Fast and Memory-Efficient Voronoi Diagram Construction on Triangle Meshes

Supplemental Materials

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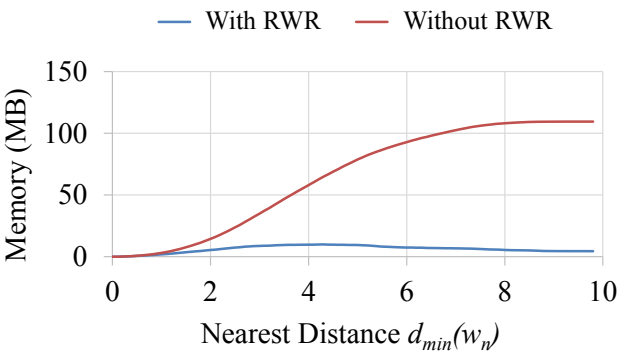
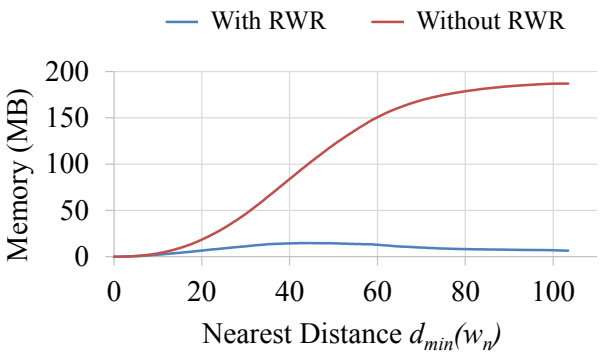
1 RWR Performance Verification

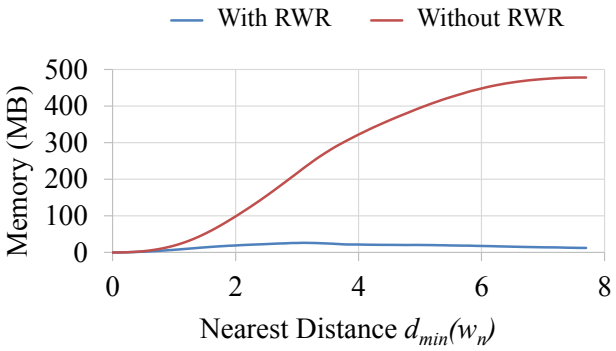
To verify that the proposed RWR procedure effectively reduces memory cost, this section compares memory costs against nearest distance $d_{\min}(w_n)$ of the wavefront between two variants of the Voronoi diagram construction: with and without RWR. In this part, the results on 8 other models with various resolutions are shown in addition to the two models (Armadillo and Asian Dragon) used in the paper.



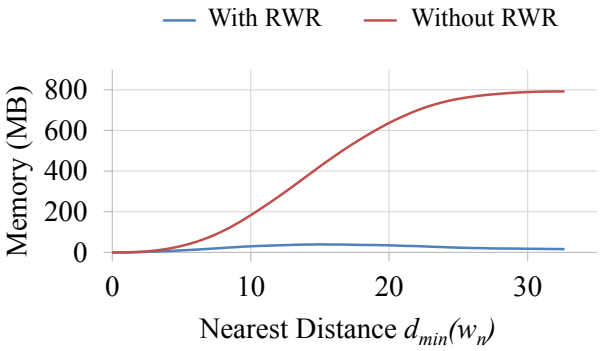
Horse (F: 96K)



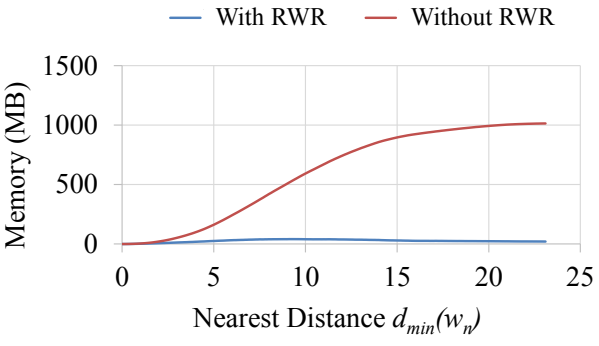
Bunny (F: 144K)



