Regularization of Voxel Art
Supplementary material: Additional results and comparisons

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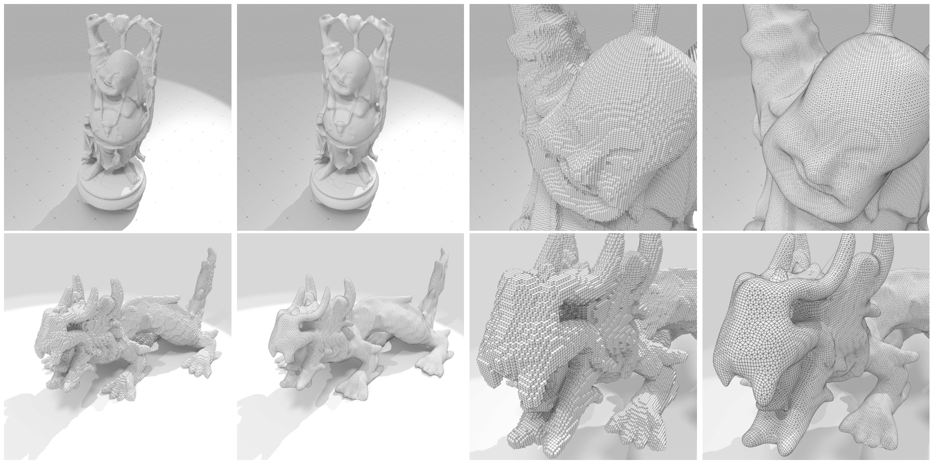
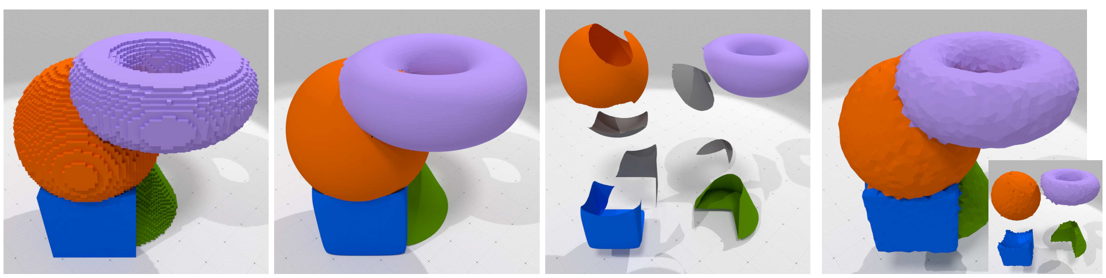


Figure 1: *Regularization on higher resolution voxel shapes:* `Buddha` *and* `Dragon` *in a* 256^3 *domain.*



(a) (b) (c) (d)

Figure 2: *Multi-labeled image with four shapes* (75^3) (a). *In* (b) *and* (c) *the regularization obtained by our approach* ($\alpha = 10^{-3}$, $\beta = 1$ *and* $\gamma = 10^{-1}$). *In* (d) *we have the interfaces obtained using a volumetric tetrahedrization from [AJR+17].*

