

# Image Perforation: Automatically Accelerating Image Pipelines by Intelligently Skipping Samples

LIMING LOU<sup>1,2</sup>

PAUL NGUYEN<sup>2</sup>

<sup>1</sup>Shandong University

JASON LAWRENCE<sup>2</sup>

<sup>2</sup>University of Virginia

CONNELLY BARNES<sup>2</sup>

Here we present additional results for our method of image perforation. On subsequent pages, we show the performance of the variant programs synthesized by our genetic algorithm for each of our applications (artistic blur, bilateral filter, bilateral grid, blur, unsharp mask) on select images from our benchmark. These images were chosen in a manner that adequately sample the image content categories (man-made, natural, people) and textureness. All images have resolution 820x614.

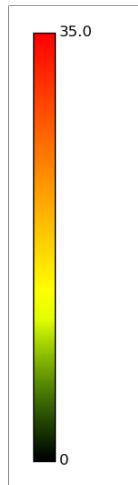
On each of the following pages, for a target speedup and benchmark image, we show the performance of a variant found by our genetic algorithm using loop perforation and a variant found using image perforation that have a runtime that corresponds with the target speedup for the selected benchmark image. The genetic algorithm operated with a population size of 100 for 200 generations with a tournament size of 2. The variant for each application for each target speed up is the variant found whose mean speedup when run on our entire test set is closest to our target speedup.

Notice that the images produced by image perforation program variants typically yield smaller total errors and produce images where the error is distributed over the image. Thus, these differences are less visible to the human eye. We have empirically found that mean LAB distances greater than 10 are intolerable. For most applications, our genetic algorithm is capable of finding variants with speedup factors for very most desirable target speedups. However, for some applications, e.g. bilateral grid, our genetic search is incapable of finding speedups beyond a certain point. Nevertheless, for these applications our image perforation genetic algorithm is capable of finding variants that have a smaller error than those found by the loop perforation genetic algorithm.

The images are compacted to fit in the page. Thus, zooming in with an appropriate document viewer will enhance the detail of the images displayed.

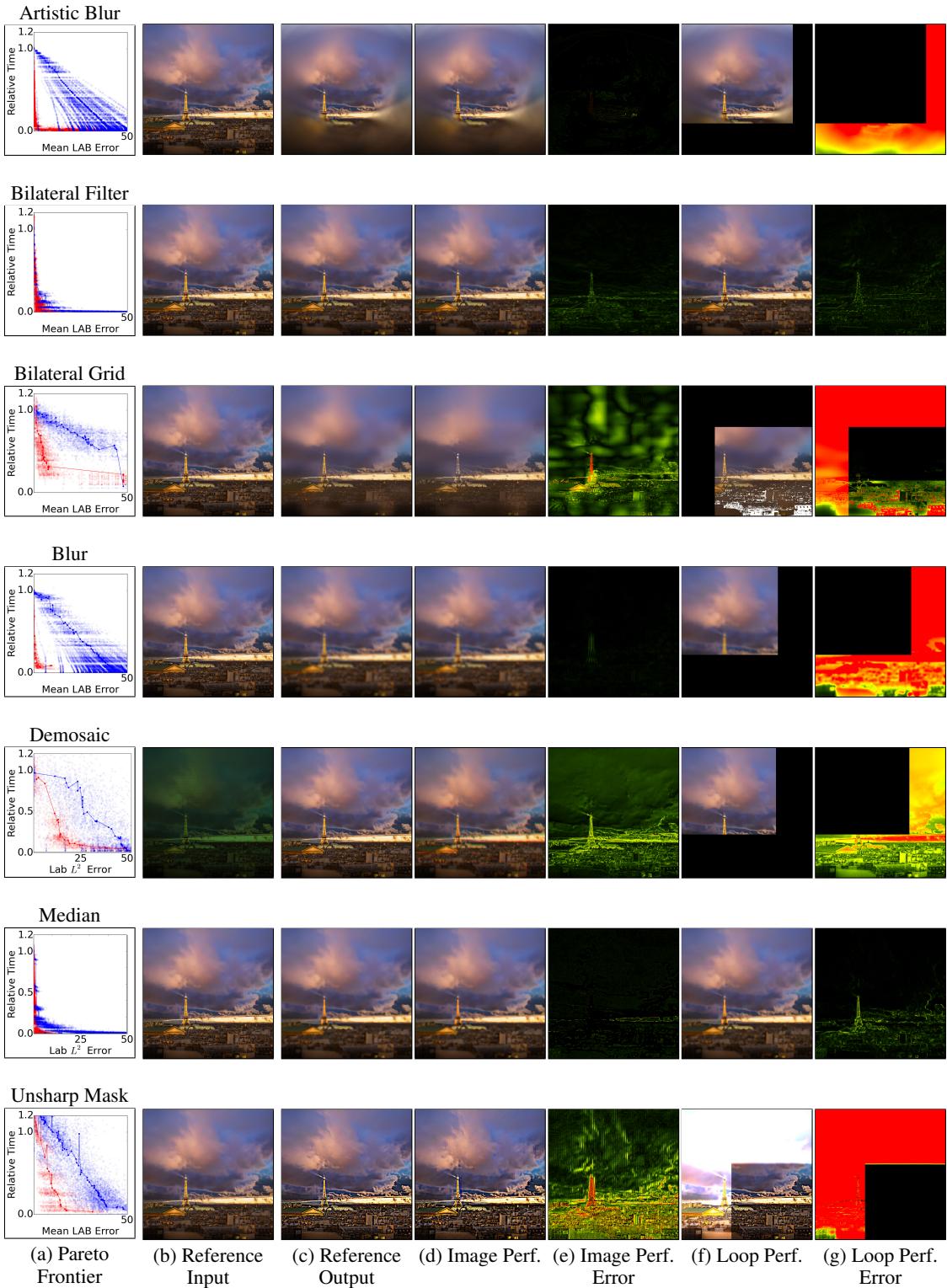
Our error visualizations use the false coloring shown in Figure 1.

Credits for all figures in the order of every five pages: Trey Ratcliff; iivangm; Neal Fowler; Trey Ratcliff; Charles Roffey.



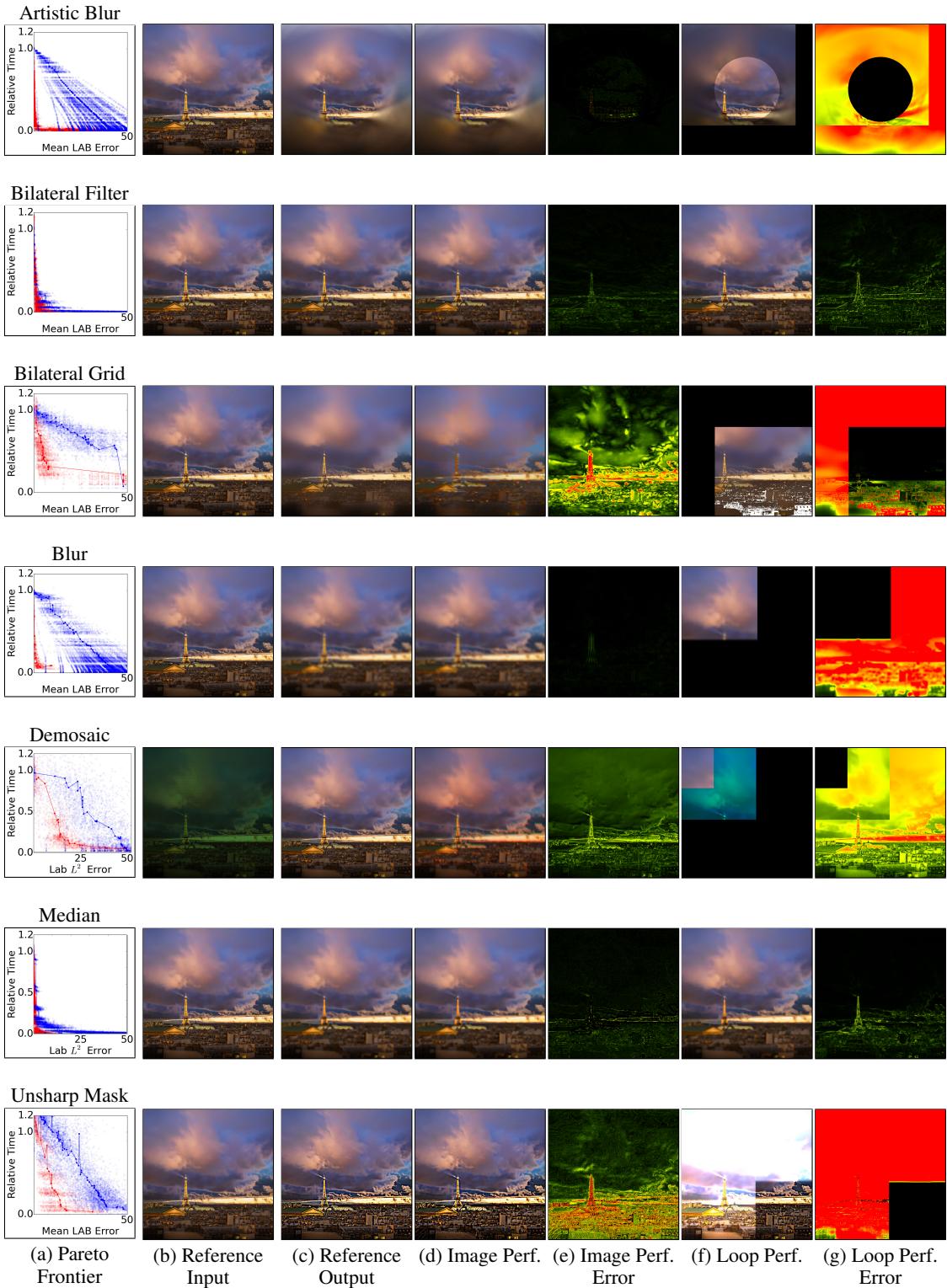
**Figure 1:** Our false coloring.

