Lossy Geometry Compression for High Resolution Voxel Scenes

Supplementary material

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1 FULL COMPRESSION RATES

In Table 1 we compare the structure size when encoding our test scenes with a standard SVDAG, a pointer compressed SVDAG (ESVDAG), a symmetry-aware SVDAG (SSVDAG) and their lossy variants compressed with our lossy compression technique (respectively LSVDAG, LESVDAG, and LSSVDAG) when using our defined default compression parameters. Additionally we include the memory requirements of a standard SVO encoding. Please note that the amount of SVDAG nodes in the original SVDAG and the SVDAG remains the same, since the difference resides only in the variable bit pointer encoding; the same is true in the case of an LSVDAG and an LESVDAG.

In Figure 1, we show a graphical representation of the size ratio obtained when using the different DAG encodings for the original data and our lossy version.

2 COMPARISON IMAGES

In Figure 2 we showcase example close-up screenshots of our test scenes in order to showcase the types of errors introduced by our compression algorithm using our default compression parameters and an aggressive set of compression parameters. As can be seen in the figure, the error is well distributed among the whole scene, making the individual added or subtracted voxels difficult to distinguish. Furthermore, the error is introduced in mostly curved areas, since flat areas tend to correspond to subtrees with a high effective reference count, which are excluded from our clustering procedure.

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Scene	Total number of DAG nodes in millions						Memory consumption in MB						bits/vox
	$2K^3$	$4K^3$	$8K^3$	$16K^3$	$32K^3$	$64K^3$	$2K^3$	$4K^3$	$8K^3$	$16K^3$	$32K^3$	$64K^3$	
Crytek Sponza (0.26 MTri)													
LSVDAG	0.1	0.4	1.0	2.6	6.6	17.1	3.8	9.9	24.9	62.2	156.0	400.2	0.082
LESVDAG	"	"	"	"	"	"	1.9	5.4	14.9	40.8	110.4	301.1	0.062
LSSVDAG	0.1	0.3	0.8	2.1	5.5	13.9	1.5	4.5	12.5	33.9	91.1	243.6	0.050
SVDAG	0.2	0.5	1.3	3.5	9.1	23.6	4.3	11.9	31.7	82.3	212.7	545.3	0.112
ESVDAG	"	"	"	"	"	"	2.1	6.4	18.7	52.7	147.4	404.0	0.083
SSVDAG	0.1	0.4	1.0	2.8	7.1	18.2	1.7	5.2	15.0	41.4	112.8	304.5	0.062
SVO	12.7	52.3	211.3	848.6	3,400.6	13,613.6	12.7	52.3	211.3	848.6	3,400.6	13,613.6	2.794