References

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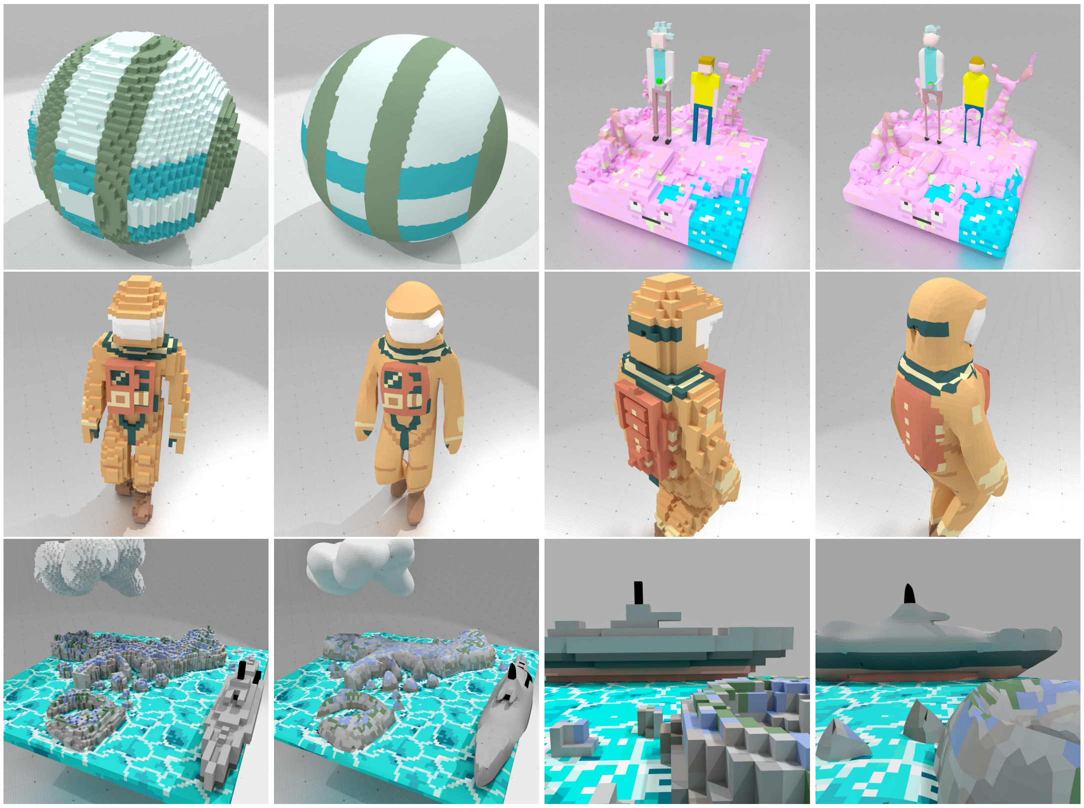


Figure 3: *Various voxel art regularization results. First row, a 50^3 ball and a 45^3 voxel scene with very thin structures. Second row: $25\times 20\times 65$ volume with 2 regions, one for the helmet glass and one for the rest. Third row: 127^3 volume with four regions: the sea, the ship, the cloud and the island. All experiments have been obtained with the same parameters ($\alpha = 10^{-3}$, $\beta = 1$ and $\gamma = 10^{-1}$). Voxel artwork courtesy of Elbriga (`https://twitter.com/gabriel_d_L`) and Mike Judge (`https://github.com/mikelovesrobots/mmmm`).*

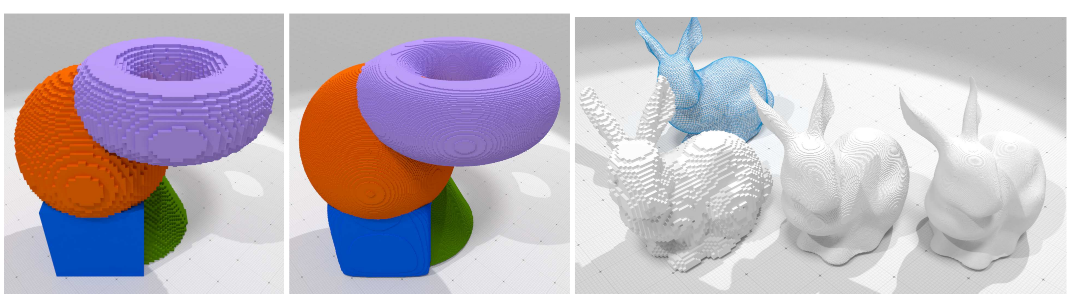


Figure 4: *Voxel upscaling using a voxelization of the regularized objects: $(left)$ from 75^3 to 512^3. $(right)$ Upscaling to 256^3 and 512^3 from the Bunny object in 64^3 and its regularized surface (in blue).*