Target Speedup: 2.0



Application	Target Speed Up	Image Perforation Speed Up	Loop Perforation Speed Up	Image Perforation Mean LAB Distance	Loop Perforation Mean LAB Distance
Artistic Blur	2.0×	1.75×	2.01×	0.16	14.01
Bilateral Filter	2.0×	2.27×	2.13×	0.61	0.63
Bilateral Grid	2.0×	1.32×	2.14×	2.92	28.97
Blur	2.0×	3.22×	2.04×	0.25	18.61
Demosaic	2.0×	2.12×	2.16×	7.94	19.95
Median	2.0×	1.99×	1.92×	0.25	0.9
Unsharp Mask	2.0×	2.11×	1.84×	4.76	33.35

Target Speedup:3.0



Application	Target Speed Up	Image Perforation Speed Up	Loop Perforation Speed Up	Image Perforation Mean LAB Distance	Loop Perforation Mean LAB Distance
Artistic Blur	3.0×	2.29×	3.03×	0.24	21.60
Bilateral Filter	3.0×	2.48×	2.65×	0.63	0.97
Bilateral Grid	3.0×	1.91×	2.14×	5.47	28.97
Blur	3.0×	3.22×	3.07×	0.25	24.13
Demosaic	3.0×	2.76×	3.3×	9.91	33.07
Median	3.0×	2.99×	3.23×	0.41	0.95
Unsharp Mask	3.0×	3.79×	2.57×	5.82	40.03

Target Speedup: 5.0

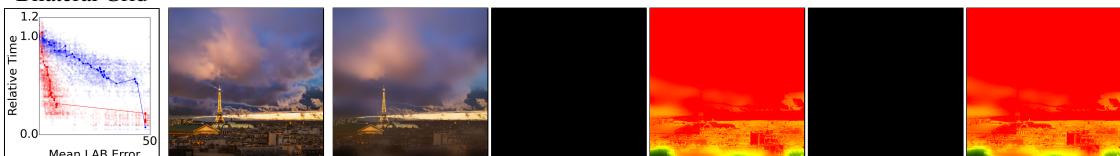
Artistic Blur



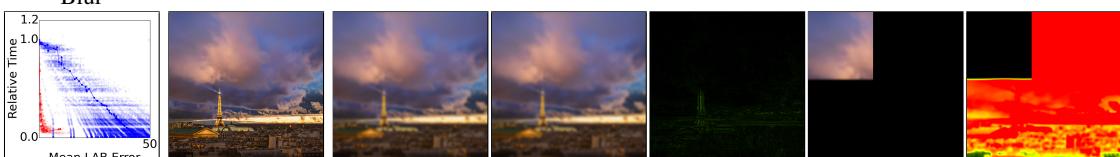
Bilateral Filter



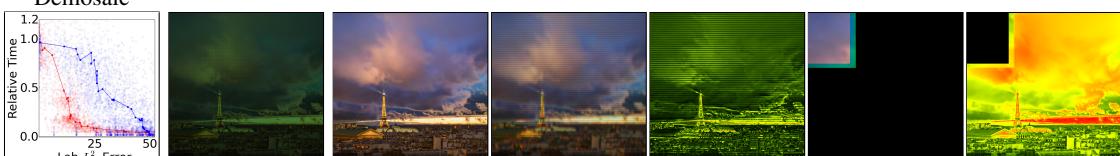
Bilateral Grid



Blur



Demosaic



Median



Unsharp Mask



(a) Pareto Frontier (b) Reference Input (c) Reference Output (d) Image Perf. (e) Image Perf. Error (f) Loop Perf. (g) Loop Perf. Error

Application	Target Speed Up	Image Perforation Speed Up	Loop Perforation Speed Up	Image Perforation Mean LAB Distance	Loop Perforation Mean LAB Distance
Artistic Blur	5.0×	4.41×	5.00×	0.23	26.25
Bilateral Filter	5.0×	3.97×	5.31×	0.78	4.64
Bilateral Grid	5.0×	4.07×	11.17×	39.74	39.74
Blur	5.0×	6.15×	5.09×	0.53	29.03
Demosaic	5.0×	4.8×	5.13×	10.43	34.53
Median	5.0×	5.04×	5.49×	0.61	1.59
Unsharp Mask	5.0×	6.98×	3.72×	8.12	45.73

*Target Speedup: 10.0*

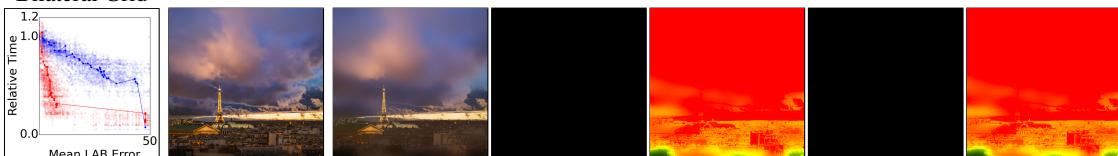
Artistic Blur



Bilateral Filter



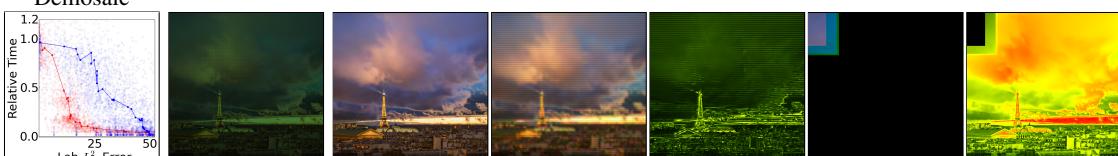
Bilateral Grid



Blur



Demosaic



Median



Unsharp Mask



(a) Pareto  
Frontier

(b) Reference  
Input

(c) Reference  
Output

(d) Image Perf.

(e) Image Perf.  
Error

(f) Loop Perf.

(g) Loop Perf.  
Error

Application	Target Speed Up	Image Perforation Speed Up	Loop Perforation Speed Up	Image Perforation Mean LAB Distance	Loop Perforation Mean LAB Distance
Artistic Blur	10.0×	9.25×	10.14×	0.34	31.04
Bilateral Filter	10.0×	9.04×	7.97×	1.58	6.32
Bilateral Grid	10.0×	5.97×	11.17×	39.76	39.74
Blur	10.0×	12.21×	9.80×	0.92	34.31
Demosaic	10.0×	9.53×	9.73×	15.64	37.36
Median	10.0×	8.46×	9.36×	0.97	3.74
Unsharp Mask	10.0×	12.58×	11.60×	8.53	47.94

Target Speedup: 2.0

Artistic Blur



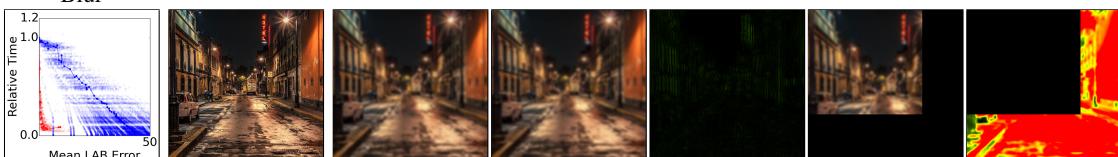
Bilateral Filter



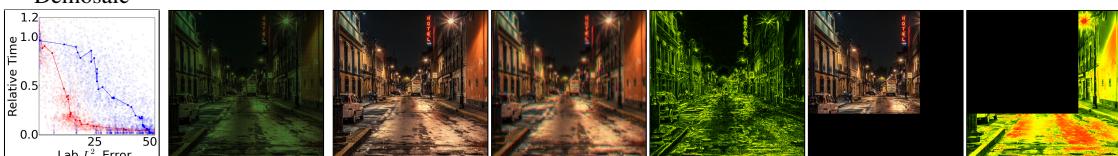
Bilateral Grid



Blur



Demosaic



Median



Unsharp Mask



(a) Pareto  
Frontier

(b) Reference  
Input

(c) Reference  
Output

(d) Image Perf.  
Speed Up

(e) Image Perf.  
Error

(f) Loop Perf.  
Speed Up

(g) Loop Perf.  
Error

Application	Target Speed Up	Image Perforation Speed Up	Loop Perforation Speed Up	Image Perforation Mean LAB Distance	Loop Perforation Mean LAB Distance
Artistic Blur	2.0×	1.79×	2.01×	0.29	17.21
Bilateral Filter	2.0×	2.18×	1.94×	0.92	0.87
Bilateral Grid	2.0×	1.70×	1.86×	6.37	20.16
Blur	2.0×	2.90×	2.04×	0.45	20.15
Demosaic	2.0×	2.12×	2.16×	9.67	21.41
Median	2.0×	1.99×	1.92×	0.49	2.09
Unsharp Mask	2.0×	2.13×	2.10×	10.61	23.89

