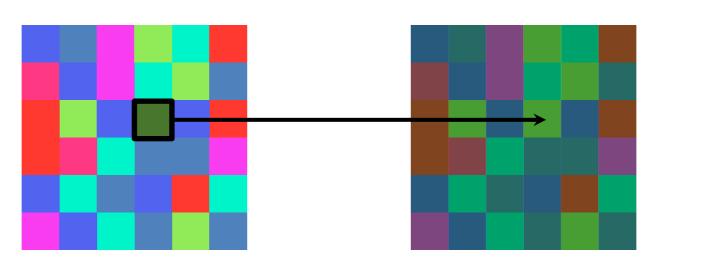


Point Processing

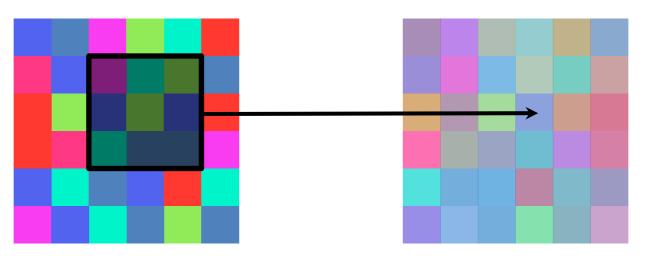
16-720 Computer Vision Carnegie Mellon University (Kris Kitani)

What kind of image filtering can we perform?

Point Operation



Neighborhood Operation



filtering

point processing

Original

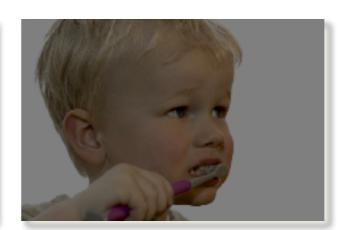


Lower Contrast

Nonlinear Lower Contrast









 \mathcal{X} pixel value

Invert





Lighten

Raise Contrast



Nonlinear Raise Contrast



Original

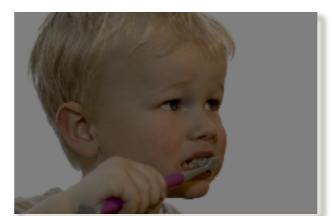


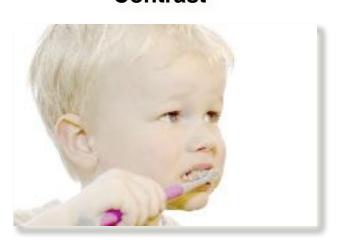
Lower Contrast

Nonlinear Lower Contrast









 \mathcal{X}

x-128 how would you code this?

