. Lavoué[1,2]

[1] Université de Lyon, CNRS, [2] INSA-Lyon, LIRIS UMR 5205, [3] Université Lyon 1

1. Edge selection efficiency

To validate our edge selection strategy, we present here the rate distortion curves obtained using different edge selection metrics: Hausdorff distance w_{gc}, texture seam deviation w_t and the combination that we propose $w_{gc} + w_t$. We use the multiscale SSIM metric presented in the paper to evaluate the quality of the obtained levels of detail (the texture map is kept in its highest resolution for this experiment). Figure 1 shows that the $w_{gc} + w_t$ selection clearly improves the visual quality of the LoDs compared to w_{gc}. Whereas, w_t seems to be insufficient as, even if texture fidelity is visually important, mesh geometry still be crucial.

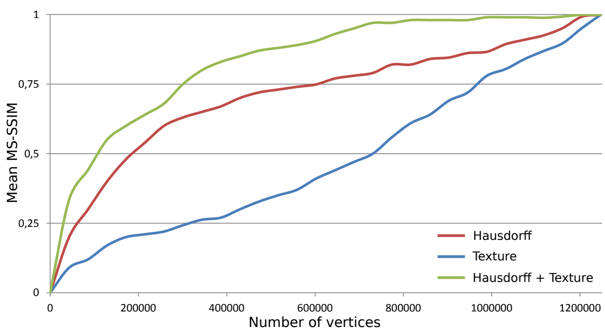

Figure 1: *Rate-Quality curves for the Dwarf model obtained with different edge selection metric: w_{gc} (Hausdorff), w_t (Texture) and their combination $w_{gc} + w_t$. The quality is measured using MS-SSIM.*

2. Batches size efficiency

As stated in the paper (section 4.3), the number of edges collapsed in a batch affect both the visual quality of the LoDs and the compression rate. Figure 2 illustrates the rate-distortion curves associated with three different strategies : minimal batch size (one edge collapsed by batch), our method (a threshold set as the average weight of the current mesh's edges), maximal batch size (as many edges collapsed as possible by batch). We can observe that our strategy provides an excellent tradeoff between the quality at low/medium bitrates and the lossless compression performance.

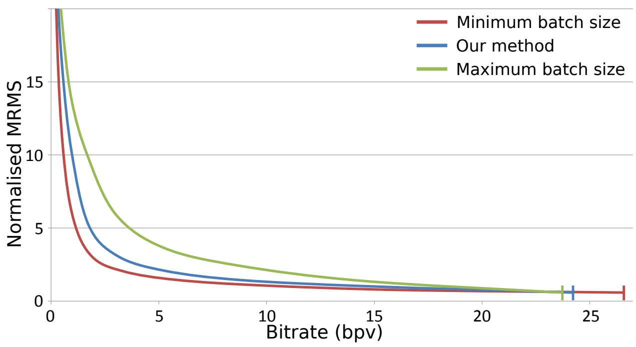

Figure 2: *Rate-distortion curves for the TigerFighter model, for different batch size strategies (only the geometry distortion is measured).*

2.1. Geometry and connectivity compression

In the paper, we have presented rate-distortion curves for the Horse model. Figure 3 shows the same curves for the Rabbit model (also triangular manifold) using Max Root Mean Square error.

3. Texture mapping compression

Figure 4 illustrates the preservation of the parametrization in several levels of detail of the Victoria model. Despite the multiple seams of this mesh, our method minimizes the texture distortion caused by the simplification and, thus, maintains the visual quality, as long as possible.

Figure 5 illustrates levels of detail obtained by our algorithm and by [LCCD16]. Because of the duplication of vertices along the seams, artifacts are clearly visible for [LCCD16]. While our method produces a very nice parametrization even for a low vertex

