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Gradient Domain Blending

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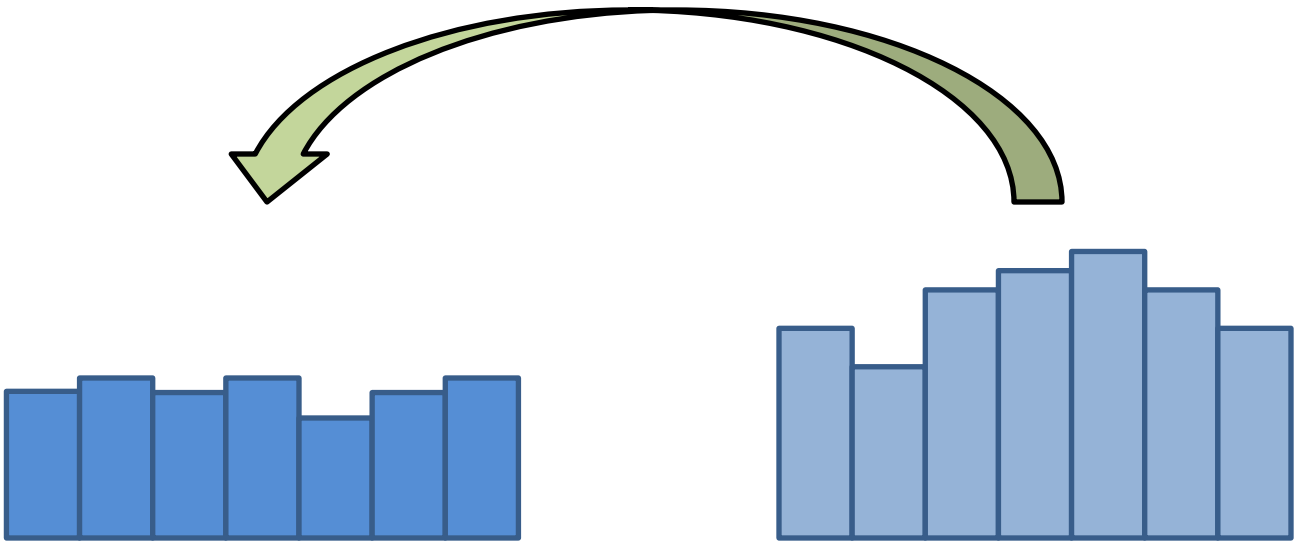
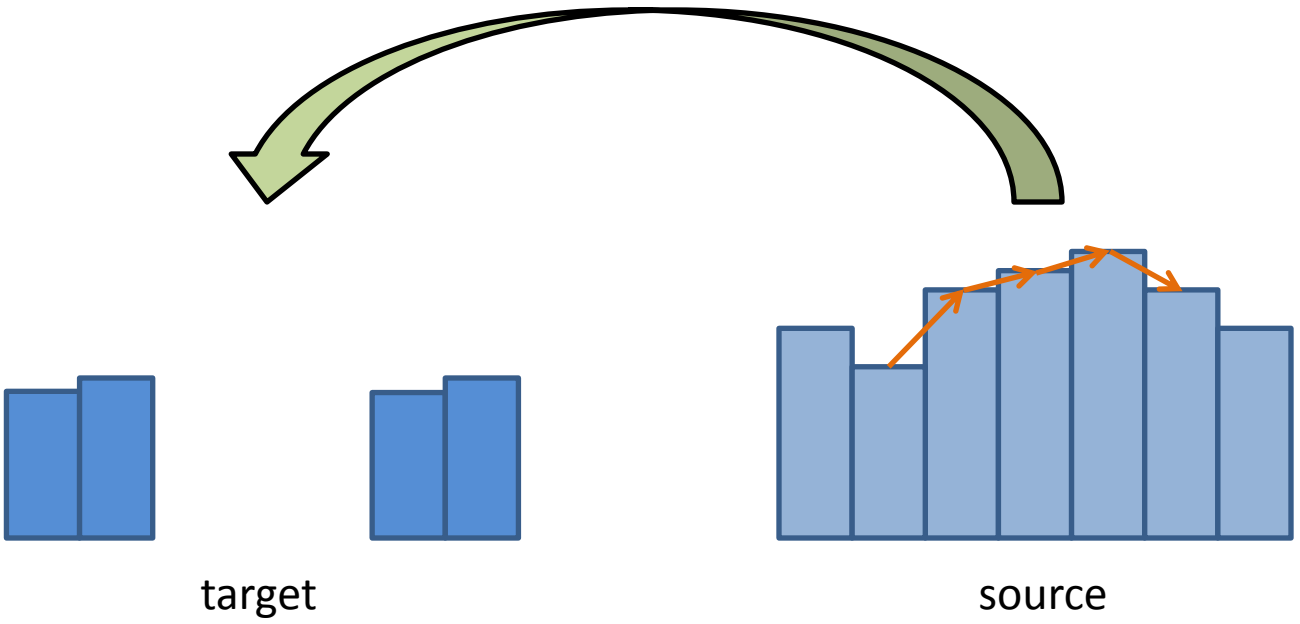
CS 129 Fall 2012