Target Speedup:3.0

Artistic Blur



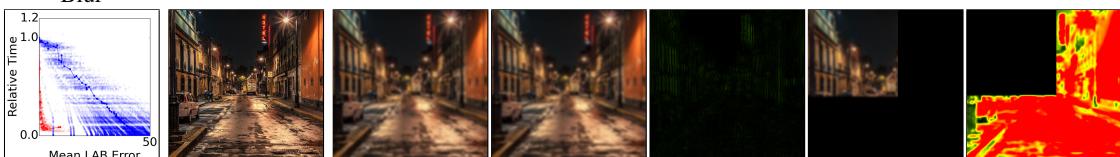
Bilateral Filter



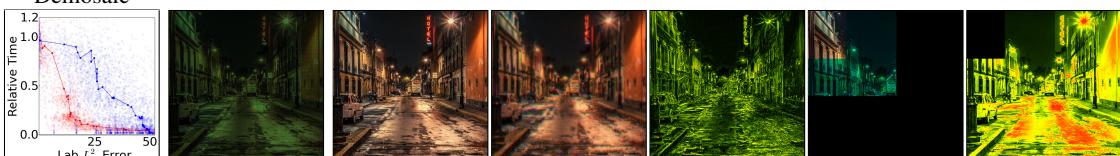
Bilateral Grid



Blur



Demosaic



Median



Unsharp Mask



(a) Pareto  
Frontier

(b) Reference  
Input

(c) Reference  
Output

(d) Image Perf.  
Speed Up

(e) Image Perf.  
Error

(f) Loop Perf.  
Speed Up

(g) Loop Perf.  
Error

Application	Target Speed Up	Image Performance Speed Up	Loop Performance Speed Up	Image Perforation Mean LAB Distance	Loop Perforation Mean LAB Distance
Artistic Blur	3.0×	2.71×	3.02×	0.47	21.01
Bilateral Filter	3.0×	2.38×	2.67×	0.92	1.42
Bilateral Grid	3.0×	2.40×	1.86×	10.34	20.16
Blur	3.0×	2.90×	3.06×	0.45	24.67
Demosaic	3.0×	2.76×	3.3×	10.5	30.27
Median	3.0×	2.99×	3.23×	0.81	2.39
Unsharp Mask	3.0×	3.91×	3.02×	12.74	30.39

Target Speedup: 5.0

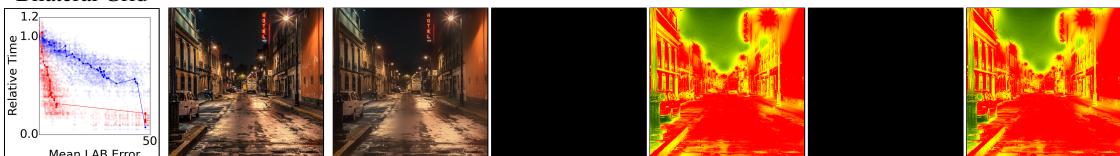
Artistic Blur



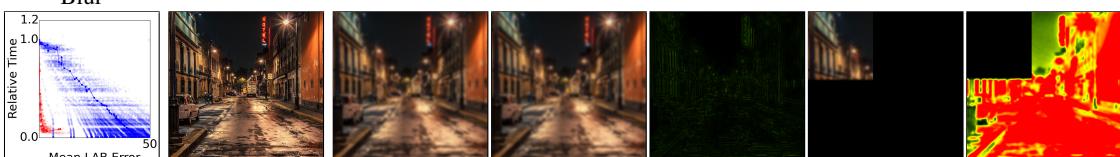
Bilateral Filter



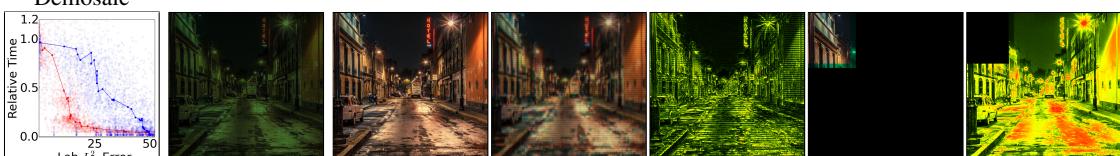
Bilateral Grid



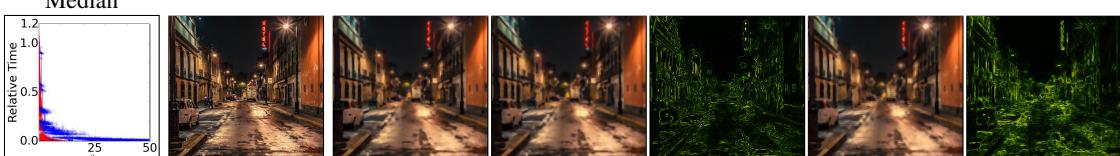
Blur



Demosaic



Median



Unsharp Mask



(a) Pareto  
Frontier

(b) Reference  
Input

(c) Reference  
Output

(d) Image Perf.  
Speed Up

(e) Image Perf.  
Error

(f) Loop Perf.  
Speed Up

(g) Loop Perf.  
Error

Application	Target Speed Up	Image Perforation Speed Up	Loop Perforation Speed Up	Image Perforation Mean LAB Distance	Loop Perforation Mean LAB Distance
Artistic Blur	5.0×	6.16×	5.01×	0.45	24.15
Bilateral Filter	5.0×	4.03×	4.52×	1.65	4.42
Bilateral Grid	5.0×	3.78×	10.77×	32.49	32.49
Blur	5.0×	5.60×	5.02×	0.70	27.25
Demosaic	5.0×	4.8×	5.13×	12.23	30.07
Median	5.0×	5.04×	5.49×	1.32	3.29
Unsharp Mask	5.0×	7.19×	4.52×	18.38	36.33