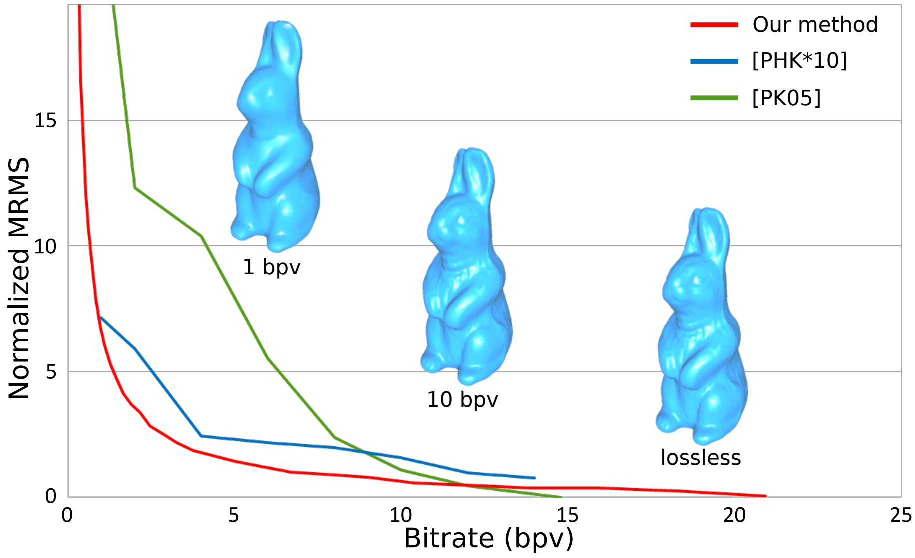

Figure 3: *Rate-distortion curves for Rabbit model. Distortion is measured by the Max Root Mean Square error. The MRMS values are scaled by* 10^4.

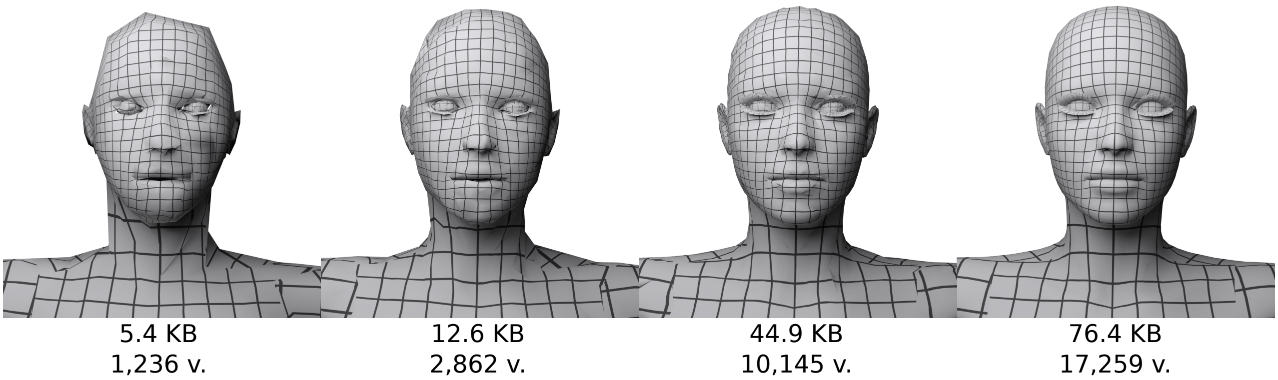

Figure 4: *Progressive decompression of the Victoria model realized by our method. For each LoD, we present the total bitrate needed (geometry, connectivity, texture mapping) and the number of vertices used.*

number (the original vertex number of the Dwarf model is more than a million). This example also shows the great compression efficiency of our method.

4. Texture multiplexing

Figure 6 illustrates our mesh-texture multiplexing. Starting from the coarsest mesh-texture combination (on the bottom left corner), we choose to add a chunk of data to the compressed stream, either to refine the mesh or the texture, in order to optimize the tradeoff between visual quality and cost (number of bits).

Figure 7 illustrates the efficiency of our mesh/texture multiplexing approach. Bitrate values for each LoD include all data (geometry, connectivity, texture mapping and texture image). It is interesting to observe that, for objects of similar shape complexity, the curves remain similar (e.g. Dwarf, Creature and TigerFighter). The lower performance for the tractor is due to the fact that this model is actually much more complex (highly not convex, with tunnels, thin parts, etc.).

5. Experiment models

We present in Figure 8 the 3D models used in Table 1 and Table 2 of the paper. Figure 9 illustrate parametrized models used in table 3.