target
source



It is impossible to faithfully preserve the gradients

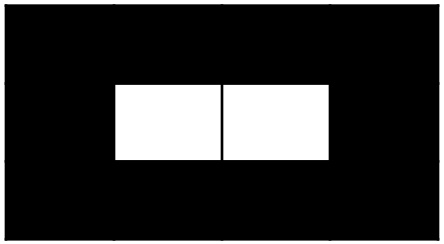
Simple 2d example

.2	.5	.2	.2
.7	.7	.7	.7
.9	.9	.8	.9

target, t

.8	.6	.6	.6
.6	.6	.2	.6
.6	.8	.6	.6

source, s



mask

?	?	?	?
?	?	?	?
?	?	?	?

output, x

What properties do we want x to have?

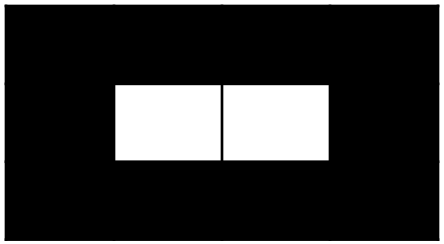
Simple 2d example

.2	.5	.2	.2
.7	.7	.7	.7
.9	.9	.8	.9

target, t

.8	.6	.6	.6
.6	.6	.2	.6
.6	.8	.6	.6

source, s



mask

?	?	?	?
?	?	?	?
?	?	?	?

output, x

(1) For unmasked pixels, $x_i = t_i$

(2) For masked pixels, we want the gradients at x_i to match the gradients at s_i

But how do we define the gradient? Instead of constraining one or many gradients, in this example we will use the Laplacian.

0	-1	0
-1	4	-1
0	-1	0

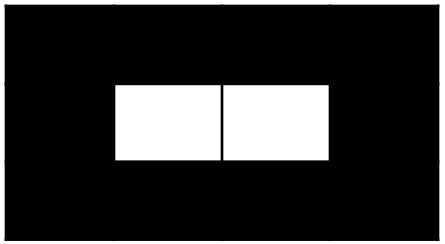
Simple 2d example

.2	.5	.2	.2
.7	.7	.7	.7
.9	.9	.8	.9

target, t

.8	.6	.6	.6
.6	.6	.2	.6
.6	.8	.6	.6

source, s



mask

0	-1	0
-1	4	-1
0	-1	0

Laplacian

?	?	?	?
?	?	?	?
?	?	?	?

output, x

1	4	7	10
2	5	8	11
3	6	9	12

Pixel indexing

$$x_1 = t_1$$
$$x_2 = t_2$$
$$x_3 = t_3$$
$$x_4 = t_4$$
$$4x_5 - x_4 - x_2 - x_6 - x_8 = 4s_5 - s_4 - s_2 - s_6 - s_8$$
$$x_6 = t_6$$
$$x_7 = t_7$$
$$4x_8 - x_7 - x_5 - x_9 - x_{11} = 4s_8 - s_7 - s_5 - s_9 - s_{11}$$
$$x_9 = t_9$$
$$x_{10} = t_{10}$$
$$x_{11} = t_{11}$$
$$x_{12} = t_{12}$$