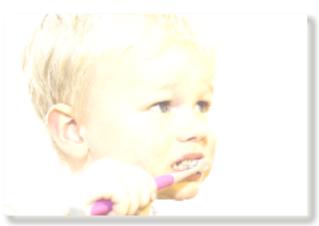
Lighten

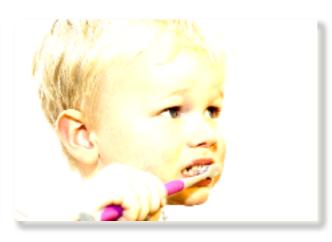
Raise Contrast





Invert







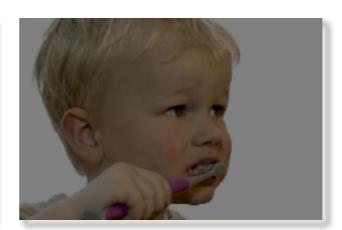


Lower Contrast

Nonlinear Lower Contrast









 \mathcal{X}

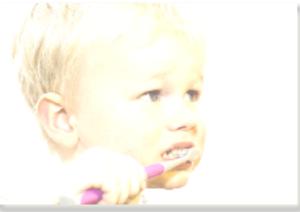
x - 128

 $\frac{x}{2}$

Invert











Nonlinear Raise Contrast





Darken

Lower Contrast

Nonlinear Lower Contrast





 \mathcal{X}

x - 128

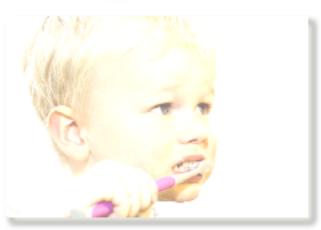
 $\frac{x}{2}$

 $\left(\frac{x}{255}\right)^{1/3} \times 255$

Invert



Lighten



Raise Contrast



Nonlinear Raise Contrast



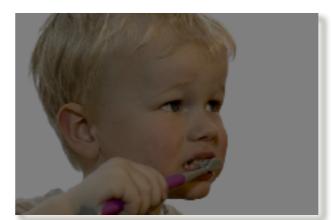


Lower Contrast

Nonlinear Lower Contrast









 \mathcal{X}

x - 128

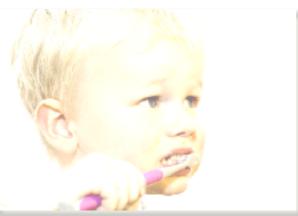
 $\frac{x}{2}$

 \times 255

Invert











Nonlinear Raise Contrast



255 - x

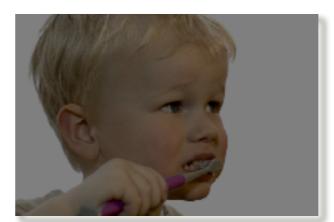


Lower Contrast

Nonlinear Lower Contrast









 \mathcal{X}

x - 128

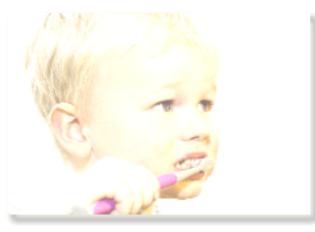
 $\frac{x}{2}$

 $\left(\frac{x}{255}\right)^{1/3} \times 255$

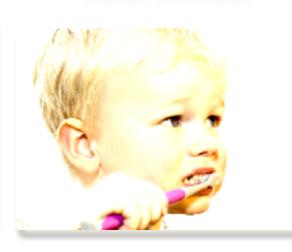
Invert



Lighten



Raise Contrast



Nonlinear Raise Contrast



255 - x

x + 128

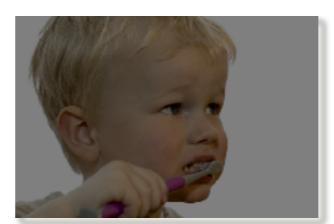


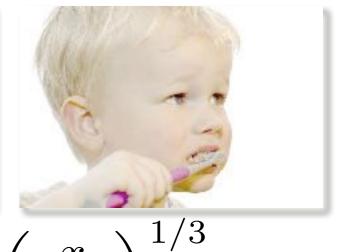
Lower Contrast

Nonlinear Lower Contrast









 \boldsymbol{x}

x - 128

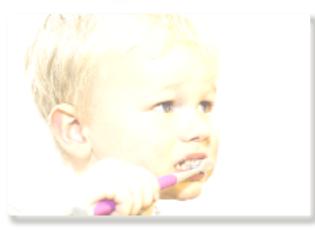
 $\frac{x}{2}$

 $\left(\frac{x}{255}\right)^{1/3} \times 255$

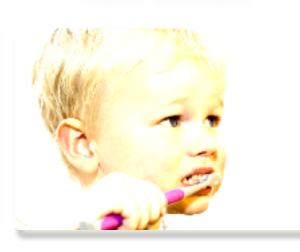
Invert



Lighten



Raise Contrast



Nonlinear Raise Contrast



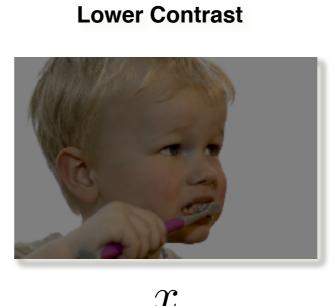
255 - x

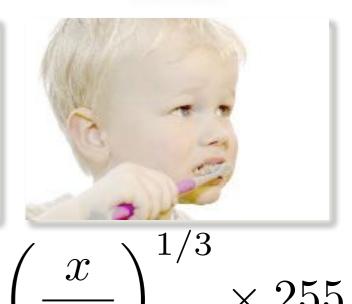
x + 128

 $x \times 2$

Original ${\mathcal X}$







Nonlinear Lower

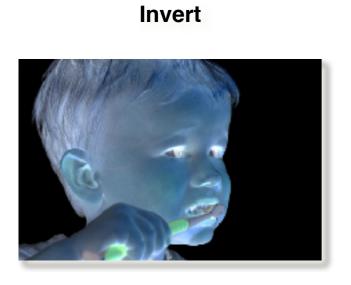
Contrast

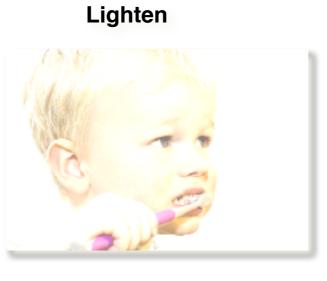
x - 128

 $\frac{x}{2}$

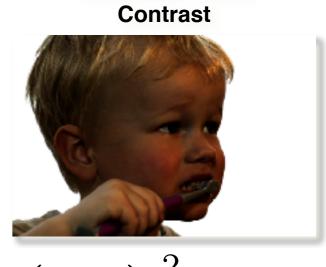
 \times 255

Nonlinear Raise









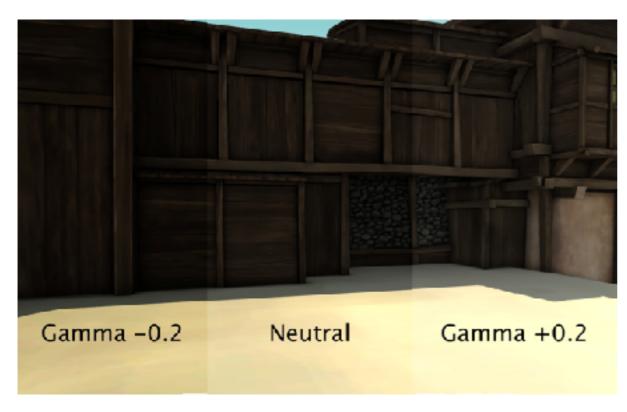
255 - x

x + 128

 $x \times 2$

$$\left(\frac{x}{255}\right)^2 \times 255$$

Other point processes







Are these point-processes?