Epic Citadel (0.39 MTri)													
LSVDAG	0.1	0.3	0.8	2.2	5.7	14.9	2.5	7.0	18.9	50.4	132.2	343.1	0.611
LESVDAG	"	"	"	"	"	"	1.2	3.8	11.4	33.2	93.4	257.4	0.458
LSSVDAG	0.1	0.2	0.7	1.8	4.8	12.7	1.0	3.2	9.6	28.0	78.5	217.0	0.386
SVDAG	0.1	0.4	1.0	2.9	7.6	19.9	3.0	8.5	23.8	65.4	174.7	454.7	0.772
ESVDAG	"	"	"	"	"	"	1.5	4.6	14.2	42.5	122.0	336.7	0.599
SSVDAG	0.1	0.3	0.8	2.3	6.2	16.2	1.2	3.7	11.5	34.0	97.3	268.7	0.456
SVO	1.5	5.9	23.9	96.1	386.4	1,552.8	1.5	5.9	23.9	96.1	386.4	1,552.8	2.637
San Miguel (10.0 MTri)													
LSVDAG	0.2	0.6	2.0	5.3	14.0	36.7	4.5	16.8	51.8	139.2	360.3	938.3	0.635
LESVDAG	"	"	"	"	"	"	1.9	7.5	24.8	73.3	208.0	596.2	0.404
LSSVDAG	0.2	0.6	1.8	4.7	12.2	31.3	1.8	6.9	22.2	64.5	180.3	504.0	0.341
SVDAG	0.2	0.7	2.3	6.6	18.6	50.0	4.7	18.1	57.8	164.5	460.5	1,228.2	0.832
ESVDAG	"	"	"	"	"	"	2.0	8.1	27.4	85.5	262.0	766.1	0.519
SSVDAG	0.2	0.6	1.9	5.5	15.2	40.0	1.9	7.3	23.8	72.4	212.3	603.5	0.409
SVO	3.8	15.5	63.0	254.9	1,025.9	4,118.9	3.8	15.5	63.0	254.9	1,025.9	3,928.5	2.660
Hairball (2.9 MTri)													
LSVDAG	4.8	13.7	35.6				132.7	373.3	951.1				2.675
LESVDAG	"	"	"				63.9	210.6	604.9				1.701
LSSVDAG	3.9	11.6	30.7				54.9	179.9	514.1				1.446
SVDAG	5.8	16.6	48.6				156.3	435.4	1,246.2				3.505
ESVDAG	"	"	"				72.7	240.0	782.2				2.200
SSVDAG	4.5	13.5	39.8				59.5	198.8	622.7				1.751
SVO	53.8	230.4	962.4				53.8	230.4	962.4				2.706
Lucy (28.1 MTri)													
LSVDAG	0.1	0.4	1.0	2.8	9.3		3.5	9.2	23.8	65.2	216.2		1.148
LESVDAG	"	"	"	"	"		1.9	5.5	16.1	47.8	165.6		0.879
LSSVDAG	0.1	0.3	0.9	2.5	8.0		1.4	4.4	13.4	41.2	141.0		0.749
SVDAG	0.2	0.5	1.7	5.7	18.3		4.1	11.9	38.6	133.5	439.3		2.332
ESVDAG	"	"	"	"	"		2.2	7.1	25.1	90.7	309.4		1.643
SSVDAG	0.1	0.4	1.4	4.8	14.4		1.6	5.5	20.0	70.4	223.9		1.189
SVO	2.0	8.2	32.9	131.6	526.6		2.0	8.2	32.9	131.6	526.6		2.796
Powerplant (12.7 MTri)													
LSVDAG	0.1	0.2	0.5	1.1	2.5	5.8	1.9	4.8	11.5	27.3	64.8	149.3	0.215
LESVDAG	"	"	"	"	"	"	0.8	2.4	6.1	15.5	39.1	97.0	0.140
LSSVDAG	0.1	0.2	0.4	0.9	2.0	4.7	0.7	2.0	5.2	13.1	32.5	80.2	0.115
SVDAG	0.1	0.2	0.5	1.2	2.9	7.0	2.0	5.1	12.4	30.1	73.3	175.4	0.252
ESVDAG	"	"	"	"	"	"	0.9	2.5	6.6	17.0	44.0	113.8	0.164
SSVDAG	0.1	0.2	0.4	1.0	2.3	5.4	0.7	2.1	5.5	14.0	35.4	89.9	0.129
SVO	1.1	5.0	22.0	94.4	404.9	1,741.0	1.1	5.0	22.0	94.4	404.9	1,741.0	2.506