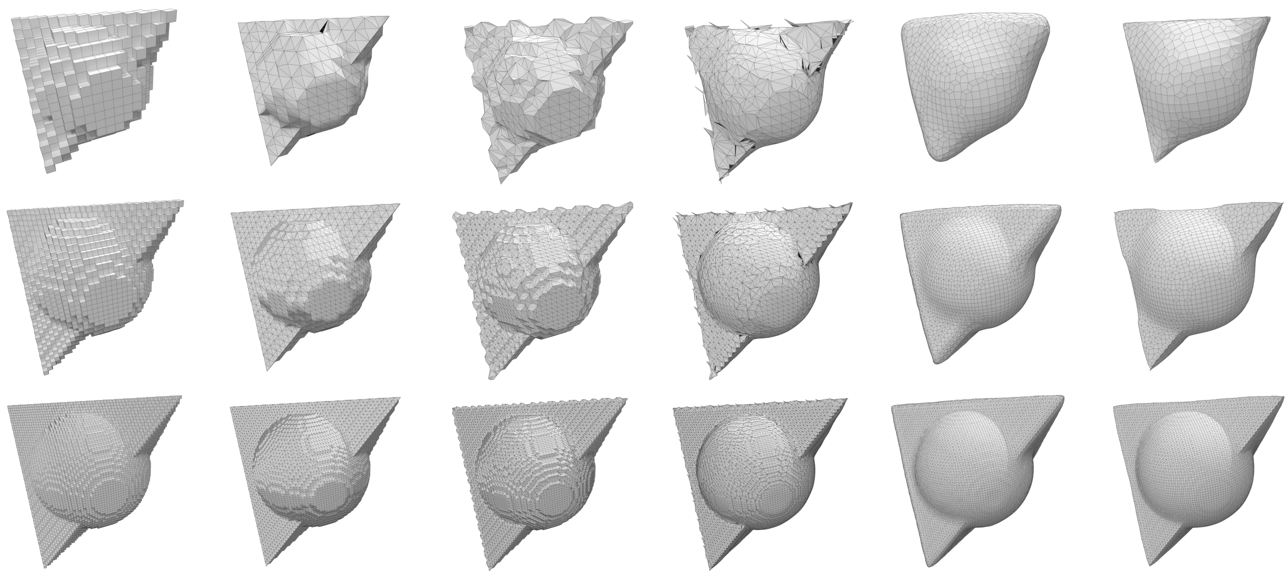


Figure 5: *Comparisons on a voxel shape with both sharp and smooth features at three different resolutions:* 10^3, 20^3 *and* 40^3*. For the last two columns (our results), we have used the same weights for all shapes (*$\alpha = 10^{-3}$, $\beta = 1$ *and* $\gamma = 10^{-1}$*).*