Target Speedup: 10.0

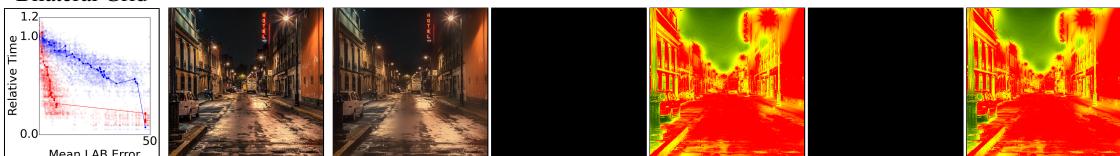
Artistic Blur



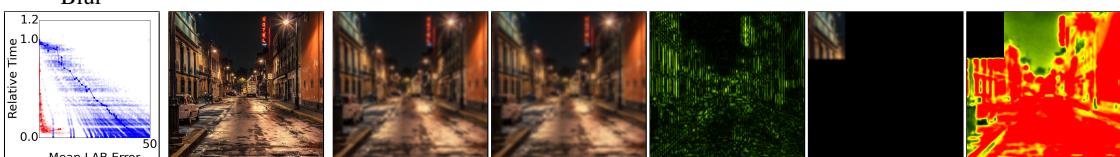
Bilateral Filter



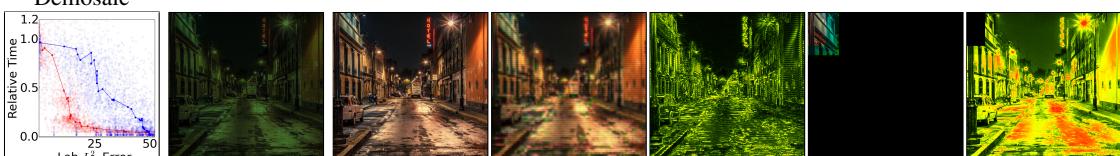
Bilateral Grid



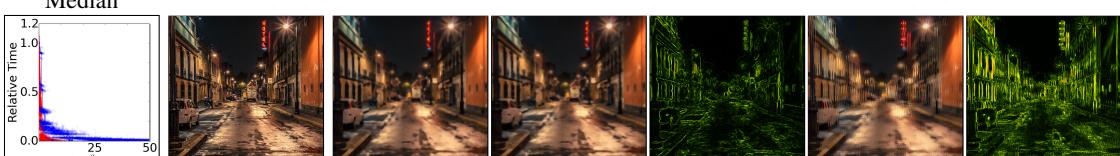
Blur



Demosaic



Median



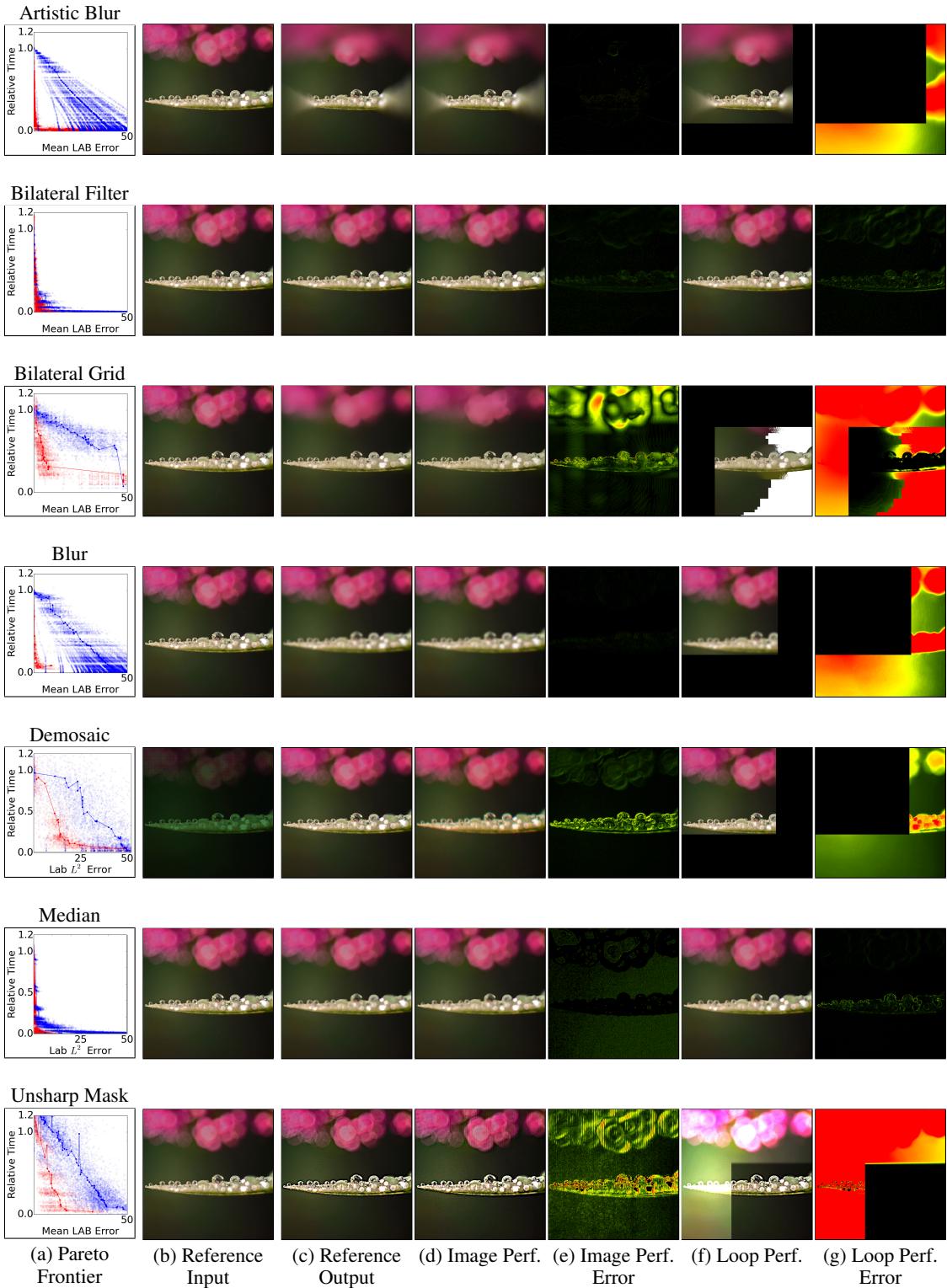
Unsharp Mask



(a) Pareto Frontier  
(b) Reference Input  
(c) Reference Output  
(d) Image Perf.  
(e) Image Perf.  
(f) Loop Perf.  
(g) Loop Perf.  
Frontier  
Input  
Output  
Error  
Error  
Error

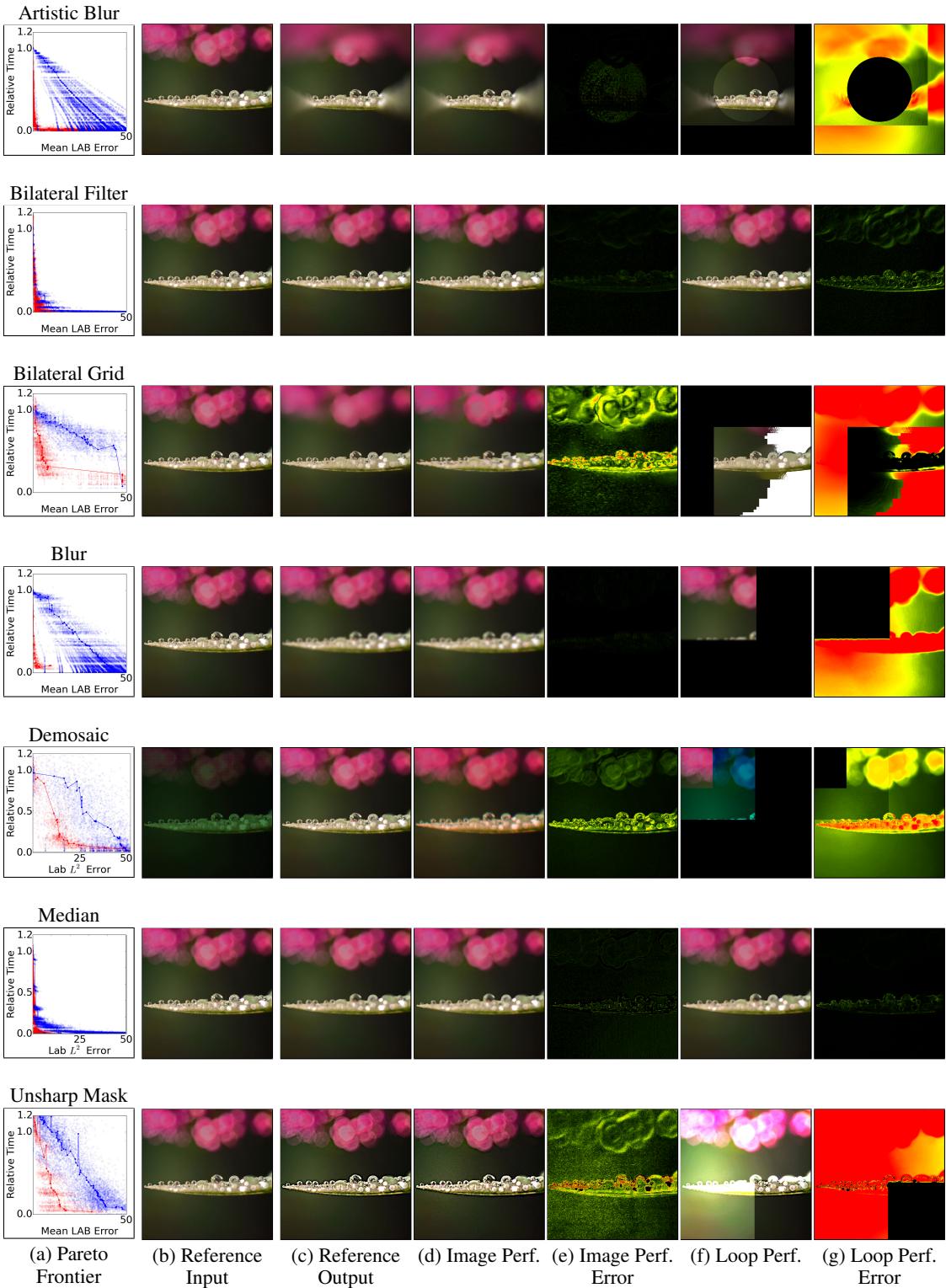
Application	Target Speed Up	Image Perforation Speed Up	Loop Perforation Speed Up	Image Perforation Mean LAB Distance	Loop Perforation Mean LAB Distance
Artistic Blur	10.0×	13.33×	10.18×	0.62	26.28
Bilateral Filter	10.0×	9.00×	9.22×	2.85	6.69
Bilateral Grid	10.0×	6.52×	10.77×	32.49	32.49
Blur	10.0×	11.24×	9.79×	1.59	29.48
Demosaic	10.0×	9.53×	9.73×	14.22	31.76
Median	10.0×	8.46×	9.36×	1.88	7.46
Unsharp Mask	10.0×	11.68×	8.28×	18.81	39.64