References

[LCCD16] LAVOUÉ G., CHEVALIER L., CAILLAUD F., DUPONT F.: Progressive streaming of textured 3d models in a web browser. In *ACM Siggraph Symposium on Interactive 3D Graphics and Games* (2016), pp. 203–203. 1, 3

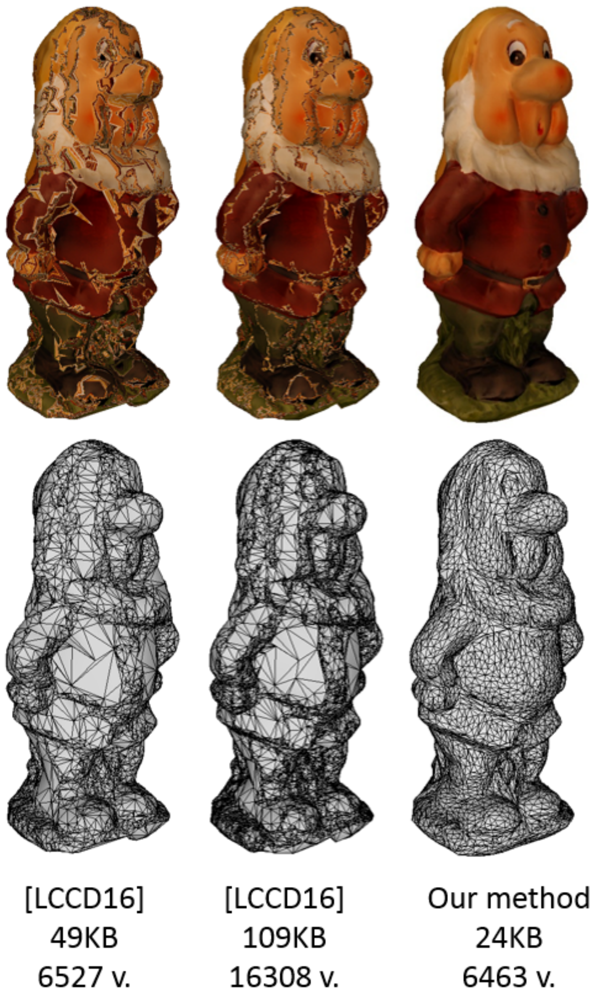

Figure 5: *Comparison of levels of detail obtained by our algorithm and by [LCCD16]. LoDs are illustrated with (top) and without (bottom) texture mapping. Bitrates and vertex number are detailed.*

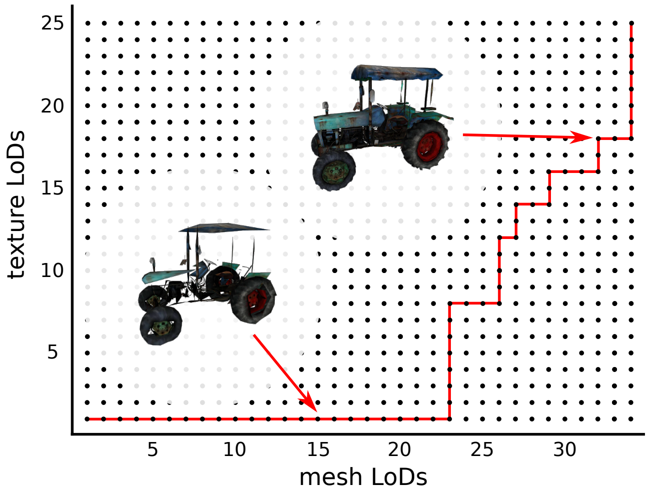

Figure 6: *The optimal path (in red) from the coarsest to the most refined mesh-texture combination for the Tractor model. Black dots represent every mesh-texture combinations.*