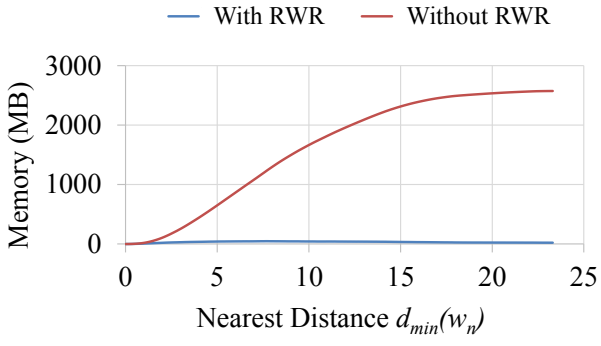
Igea (F: 268K)



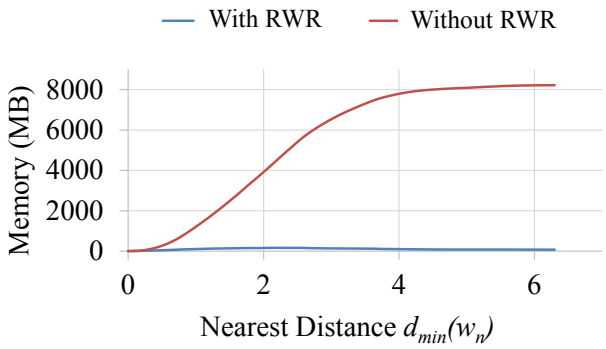
Pulley (F: 392K)



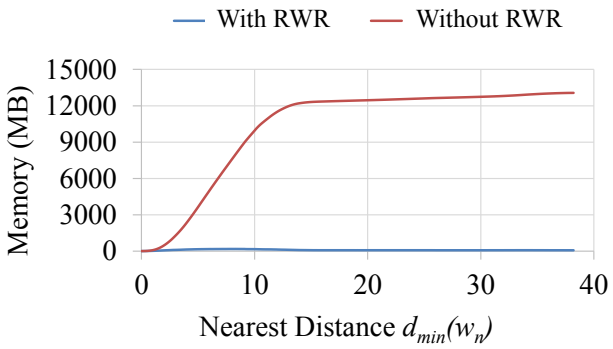
Rocker Arm (F: 482K)



IsidoreHorse (F: 2M)



Happy Buddha (F: 2.6M)



Neptune (F: 4M)

2 Performance Comparison on Geodesic Computation

This part compares the performance among state-of-the-art Voronoi diagram oriented geodesic algorithms, MMP (Surazhsky et al., 2005), FWP-MMP (Xu et al., 2015) and the proposed *window*-VTP on the model set proposed in (Qin et al., 2016).

Model	**Performance**	**Algorithms**		
		MMP	**FWP-MMP**	***window*-VTP**
Twirl (F: 10K)	Time(s)	0.073	0.032	0.031
	#windows stored	71,918	71,918	10,835
	Peak memory(MB)	5.49	5.49	1.77
Sword (F: 29K)	Time(s)	0.374	0.164	0.147
	#windows stored	342,133	342,332	33,806
	Peak memory(MB)	26.10	26.12	4.94
Femur (F: 30K)	Time(s)	0.292	0.124	0.119
	#windows stored	263,839	263,839	22,463
	Peak memory(MB)	20.13	20.13	3.36
Cow (F: 36K)	Time(s)	0.408	0.16	0.14
	#windows stored	360,289	360,289	27,630
	Peak memory(MB)	27.49	27.49	3.41
Venus (F: 43K)	Time(s)	0.57	0.267	0.22
	#windows stored	518,629	518,629	35,210
	Peak memory(MB)	39.57	39.57	4.52
Foot (F: 44K)	Time(s)	0.581	0.235	0.226
	#windows stored	495,620	495,624	32,785
	Peak memory(MB)	37.81	37.81	5.45
Camel (F: 48K)	Time(s)	0.626	0.303	0.28
	#windows stored	533,141	533,141	28,674
	Peak memory(MB)	40.68	40.68	4.34
HomerSimpson (F: 48K)	Time(s)	0.651	0.256	0.241
	#windows stored	533,641	533,649	39,277
	Peak memory(MB)	40.71	40.71	5.74