Target Speedup: 2.0



Application	Target Speed Up	Image Perforation Speed Up	Loop Perforation Speed Up	Image Perforation Mean LAB Distance	Loop Perforation Mean LAB Distance
Artistic Blur	2.0×	1.86×	2.02×	0.09	8.43
Bilateral Filter	2.0×	1.83×	1.98×	0.39	0.46
Bilateral Grid	2.0×	1.32×	1.71×	2.96	39.83
Blur	2.0×	3.36×	2.04×	0.14	10.81
Demosaic	2.0×	2.12×	2.16×	4.03	11.79
Median	2.0×	1.99×	1.92×	0.26	0.52
Unsharp Mask	2.0×	2.03×	1.85×	3.43	28.06

Target Speedup:3.0



Application	Target Speed Up	Image Perforation Speed Up	Loop Perforation Speed Up	Image Perforation Mean LAB Distance	Loop Perforation Mean LAB Distance
Artistic Blur	3.0×	2.64×	3.03×	0.19	14.41
Bilateral Filter	3.0×	3.13×	2.62×	0.40	0.73
Bilateral Grid	3.0×	2.08×	1.71×	3.63	39.83
Blur	3.0×	3.36×	3.07×	0.14	16.83
Demosaic	3.0×	2.76×	3.3×	5.92	23.89
Median	3.0×	2.99×	3.23×	0.32	0.54
Unsharp Mask	3.0×	1.93×	2.71×	3.72	33.03

Target Speedup: 5.0

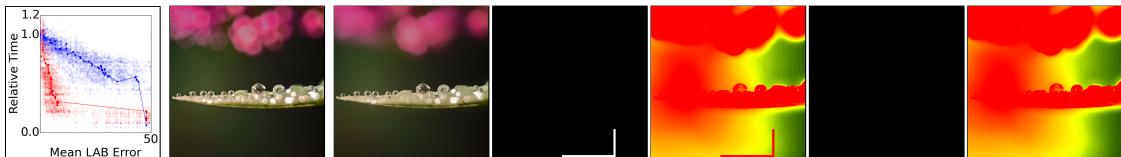
Artistic Blur



Bilateral Filter



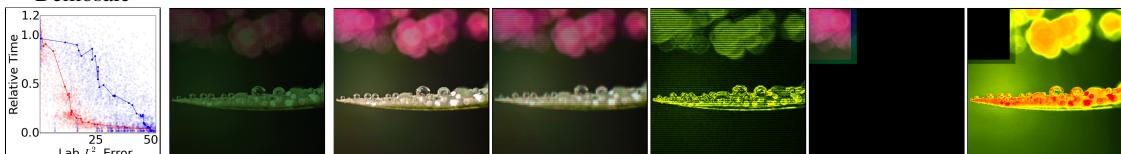
Bilateral Grid



Blur



Demosaic



Median



Unsharp Mask



(a) Pareto Frontier (b) Reference Input (c) Reference Output (d) Image Perf. (e) Image Perf. (f) Loop Perf. (g) Loop Perf.  
Frontier Input Output Error Error Error Error

Application	Target Speed Up	Image Perforation Speed Up	Loop Perforation Speed Up	Image Perforation Mean LAB Distance	Loop Perforation Mean LAB Distance
Artistic Blur	5.0×	4.02×	4.97×	0.18	18.29
Bilateral Filter	5.0×	5.42×	4.49×	0.48	3.75
Bilateral Grid	5.0×	2.63×	9.68×	31.16	29.73
Blur	5.0×	5.64×	5.13×	0.37	21.24
Demosaic	5.0×	4.8×	5.13×	6.84	24.78
Median	5.0×	5.04×	5.49×	0.42	0.81
Unsharp Mask	5.0×	6.70×	4.61×	4.94	37.02

Target Speedup: 10.0

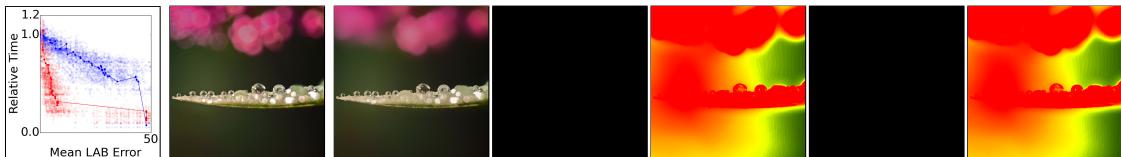
Artistic Blur



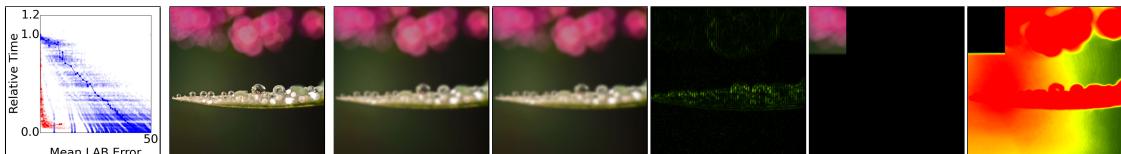
Bilateral Filter



Bilateral Grid



Blur



Demosaic



Median



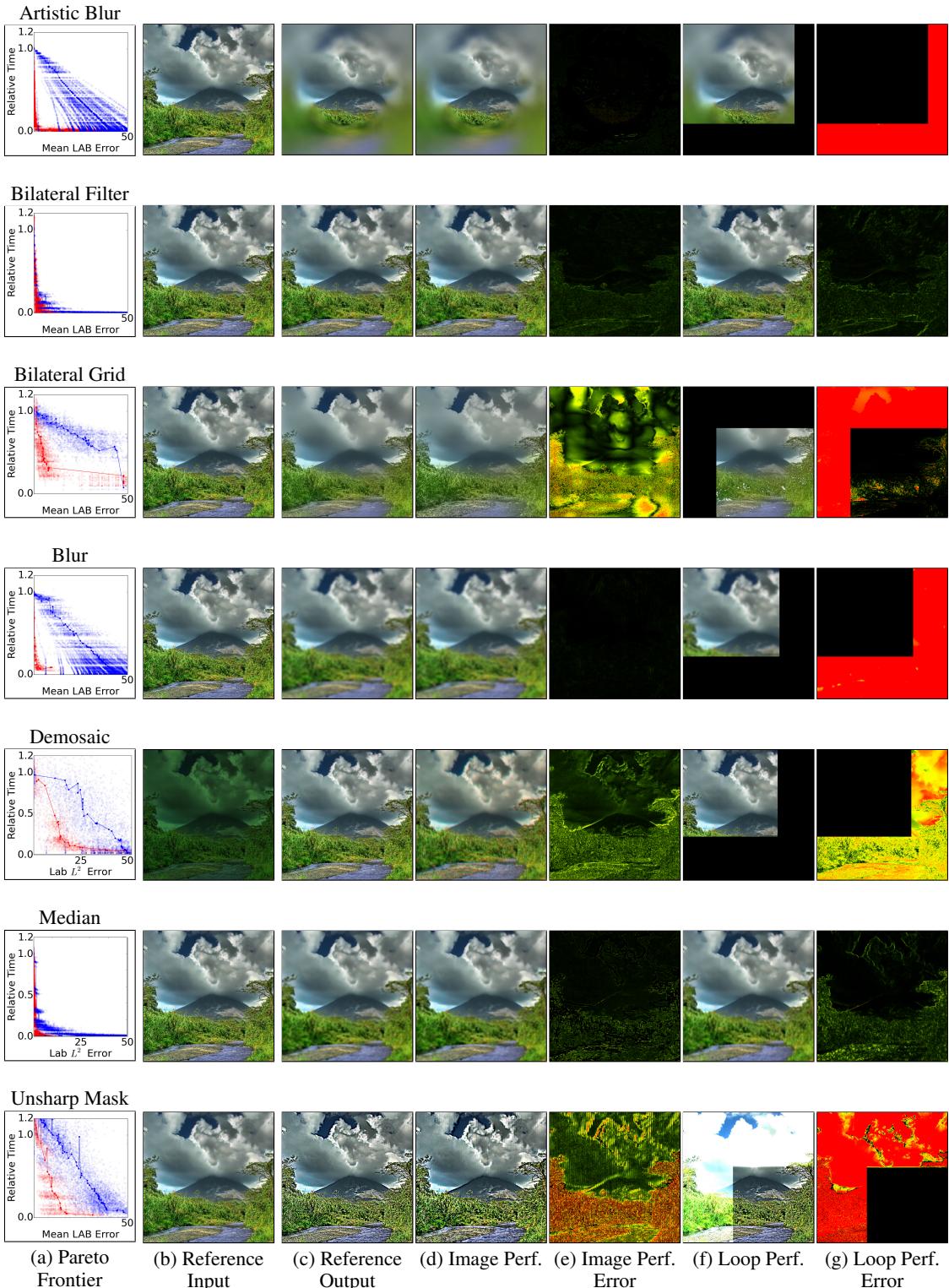
Unsharp Mask



(a) Pareto Frontier (b) Reference Input (c) Reference Output (d) Image Perf. (e) Image Perf. (f) Loop Perf. (g) Loop Perf.  
Frontier Input Output Error Error Error Error