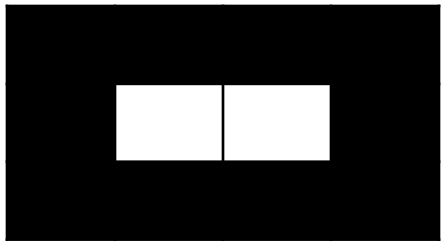
Simple 2d example

.2	.5	.2	.2
.7	.7	.7	.7
.9	.9	.8	.9

target, t

.8	.6	.6	.6
.6	.6	.2	.6
.6	.8	.6	.6

source, s



mask

0	-1	0
-1	4	-1
0	-1	0

Laplacian

?	?	?	?
?	?	?	?
?	?	?	?

output, x

1	4	7	10
2	5	8	11
3	6	9	12

Pixel indexing

$$x_1 = 0.2$$
$$x_2 = 0.7$$
$$x_3 = 0.9$$
$$x_4 = 0.5$$
$$4x_5 - x_4 - x_2 - x_6 - x_8 = 0.2$$
$$x_6 = 0.9$$
$$x_7 = 0.2$$
$$4x_8 - x_7 - x_5 - x_9 - x_{11} = -1.6$$
$$x_9 = 0.8$$
$$x_{10} = 0.2$$
$$x_{11} = 0.7$$
$$x_{12} = 0.9$$

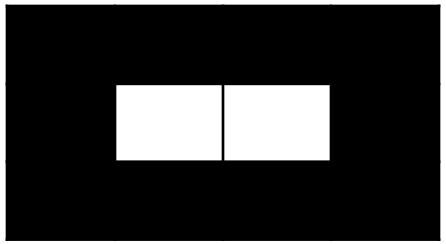
Simple 2d example

.2	.5	.2	.2
.7	.7	.7	.7
.9	.9	.8	.9

target, t

.8	.6	.6	.6
.6	.6	.2	.6
.6	.8	.6	.6

source, s



mask

0	-1	0
-1	4	-1
0	-1	0

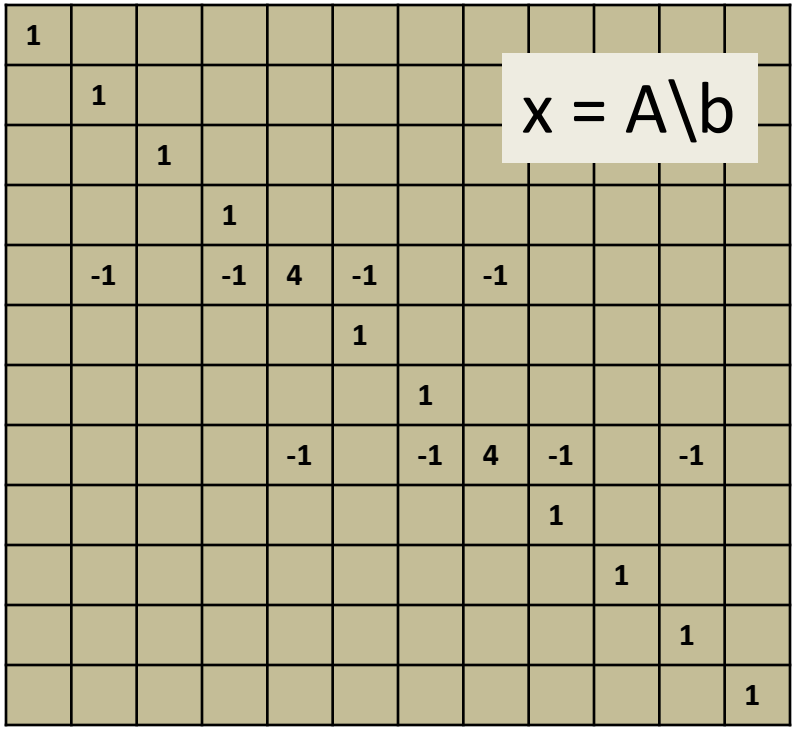
Laplacian

?	?	?	?
?	?	?	?
?	?	?	?

output, x

1	4	7	10
2	5	8	11
3	6	9	12

Pixel indexing



A

*

?
?
?
?
?
?
?
?
?
?
?
?