Continue from previous table

Model	Performance	Algorithms		
		MMP	**FWP-MMP**	***window*-VTP**
Dilo (F: 54K)	Time(s)	0.789	0.355	0.294
	#windows stored	684,702	684,720	37,512
	Peak memory(MB)	52.24	52.25	5.04
SketchedVase (F: 54K)	Time(s)	1.234	0.42	0.392
	#windows stored	945,438	945,438	80,584
	Peak memory(MB)	72.13	72.13	10.85
Knot (F: 56K)	Time(s)	1.073	0.345	0.328
	#windows stored	738,428	738,428	41,106
	Peak memory(MB)	56.34	56.34	6.73
Buste (F: 60K)	Time(s)	0.957	0.369	0.342
	#windows stored	654,859	654,859	40,265
	Peak memory(MB)	49.96	49.96	6.84
Casting (F: 90K)	Time(s)	1.566	0.66	0.609
	#windows stored	1,121,043	1,121,043	53,522
	Peak memory(MB)	85.53	85.53	9.68
Horse (F: 96K)	Time(s)	1.966	0.685	0.66
	#windows stored	1,433,970	1,433,990	59,009
	Peak memory(MB)	109.40	109.41	9.98
Shark (F: 107K)	Time(s)	2.345	0.868	0.817
	#windows stored	1,748,695	1,748,791	74,777
	Peak memory(MB)	133.42	133.42	11.82
Pegasus (F: 127K)	Time(s)	2.749	0.977	0.932
	#windows stored	1,849,764	1,849,768	67,633
	Peak memory(MB)	141.13	141.13	12.97
Bunny (F: 144K)	Time(s)	3.637	1.27	1.07
	#windows stored	2,451,104	2,451,105	85,959
	Peak memory(MB)	187.00	187.00	14.86
Bimba (F: 149K)	Time(s)	3.576	1.358	1.218
	#windows stored	2,461,523	2,461,523	83,382
	Peak memory(MB)	187.80	187.80	13.40
Hand (F: 176K)	Time(s)	7.345	2.296	2.076
	#windows stored	4,517,908	4,517,982	175,080
	Peak memory(MB)	344.69	344.70	22.73
Filigree (F: 186K)	Time(s)	3.518	1.36	1.284
	#windows stored	2,363,812	2,363,913	84,379
	Peak memory(MB)	180.35	180.35	17.05
Woodfish (F: 191K)	Time(s)	6.458	2.028	1.821
	#windows stored	3,875,027	3,875,066	112,070
	Peak memory(MB)	295.64	295.64	19.47
Maxplanck (F: 210K)	Time(s)	7.105	2.346	2.121
	#windows stored	4,384,798	4,384,805	129,240
	Peak memory(MB)	334.53	334.53	20.64