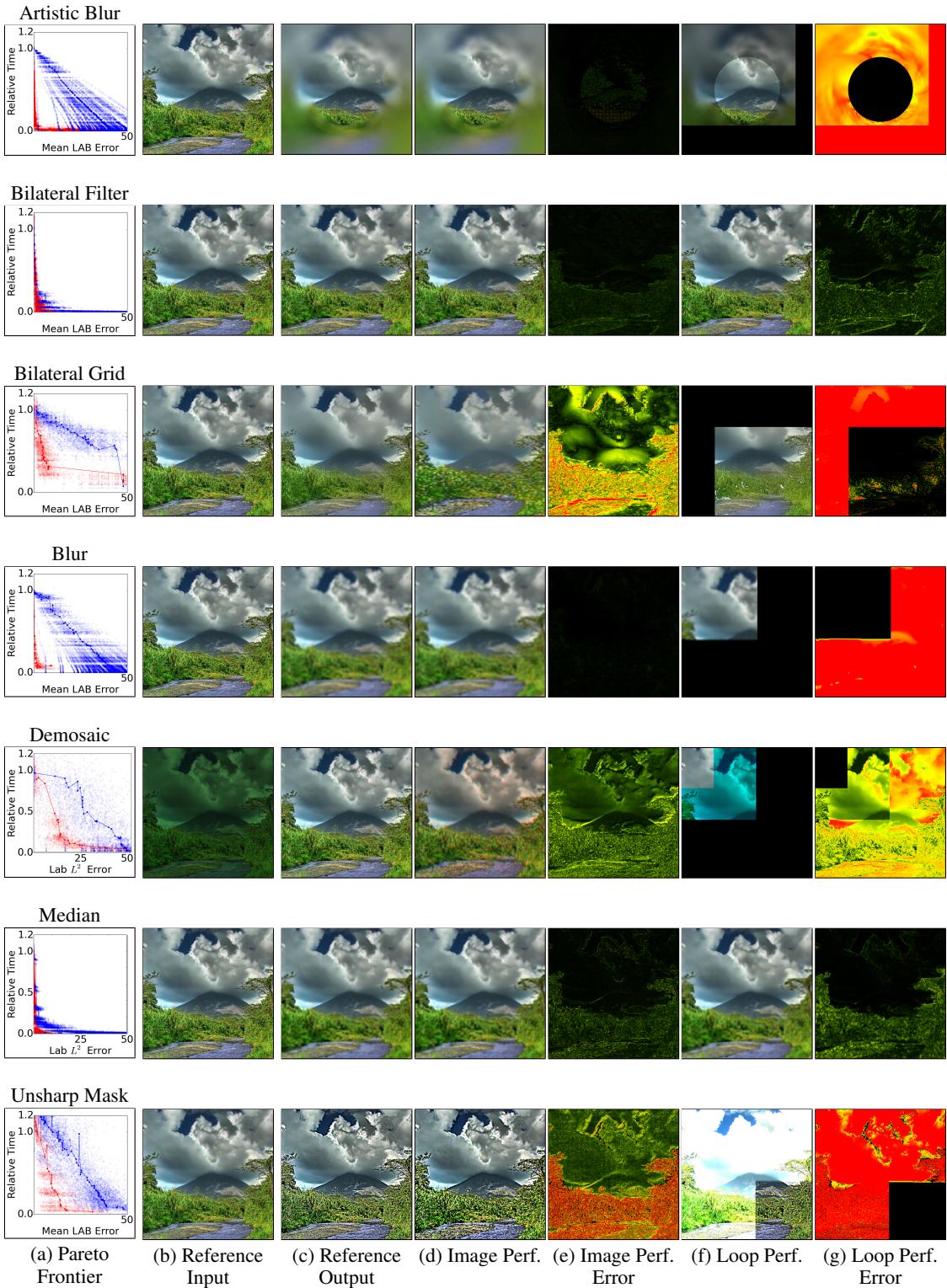
Application	Target Speed Up	Image Perforation Speed Up	Loop Perforation Speed Up	Image Perforation Mean LAB Distance	Loop Perforation Mean LAB Distance
Artistic Blur	10.0×	7.09×	9.99×	0.29	21.88
Bilateral Filter	10.0×	11.74×	8.01×	1.07	5.02
Bilateral Grid	10.0×	5.40×	9.68×	29.73	29.73
Blur	10.0×	10.00×	9.83×	0.61	24.59
Demosaic	10.0×	9.53×	9.73×	8.34	27.41
Median	10.0×	8.46×	9.36×	0.61	2.6
Unsharp Mask	10.0×	11.99×	12.29×	5.49	37.83

Target Speedup: 2.0



Application	Target Speed Up	Image Perforation Speed Up	Loop Perforation Speed Up	Image Perforation Mean LAB Distance	Loop Perforation Mean LAB Distance
Artistic Blur	2.0×	1.71×	2.01×	0.24	25.50
Bilateral Filter	2.0×	2.27×	1.88×	1.02	1.01
Bilateral Grid	2.0×	1.41×	2.07×	7.51	32.28
Blur	2.0×	3.23×	2.03×	0.48	31.11
Demosaic	2.0×	2.12×	2.16×	13.6	33.58
Median	2.0×	1.99×	1.92×	0.56	2.26
Unsharp Mask	2.0×	2.12×	2.02×	12.69	30.55

Target Speedup:3.0



Application	Target Speed Up	Image Perforation Speed Up	Loop Perforation Speed Up	Image Perforation Mean LAB Distance	Loop Perforation Mean LAB Distance
Artistic Blur	3.0×	2.06×	3.03×	0.42	33.71
Bilateral Filter	3.0×	2.53×	3.01×	1.04	1.63
Bilateral Grid	3.0×	2.31×	2.07×	10.82	32.28
Blur	3.0×	3.23×	3.04×	0.48	38.37
Demosaic	3.0×	2.76×	3.3×	15.54	45.21
Median	3.0×	2.99×	3.23×	0.85	2.75
Unsharp Mask	3.0×	3.85×	1.99×	16.35	37.41

Target Speedup: 5.0

Artistic Blur



Bilateral Filter



Bilateral Grid



Blur



Demosaic



Median



Unsharp Mask



(a) Pareto  
Frontier

(b) Reference  
Input

(c) Reference  
Output

(d) Image Perf.

(e) Image Perf.  
Error

(f) Loop Perf.

(g) Loop Perf.  
Error

Application	Target Speed Up	Image Performance Speed Up	Loop Performance Speed Up	Image Perforation Mean LAB Distance	Loop Perforation Mean LAB Distance
Artistic Blur	5.0×	5.83×	4.99×	0.41	40.35
Bilateral Filter	5.0×	3.92×	4.48×	1.61	7.06
Bilateral Grid	5.0×	4.20×	10.77×	57.17	57.17
Blur	5.0×	5.41×	5.04×	0.89	44.31
Demosaic	5.0×	4.8×	5.13×	14.75	50.04
Median	5.0×	5.04×	5.49×	1.28	4.01
Unsharp Mask	5.0×	6.75×	4.31×	23.24	44.60

*Target Speedup: 10.0*

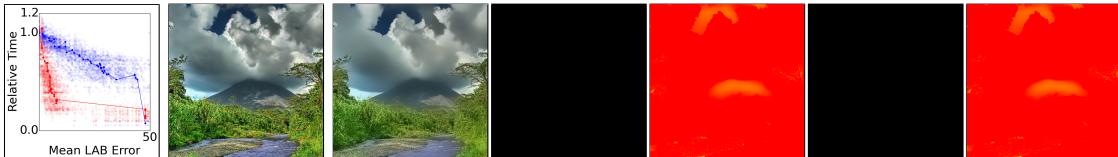
Artistic Blur



Bilateral Filter



Bilateral Grid



Blur



Demosaic



Median



Unsharp Mask



(a) Pareto  
Frontier

(b) Reference  
Input

(c) Reference  
Output

(d) Image Perf.  
Speed Up

(e) Image Perf.  
Error

(f) Loop Perf.  
Speed Up

(g) Loop Perf.  
Error

Application	Target Speed Up	Image Performance Speed Up	Loop Performance Speed Up	Image Perforation Mean LAB Distance	Loop Perforation Mean LAB Distance
Artistic Blur	10.0×	9.54×	10.15×	0.54	45.25
Bilateral Filter	10.0×	8.32×	9.09×	3.21	9.76
Bilateral Grid	10.0×	6.38×	10.77×	57.17	57.17
Blur	10.0×	11.79×	9.77×	1.69	49.34
Demosaic	10.0×	9.53×	9.73×	20.11	53.68
Median	10.0×	8.46×	9.36×	1.79	8.54
Unsharp Mask	10.0×	12.76×	11.54×	23.59	49.30

*Target Speedup: 2.0*

Artistic Blur



Bilateral Filter



Bilateral Grid



Blur



Demosaic



Median



Unsharp Mask



(a) Pareto  
Frontier

(b) Reference  
Input

(c) Reference  
Output

(d) Image Perf.