x

=

.2
.7
.9
.5
.2
.9
.2
-1.6
.8
.2
.7
.9

b

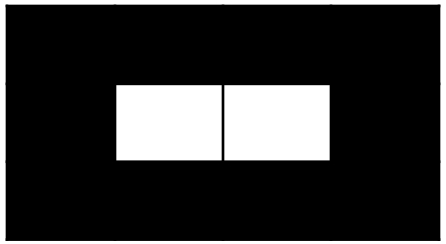
Simple 2d example

.2	.5	.2	.2
.7	.7	.7	.7
.9	.9	.8	.9

target, t

.8	.6	.6	.6
.6	.6	.2	.6
.6	.8	.6	.6

source, s



mask

0	-1	0
-1	4	-1
0	-1	0

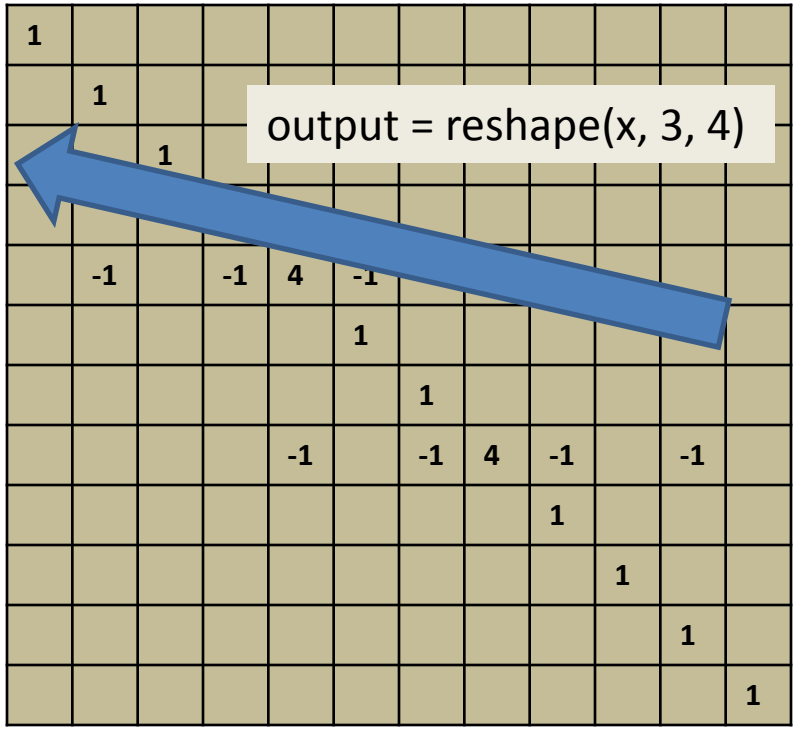
Laplacian

.2	.5	.2	.2
.7	.62	.18	.7
.9	.9	.8	.9

output, x

1	4	7	10
2	5	8	11
3	6	9	12

Pixel indexing



A

*

.2
.7
.9
.5
.62
.9
.2
.18
.8
.2
.7
.9

x

=

.2
.7
.9
.5
.2
.9
.2
-1.6
.8
.2
.7
.9

b

target

source

mask

no blending

gradient domain blending

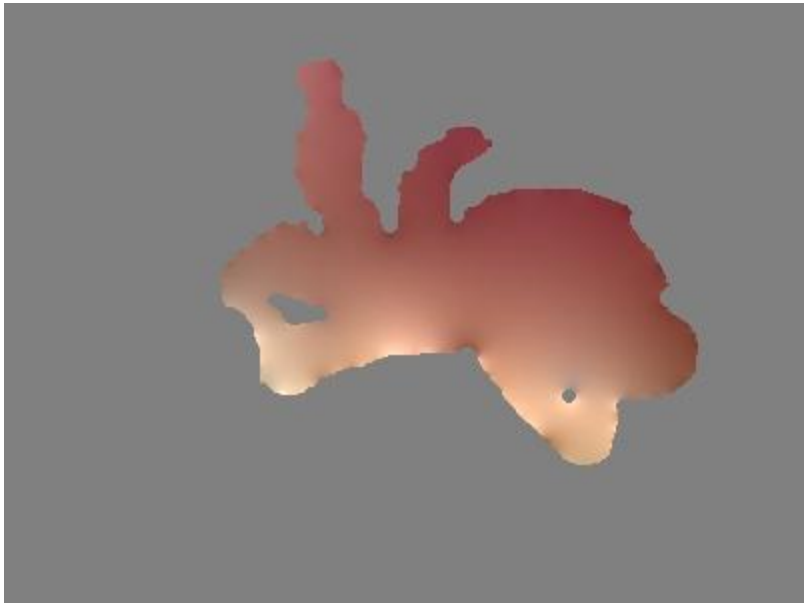
What's the difference?