Continue from previous table

Model	Performance	Algorithms		
		MMP	**FWP-MMP**	***window*-VTP**
Duck (F: 219K)	Time(s)	7.969	2.615	2.406
	#windows stored	4,739,873	4,740,044	136,862
	Peak memory(MB)	364.62	361.64	22.47
Tooth (F: 220K)	Time(s)	8.479	2.709	2.365
	#windows stored	4,717,835	4,717,834	137,556
	Peak memory(MB)	359.94	359.94	22.66
Moai (F: 238K)	Time(s)	9.165	2.963	2.603
	#windows stored	5,171,473	5,171,567	137,861
	Peak memory(MB)	394.55	394.56	25.11
Dancing Children (F: 265K)	Time(s)	8.526	2.79	2.501
	#windows stored	4,891,962	4,891,983	130,293
	Peak memory(MB)	373.23	373.23	22.04
Igea (F: 268K)	Time(s)	10.916	3.362	3.019
	#windows stored	6,266,009	6,266,232	161,435
	Peak memory(MB)	478.06	478.08	26.50
Cup (F: 316K)	Time(s)	15.955	4.317	3.827
	#windows stored	7,130,333	7,130,438	172,881
	Peak memory(MB)	544.00	544.01	32.86
Armadillo (F: 345K)	Time(s)	9.863	3.304	2.982
	#windows stored	5,771,551	5,771,552	109,213
	Peak memory(MB)	440.33	440.33	21.09
Vase (F: 354K)	Time(s)	17.61	5.07	4.6
	#windows stored	9,000,357	9,000,338	204,435
	Peak memory(MB)	686.67	686.67	28.35
Red circular box (F: 360K)	Time(s)	8.67	3.053	2.763
	#windows stored	5,058,283	5,058,359	95,243
	Peak memory(MB)	385.92	385.92	16.65
Julius Caesar (F: 386K)	Time(s)	17.102	5.198	4.435
	#windows stored	8,302,679	8,302,680	163,670
	Peak memory(MB)	633.44	633.44	29.08
Pulley (F: 392K)	Time(s)	23.917	6.622	5.345
	#windows stored	10,381,917	10,382,287	218,368
	Peak memory(MB)	792.08	792.11	39.69
Eros (F: 394K)	Time(s)	15.908	4.892	4.393
	#windows stored	7,977,843	7,977,925	146,482
	Peak memory(MB)	608.66	608.67	27.93
Frog (F: 394K)	Time(s)	25.859	6.93	5.366
	#windows stored	10,599,549	10,599,799	264,306
	Peak memory(MB)	808.68	808.70	46.46
Magalie's hand (F: 396K)	Time(s)	16.947	4.923	4.237
	#windows stored	7,828,886	7,828,888	137,411
	Peak memory(MB)	597.30	597.30	32.20

Continue from previous table

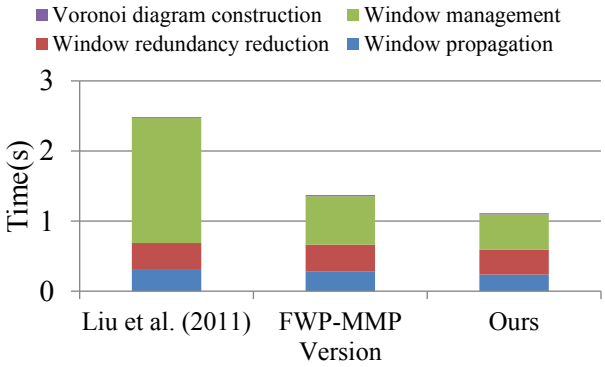
Model	Performance	Algorithms		
		MMP	**FWP-MMP**	***window*-VTP**
WoodenChair (F: 408K)	Time(s)	20.081	5.995	5.232
	#windows stored	10,611,023	10,611,108	166,678
	Peak memory(MB)	809.56	809.56	29.84
Angel (F: 474K)	Time(s)	21.463	6.764	5.67
	#windows stored	10,797,339	10,797,405	191,428
	Peak memory(MB)	823.77	823.78	29.56
Rocker arm (F: 482K)	Time(s)	32.012	9.088	6.985
	#windows stored	13,282,080	13,282,139	271,040
	Peak memory(MB)	1013.34	1013.35	41.50
Fertility (F: 483K)	Time(s)	35.412	9.235	6.986
	#windows stored	14,209,376	14,213,322	343,115
	Peak memory(MB)	1084.09	1084.39	49.44
Heptoroid (F: 573K)	Time(s)	88.438	16.295	11.854
	#windows stored	25,684,650	25,686,036	680,891
	Peak memory(MB)	1959.58	1959.69	110.13
Pierrot (F: 887K)	Time(s)	102.134	22.831	15.986
	#windows stored	30,719,649	30,720,244	471,137
	Peak memory(MB)	2343.72	2343.77	82.37
Bozbezbozzel (F: 911K)	Time(s)	67.579	16.903	13.444
	#windows stored	25,725,566	25,725,665	297,927
	Peak memory(MB)	1962.70	1962.71	54.70
Chinese dragon (F: 1,222K)	Time(s)	137.814	32.257	22.836
	#windows stored	42,905,252	42,905,259	461,210
	Peak memory(MB)	3273.41	3273.41	89.39
Ramesses (F: 1,653K)	Time(s)	55.345	21.233	15.4
	#windows stored	22,398,278	22,398,569	232,074
	Peak memory(MB)	1708.85	1708.88	36.93
Asian dragon (F: 1,400K)	Time(s)	110.083	28.247	20.281
	#windows stored	36,317,620	36,317,847	346,142
	Peak memory(MB)	2770.81	2770.83	76.75
Pensatore (F: 1,996K)	Time(s)	258.372	60.713	37.665
	#windows stored	67,448,762	67,448,895	592,650
	Peak memory(MB)	5145.93	5145.94	111.73
Seahorse (F: 2,014K)	Time(s)	366.545	72.9	47.885
	#windows stored	90,781,860	90,782,014	716,661
	Peak memory(MB)	6926.11	6926.12	145.24
IsidoreHorse (F: 2,209K)	Time(s)	89.538	31.107	21.299
	#windows stored	33,738,770	33,738,791	283,255
	Peak memory(MB)	2574.06	2574.07	46.79
Happy buddha (F: 2,583K)	Time(s)	482.715	105.009	58.946
	#windows stored	107,722,874	107,732,048	912,637
	Peak memory(MB)	8218.60	8219.30	161.98