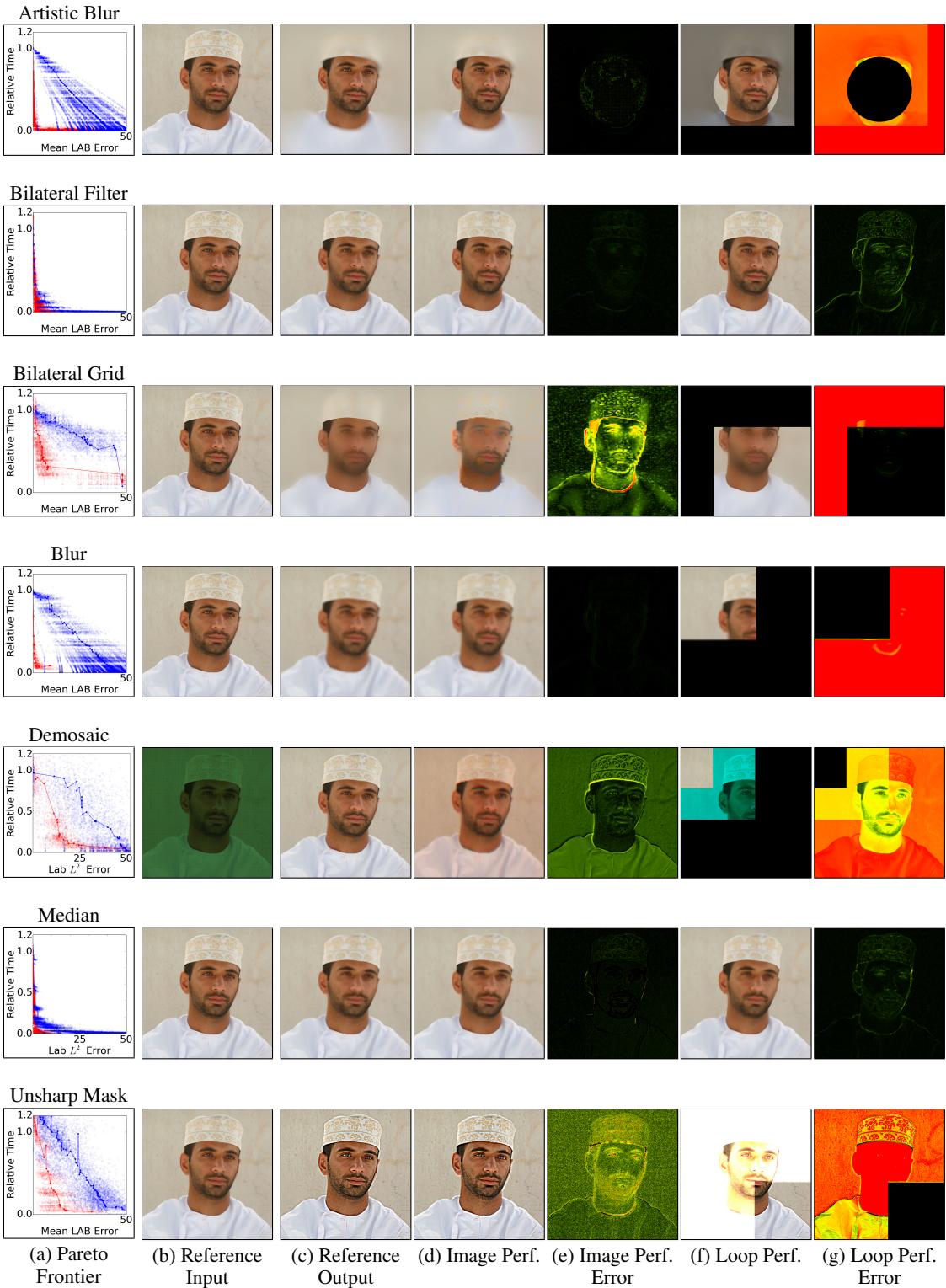
(e) Image Perf.  
Error

(f) Loop Perf.

(g) Loop Perf.  
Error

Application	Target Speed Up	Image Perforation Speed Up	Loop Perforation Speed Up	Image Perforation Mean LAB Distance	Loop Perforation Mean LAB Distance
Artistic Blur	2.0×	1.22×	2.01×	0.06	34.59
Bilateral Filter	2.0×	2.67×	2.14×	0.45	0.47
Bilateral Grid	2.0×	1.48×	1.87×	1.89	41.86
Blur	2.0×	2.90×	2.03×	0.38	40.58
Demosaic	2.0×	2.12×	2.16×	9.13	43.61
Median	2.0×	1.99×	1.92×	0.22	0.57
Unsharp Mask	2.0×	2.04×	1.82×	4.43	18.43

*Target Speedup:3.0*



Application	Target Speed Up	Image Perforation Speed Up	Loop Perforation Speed Up	Image Perforation Mean LAB Distance	Loop Perforation Mean LAB Distance
Artistic Blur	3.0×	3.35×	3.05×	0.16	45.05
Bilateral Filter	3.0×	2.87×	2.65×	0.45	0.71
Bilateral Grid	3.0×	2.62×	1.87×	3.16	41.86
Blur	3.0×	2.90×	3.04×	0.38	49.19
Demosaic	3.0×	2.76×	3.3×	13.69	61.8
Median	3.0×	2.99×	3.23×	0.3	0.62
Unsharp Mask	3.0×	3.69×	2.50×	5.43	23.71

Target Speedup: 5.0

Artistic Blur



Bilateral Filter



Bilateral Grid



Blur



Demosaic



Median



Unsharp Mask



(a) Pareto Frontier (b) Reference Input (c) Reference Output (d) Image Perf. (e) Image Perf. (f) Loop Perf. (g) Loop Perf.  
Frontier Input Output Error Error Error Error

Application	Target Speed Up	Image Perforation Speed Up	Loop Perforation Speed Up	Image Perforation Mean LAB Distance	Loop Perforation Mean LAB Distance
Artistic Blur	5.0×	7.88×	4.98×	0.12	53.53
Bilateral Filter	5.0×	4.46×	4.50×	0.56	6.43
Bilateral Grid	5.0×	4.35×	10.67×	72.19	74.20
Blur	5.0×	5.59×	5.10×	0.76	56.85
Demosaic	5.0×	4.8×	5.13×	14.48	64.8
Median	5.0×	5.04×	5.49×	0.41	0.93
Unsharp Mask	5.0×	6.35×	3.85×	7.54	27.20

*Target Speedup: 10.0*

Artistic Blur



Bilateral Filter



Bilateral Grid



Blur



Demosaic



Median



Unsharp Mask



(a) Pareto  
Frontier

(b) Reference  
Input

(c) Reference  
Output

(d) Image Perf.

(e) Image Perf.  
Error

(f) Loop Perf.

(g) Loop Perf.  
Error

Application	Target Speed Up	Image Perforation Speed Up	Loop Perforation Speed Up	Image Perforation Mean LAB Distance	Loop Perforation Mean LAB Distance
Artistic Blur	10.0×	11.91×	10.09×	0.27	59.82
Bilateral Filter	10.0×	11.65×	7.97×	1.37	8.46
Bilateral Grid	10.0×	6.65×	10.67×	74.20	74.20
Blur	10.0×	12.19×	9.80×	1.22	63.64
Demosaic	10.0×	9.53×	9.73×	22.95	69.26
Median	10.0×	8.46×	9.36×	0.59	3.97
Unsharp Mask	10.0×	12.10×	6.63×	7.77	28.91