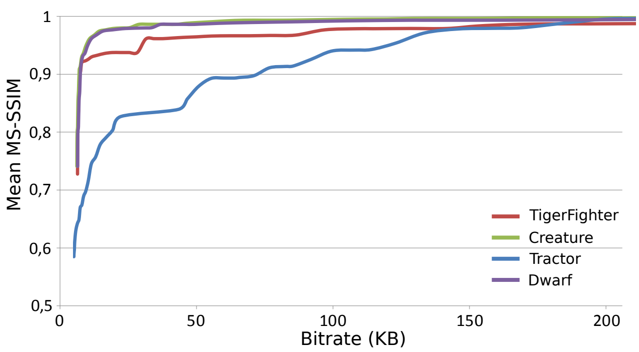

Figure 7: *Rate-quality curves for different textured models (Tractor, Creature, Dwarf and TigerFighter). LoDs are obtained through our mesh-texture multiplexing scheme. Visual quality is measured by the mean MS-SSIM values.*

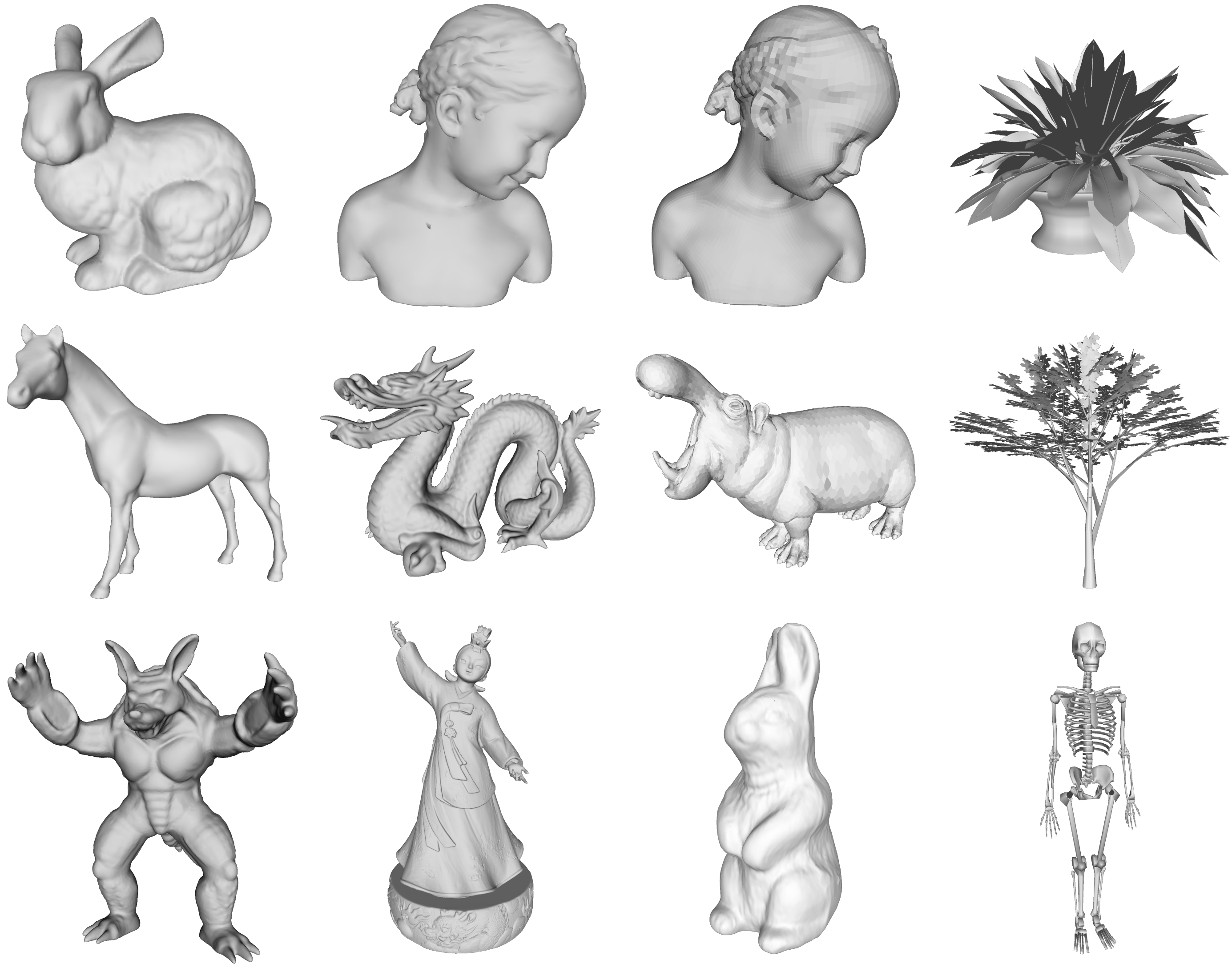

Figure 8: *3D models used in tables 1 and 2 from the paper. From left to right and from top to bottom : Bunny, Bimba, Bimba-q, House Plant, Horse, Dragon, Hippo, Maple, Armadillo, Dancing Ari, Rabbit, Skeleton.*