gradient domain blending

-

no blending

=



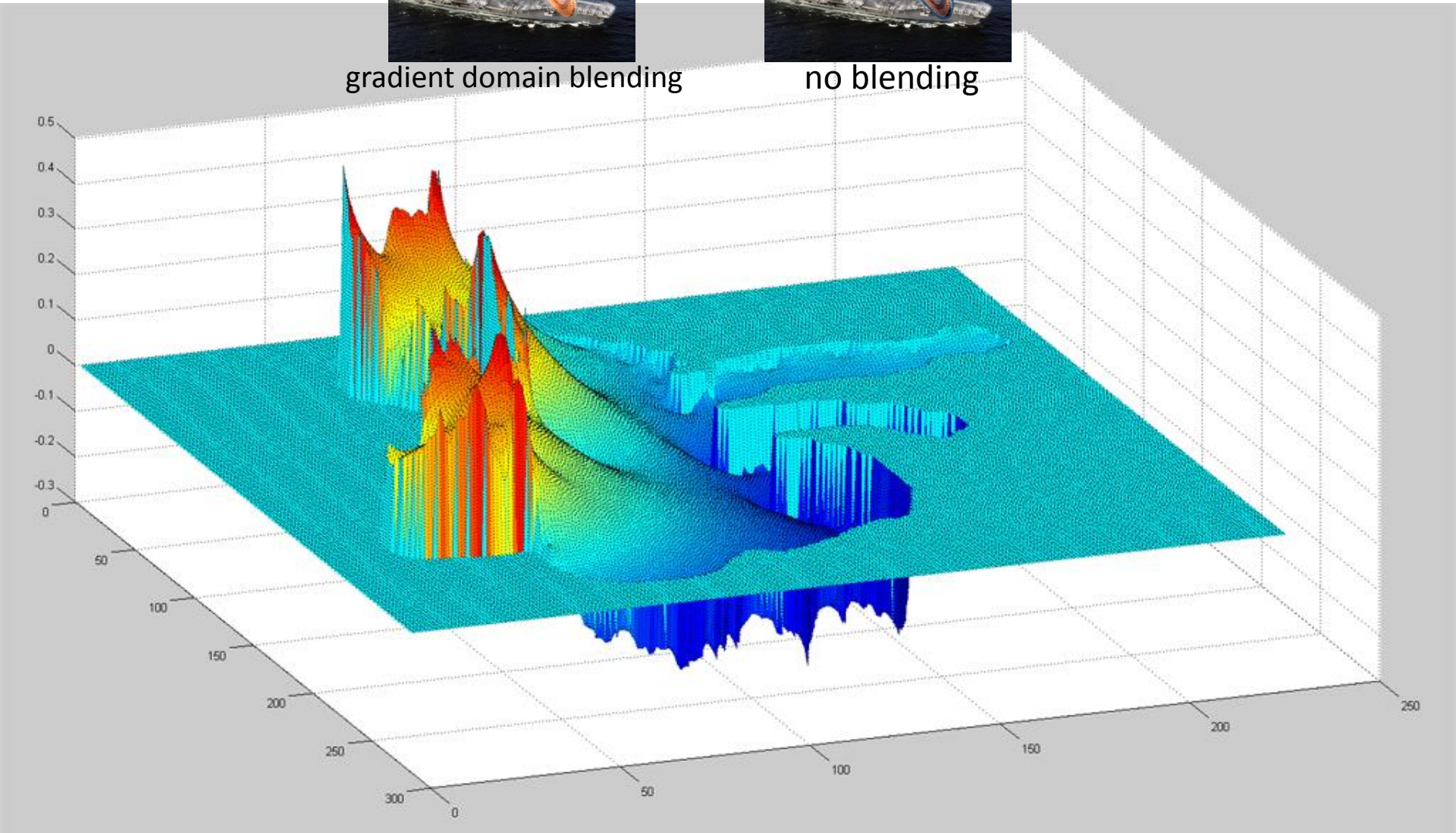
What's the difference?

gradient domain blending

-

no blending

=



What's the difference?

gradient domain blending

-

no blending

=