*Target Speedup: 2.0*

Artistic Blur



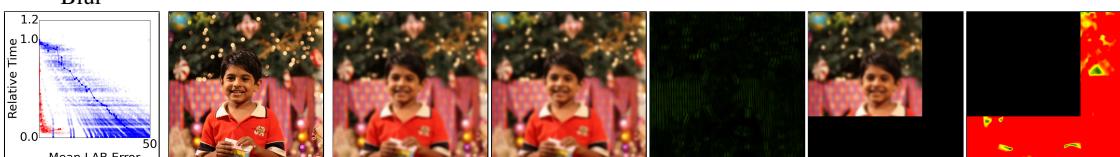
Bilateral Filter



Bilateral Grid



Blur



Demosaic



Median



Unsharp Mask



(a) Pareto  
Frontier

(b) Reference  
Input

(c) Reference  
Output

(d) Image Perf.  
Speed Up

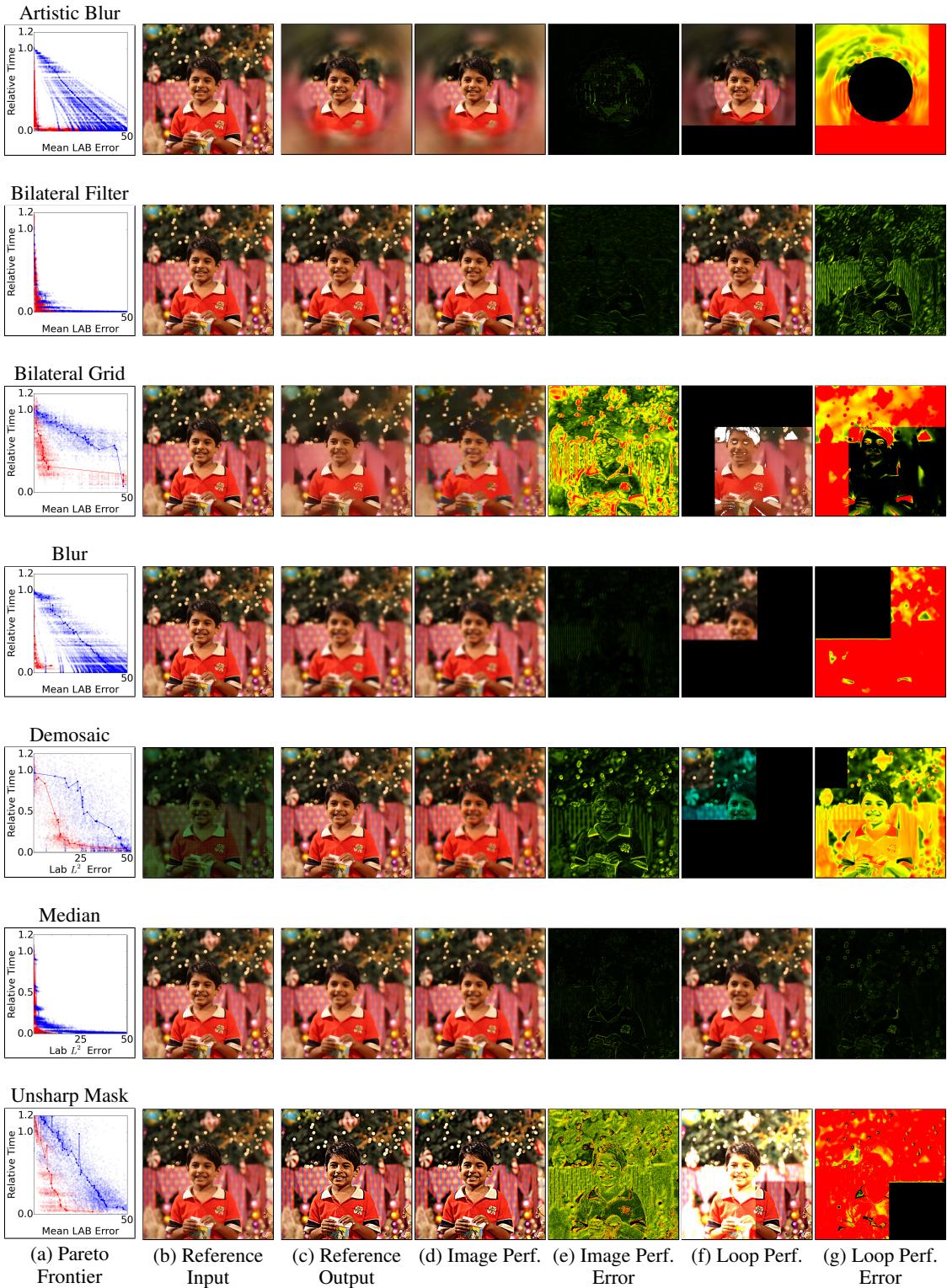
(e) Image Perf.  
Error

(f) Loop Perf.  
Speed Up

(g) Loop Perf.  
Error

Application	Target Speed Up	Image Perforation Speed Up	Loop Perforation Speed Up	Image Perforation Mean LAB Distance	Loop Perforation Mean LAB Distance
Artistic Blur	2.0×	1.75×	2.01×	0.20	30.09
Bilateral Filter	2.0×	2.44×	2.14×	0.79	1.28
Bilateral Grid	2.0×	1.48×	1.87×	7.41	27.39
Blur	2.0×	2.91×	2.04×	0.61	37.00
Demosaic	2.0×	2.12×	2.16×	8.06	39.93
Median	2.0×	1.99×	1.92×	0.43	1.61
Unsharp Mask	2.0×	2.10×	1.95×	8.96	29.31

Target Speedup:3.0



Application	Target Speed Up	Image Perforation Speed Up	Loop Perforation Speed Up	Image Perforation Mean LAB Distance	Loop Perforation Mean LAB Distance
Artistic Blur	3.0×	3.36×	3.06×	0.30	35.59
Bilateral Filter	3.0×	2.99×	2.65×	0.81	2.13
Bilateral Grid	3.0×	2.60×	1.87×	10.44	27.39
Blur	3.0×	2.91×	3.06×	0.61	44.22
Demosaic	3.0×	2.76×	3.3×	10.06	54.29
Median	3.0×	2.99×	3.23×	0.63	1.29
Unsharp Mask	3.0×	3.79×	2.88×	7.88	35.94

Target Speedup: 5.0

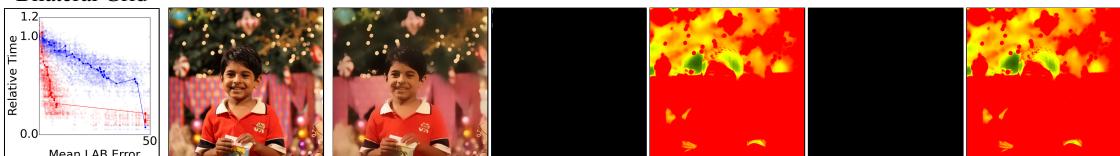
Artistic Blur



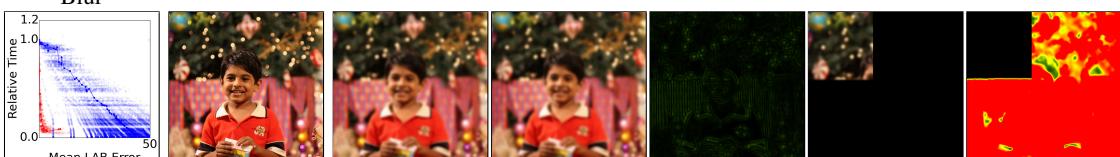
Bilateral Filter



Bilateral Grid



Blur



Demosaic



Median



Unsharp Mask



(a) Pareto  
Frontier

(b) Reference  
Input

(c) Reference  
Output

(d) Image Perf.  
Speed Up

(e) Image Perf.  
Error

(f) Loop Perf.  
Speed Up

(g) Loop Perf.  
Error

Application	Target Speed Up	Image Performance Speed Up	Loop Performance Speed Up	Image Perforation Mean LAB Distance	Loop Perforation Mean LAB Distance
Artistic Blur	5.0×	5.96×	4.96×	0.28	41.39
Bilateral Filter	5.0×	4.45×	4.51×	1.25	5.83
Bilateral Grid	5.0×	4.39×	10.73×	56.96	56.98
Blur	5.0×	6.15×	5.12×	1.01	49.83
Demosaic	5.0×	4.8×	5.13×	14.2	54.33
Median	5.0×	5.04×	5.49×	1.05	1.92
Unsharp Mask	5.0×	7.08×	4.23×	9.92	41.89

*Target Speedup: 10.0*

Artistic Blur



Bilateral Filter



Bilateral Grid



Blur



Demosaic



Median



Unsharp Mask



(a) Pareto  
Frontier

(b) Reference  
Input

(c) Reference  
Output

(d) Image Perf.  
Loop Perf.

(e) Image Perf.  
Error

(f) Loop Perf.  
Error

(g) Loop Perf.  
Error

Application	Target Speed Up	Image Perforation Speed Up	Loop Perforation Speed Up	Image Perforation Mean LAB Distance	Loop Perforation Mean LAB Distance
Artistic Blur	10.0×	11.57×	10.17×	0.52	44.35
Bilateral Filter	10.0×	10.20×	9.23×	2.69	8.24
Bilateral Grid	10.0×	7.59×	10.73×	57.01	56.98
Blur	10.0×	11.12×	9.85×	2.12	52.24
Demosaic	10.0×	9.53×	9.73×	15.44	55.86
Median	10.0×	8.46×	9.36×	1.75	6.95
Unsharp Mask	10.0×	12.67×	12.96×	11.83	45.37