Continue from previous table

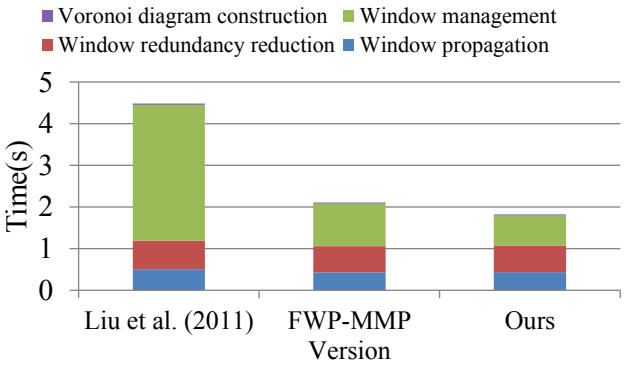
Model	Performance	Algorithms		
		MMP	**FWP-MMP**	***window*-VTP**
Cervino Terrain (F: 3,146K)	Time(s)	259.395	66.332	45.838
	#windows stored	72,176,116	72,195,898	575,108
	Peak memory(MB)	5506.60	5508.11	104.44
Neptune (F: 4,008K)	Time(s)	832.83	173.055	96.843
	#windows stored	171,319,703	171,374,203	857,068
	Peak memory(MB)	13070.70	13074.80	176.30
Vase lion (F: 6,370K)	Time(s)	Out of Memory	Out of Memory	238.298
	#windows stored			2,299,918
	Peak memory(MB)			333.65
Lucy (F: 14,464K)	Time(s)	Out of Memory	Out of Memory	806.118
	#windows stored			12,071,796
	Peak memory(MB)			921.005

3 Performance Profiling

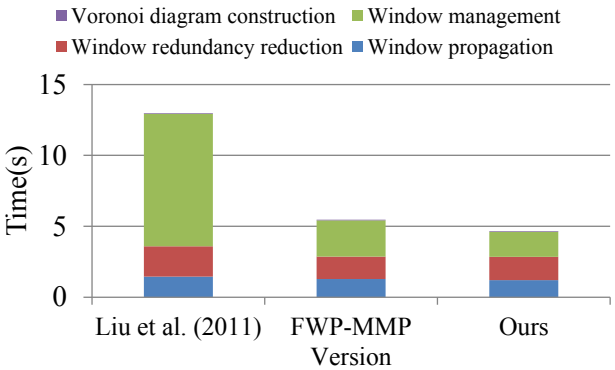
This section profiles the running times of the four individual components (Voronoi diagram construction, window propagation, window redundancy reduction and window management) in the Voronoi diagram construction. The comparison is performed on three versions of the solution, (1) the original method in (Liu et al., 2011); (2) the FWP-MMP version which replaces the MMP algorithm used in (Liu et al., 2011) with the FWP-MMP algorithm (Xu et al., 2015); (3) Our version which replaces the MMP algorithm used in (Liu et al., 2011) with the proposed *window*-VTP algorithm. In addition to the two models (Armadillo and Asian Dragon) used in the paper, the results on 8 other models with various resolutions are also shown in this part.