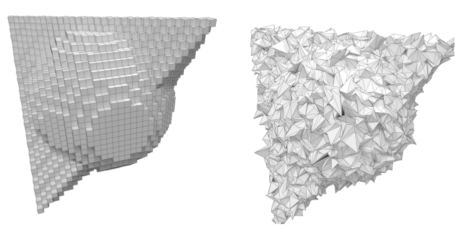
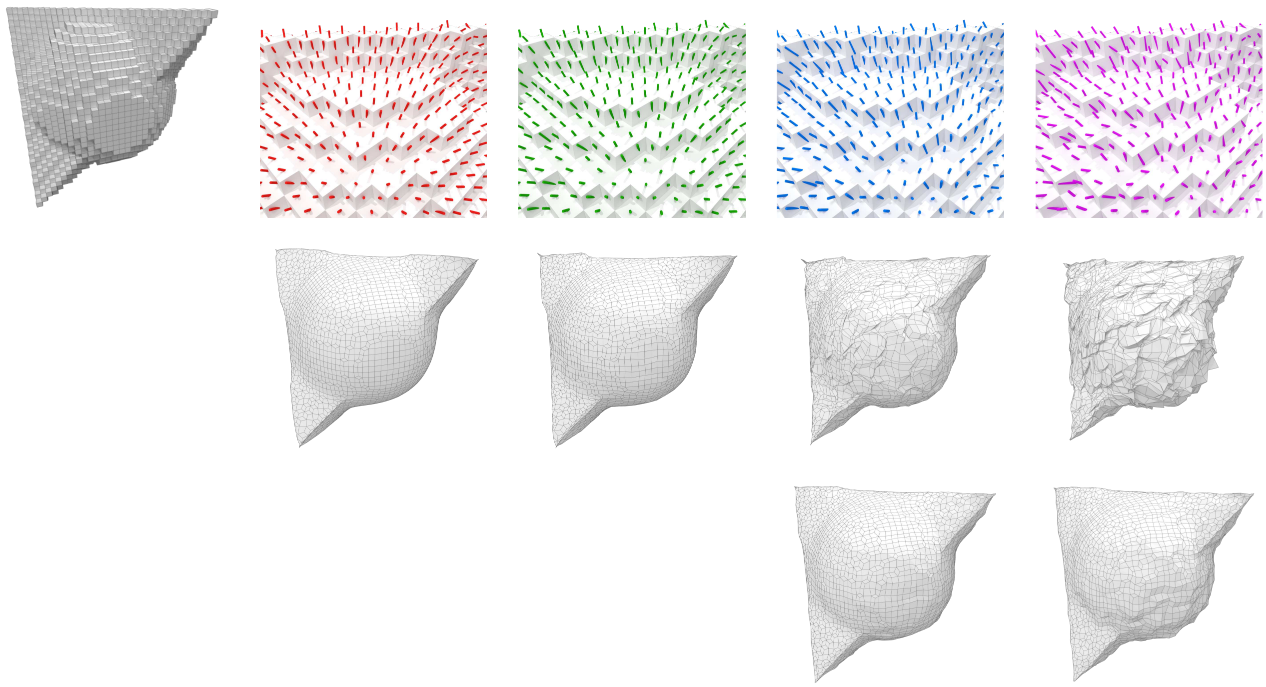
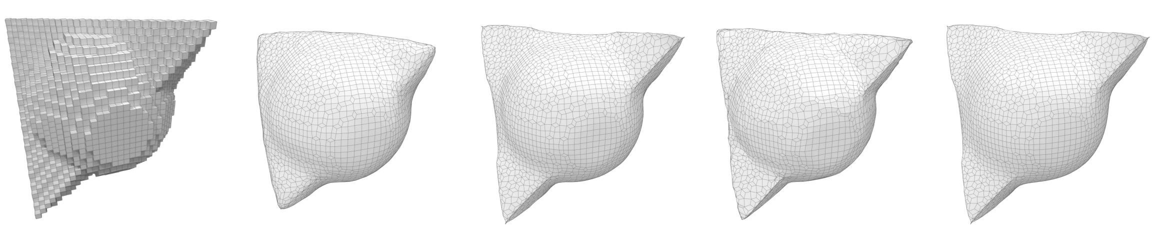


Figure 6: *Numerical instability of DC when using a robust normal vector field from [CFGL16] (same as the one in Fig. 8-*(d)*) but with positions still located in-between adjacent voxels.*



(a) (b) (c) (d)

Figure 7: *Stability of our method with respect to perturbations in the input normal vector field (40^3 shape, same α, β and γ parameters): (a) the regularization with the input normal vector field from [CFGL16], (b) random shifts ϵ with $\|\epsilon\| < 0.2$ (up to 11°), (c) with $\|\epsilon\| < 0.5$ (up to 26.5°), and (d) with $\|\epsilon\| < 0.8$ (up to 38.7°). For the second row, we have used the default parameters ($\alpha = 10^{-3}$, $\beta = 1$, $\gamma = 10^{-1}$). For the third row, we have reduced the alignment term ($\beta = 10^{-1}$) to handle the strong noise (only for (c) and (d)).*



(a) (b) (c) (d) (e)

Figure 8: *Regularization for various normal vector estimators: (a) trivial normal vectors, (b) isotropic integral invariant estimator [CLL14], (c) robust anisotropic voting based normal vectors [BM12], and (d) piecewise smooth anisotropic normal vectors [CFGL16].*