Supplementary of Automatic Mesh and Shader Level of Detail

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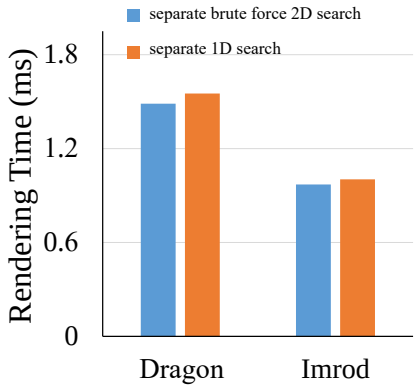

Fig. 1: Performance comparison of LODs generated by our separate 1D search and our separate brute-force 2D search.

1 Supplemental Results

We present more results of our paper "Automatic Mesh and Shader Levels of Detail" in this supplemental document.

1.1 Comparison with brute-force 2D Searching

In our separate optimization, we further compare the brute-force 2D search strategy and the 1D search strategy in the Imrod and Dragon demos, as shown in Figure 1. The brute-force 2D search enumerates all combination pairs in the simplified mesh sequence and simplified shader sequence, while the 1D search reduces the search dimension by utilizing the monotonicity of the quality loss of the two sequences. We plot the performance of the LOD results, which shows that our separate 1D search produces almost the same results as those generated by the separate brute-force 2D search. However, in the Imrod demo, the brute-force 2D search takes 6.4 hours to evaluate 346 shader variants and 500 simplified mesh candidates at 10 different levels. In the Dragon demo, all 300 shader variants are generated. It also takes 1.83 hours to evaluate these variants. In contrast, our 1D search only evaluates tens of pairs and finds optimal pairs at each level, requireing a total of 47 minutes and 14 minutes, respectively.

1.2 With/Without Level Optimization

In Table 1, we compare the performance and memory usage of our generated LODs with and without level optimization. The table shows that although we can achieve the best performance without level optimization, it takes more memory to maintain all the levels. With our level optimization, we can reduce memory usage by 6.7% to 75% without losing much quality. Therefore, level optimization provides a better tradeoff between memory usage and rendering performance.

1.3 Results on Different Platforms

To further test the applicability of the separate optimization among different rendering platforms (graphics cards), we also generate relative LODs on an NVIDIA GeForce GTX 960 with 4 GB RAM and test the rendering performance on different graphics cards. The results are presented in Table 2. "Simp. Platform" indicates which platform is used to generate the LOD with our algorithm. "Perf. Testing Platform" indicates which platform is used to measure the performance of those generated LODs. The results show that the rendering times of the LODs generated on GTX1080 and GTX960 are close to each other if we measure the performance on the same platform. In other words, we can apply the LODs that our algorithm generates on one platform to other different platforms.

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TABLE 1: Statistics of generated LODs with/without level distribution optimization (L. Opt.).

	Rendering Time (ms)				Memory (KB)			
	1D No L. Opt.	1D L. Opt.	joint No L. Opt.	joint L. Opt.	1D No L. Opt.	1D L. Opt.	joint No L.opt	joint L.opt
Dragon	1.49	1.54	1.48	1.52	1284	941	1217	817
Imrod	1.02	1.04	0.97	1.00	2407	2256	2245	2136
Couch	0.74	0.74	0.73	0.75	1016	755	1009	659
Rocket	0.50	0.53	0.47	0.47	625	158	603	412
Statue	0.48	0.52	0.46	0.48	1785	1513	1764	1430

TABLE 2: Performance comparison of LODs generated on 2 different platforms.

Demo	Perf. Testing Platform	Simp. Platform	LOD 1	LOD 4	LOD 9	MIX
Imrod	GTX1080	GTX1080	2.70	1.43	0.79	0.99
		GTX960	3.34	1.54	0.84	1.08
	GTX960	GTX1080	3.63	1.97	1.17	1.46
		GTX960	4.60	2.12	1.24	1.55
Rocket	GTX1080	GTX1080	0.55	0.42	0.40	0.44
		GTX960	0.55	0.39	0.35	0.42
	GTX960	GTX1080	0.79	0.59	0.59	0.61
		GTX960	0.76	0.60	0.54	0.56
Marble	GTX1080	GTX1080	3.78	2.90	1.01	1.50
		GTX960	3.80	2.70	1.19	1.63
	GTX960	GTX1080	5.38	4.03	1.38	2.12
		GTX960	5.38	3.83	1.53	2.25
Couch	GTX1080	GTX1080	1.10	0.61	0.66	0.62
		GTX960	1.10	0.57	0.48	0.57
	GTX960	GTX1080	1.55	0.92	1.00	0.88
		GTX960	1.55	0.78	0.67	0.75
Statue	GTX1080	GTX1080	1.54	0.66	0.36	0.52
		GTX960	1.55	0.62	0.36	0.50
	GTX960	GTX1080	2.06	0.90	0.54	0.70
		GTX960	2.06	0.94	0.55	0.70