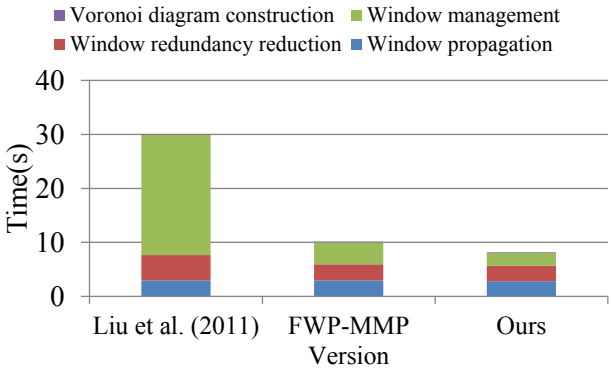
Horse (F: 96K)



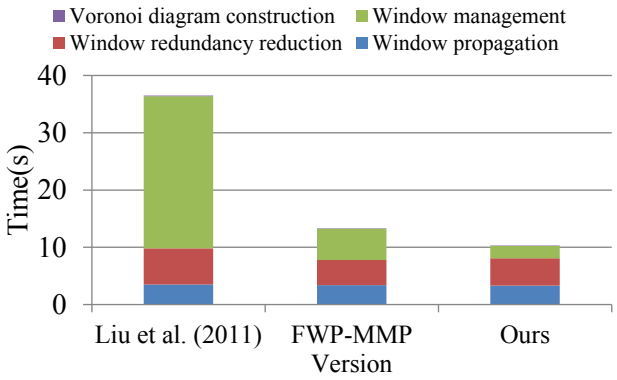
Bunny (F: 144K)



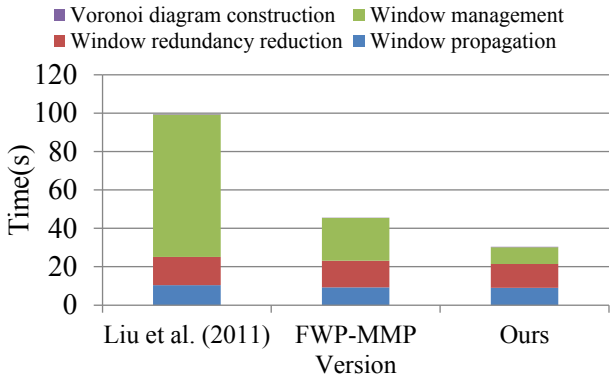
Igea (F: 268K)



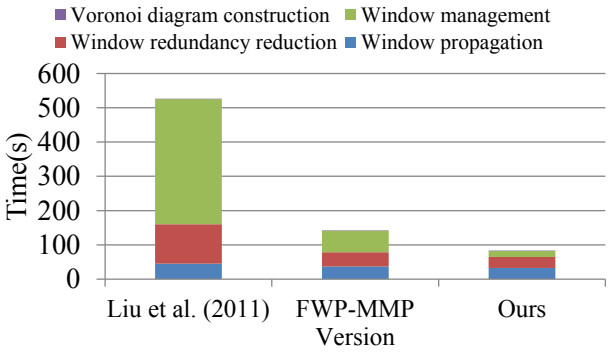
Pulley (F: 392K)



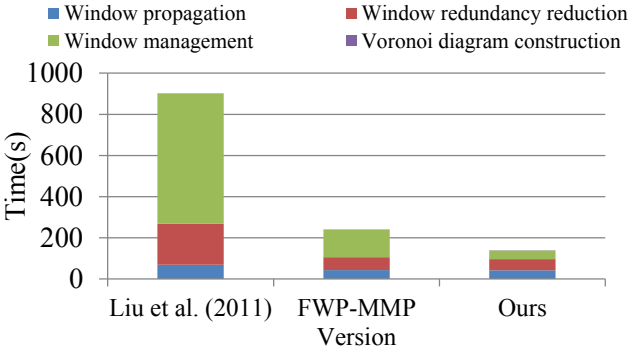
Rocker Arm (F: 482K)



IsidoreHorse (F: 2M)



Happy Buddha (F: 2.6M)



Neptune (F: 4M)

References

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