Table 1. Structure size of our structure output with defaults parameters compared to the input SVDAG. Bits per voxel metric is specified for the highest resolution at which the dataset was processed. Some entries are missing due to hardware limitations.
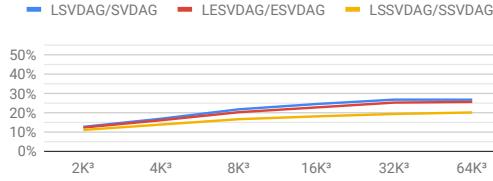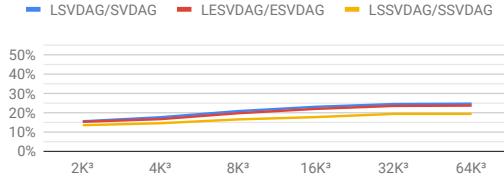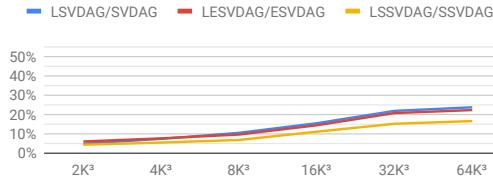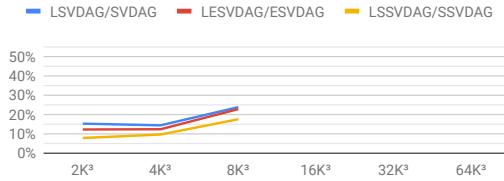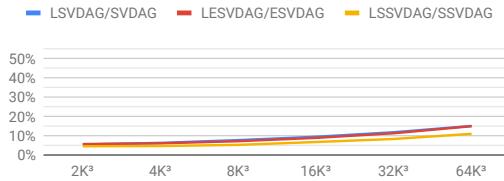
Fig. 1. Memory reduction (as a size percentage ratio) comparison of the LSVDAG relative to the SVDAG, the LESVDAG relative to the ESVDAG, and LSSVDAG relative to the SSVDAG.
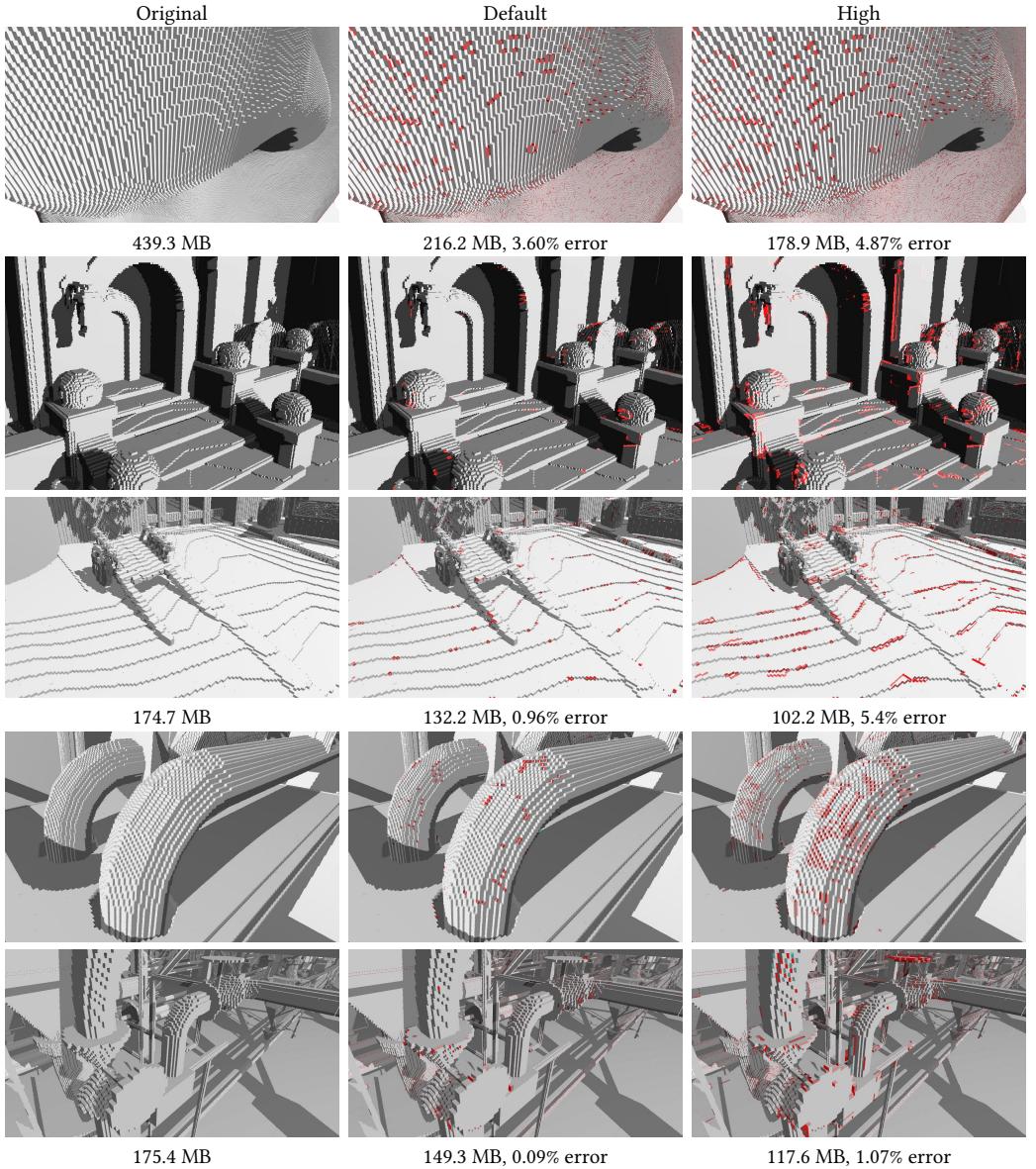
Fig. 2. A visualization of the errors introduced by our compression method in different scenes using default parameters and high compression parameters, for the Epic Citadel (top), Lucy (middle) and Powerplant (bottom) test scenes at $32K^3$ resolution. For the high compression of the Lucy scene, we only increased the threshold on effective reference count to 4. For the rest of the scenes, we used an inflation of 1.5, difference factor 4 and reference count threshold 4 as high compression settings. The voxel difference is highlighted in red.