Simple operations

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Brightness

$O = I + b$ → our parameter

$$\begin{bmatrix} 3 & 7 & 2 \\ 4 & 0 & 3 \\ 4 & 2 & 5 \end{bmatrix}$$ Sample Image

Example: apply brightness +3

$$\begin{bmatrix} & & \\ & & \\ & & \end{bmatrix}$$

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→ should be applied to all pixels individually

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$3+3=6$ $7+3=7$ → 7 is max you should stay within range.
0 is min

$$\begin{bmatrix} 6 & 7 & 5 \\ 7 & 3 & 6 \\ 7 & 5 & 7 \end{bmatrix}$$

what happened to the image?

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Contrast

$$O = c\left(I - \left\lceil \frac{max}{2} \right\rceil\right) + \left\lceil \frac{max}{2} \right\rceil$$ → or $2^{(B-1)}$

Increases the contrast if $c > 1$

Decreases if $c < 1$

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apply for $c=2$

$2.(3-4)+4 = 2$

$2.(7-4)+4 = 7$

$2.(2-4)+4 = 0$

$$\begin{bmatrix} 2 & 7 & 0 \\ 4 & 0 & 2 \\ 4 & 0 & 6 \end{bmatrix}$$

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Gamma

$$O = (2^B - 1)\left(\frac{I}{2^B - 1}\right)^{\gamma}$$ → operation should be done in real numbers.

ie. `255 * ((float) img(x,y) ...`

$\gamma < 1$ increases brightness

$\gamma > 1$ decreases brightness

apply for $\gamma = 0.7$

$7 \cdot \left(\frac{3}{7}\right)^{0.7} = 3.87 \approx 4$

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Invert

~~$O = 2^{(B-1)} - I$~~

$O = 2^B - 1 - I$

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no parameters!

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$7-3=4$

$7-7=0$

$7-2=5$