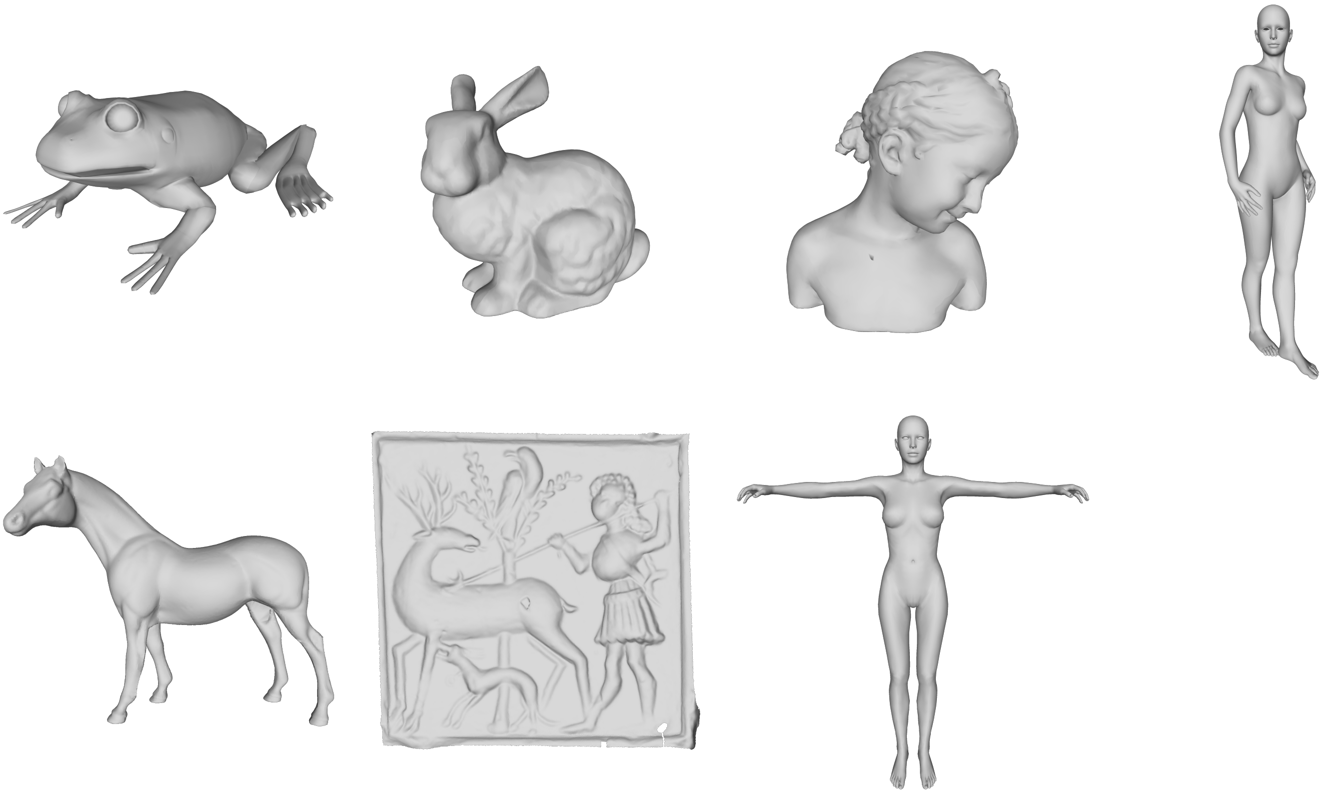

Figure 9: *Parametrized 3D models used in table 3 from the paper. From left to right and from top to bottom : Frog, Bunny, Bimba, Fiery, Horse, Kachel, Victoria.*