26 June 2017

Image Enhancement Technique Using Retinex of HSV Color Space and Saturation Correction

ISL lab Seminar

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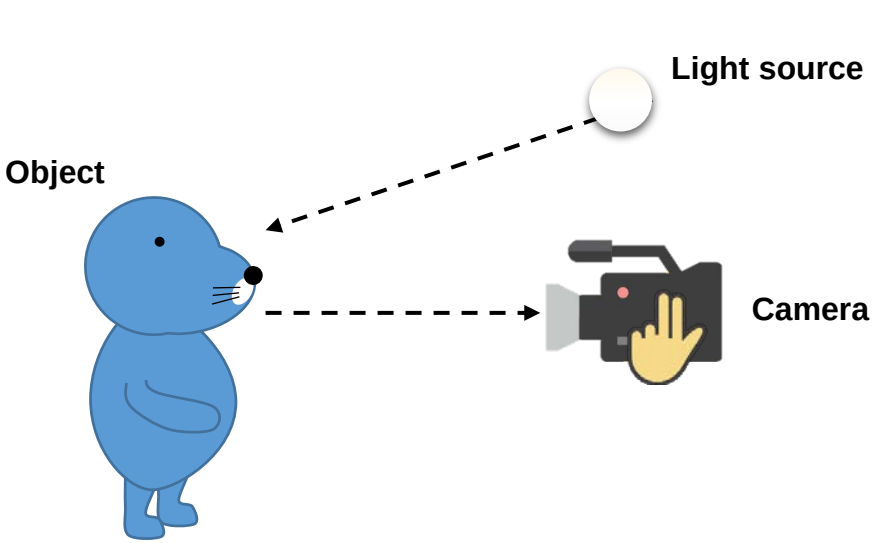
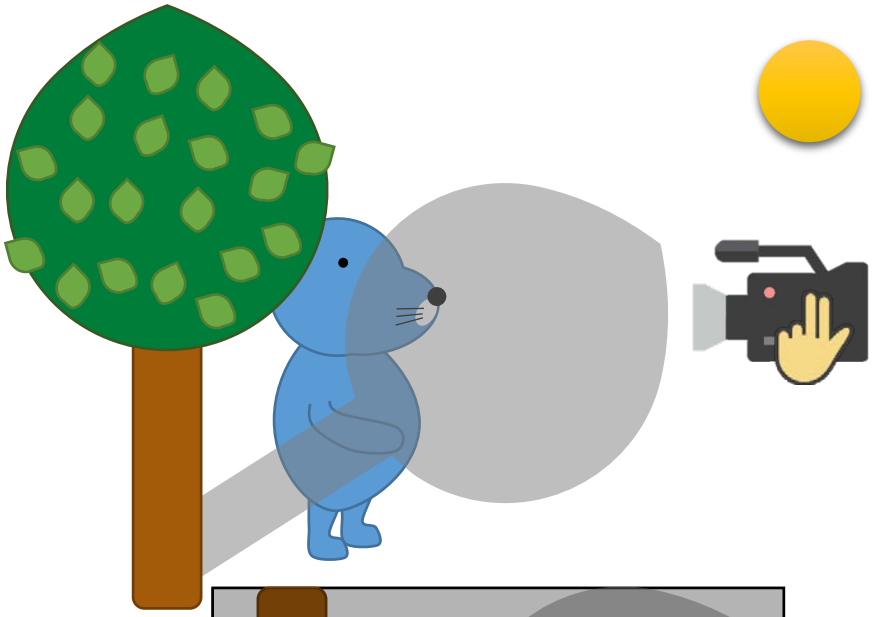
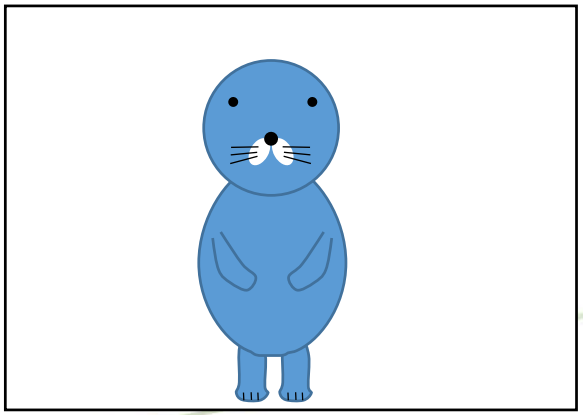
Contents

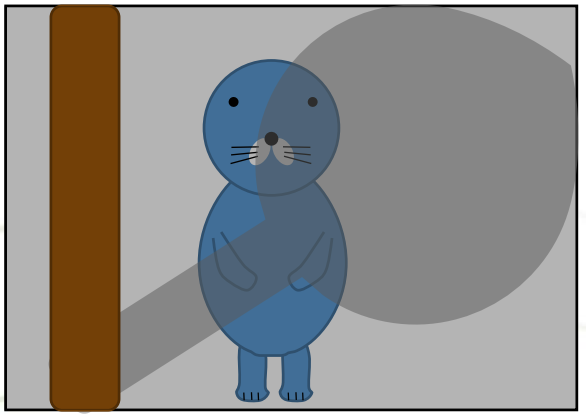
Introduction

- Image quality



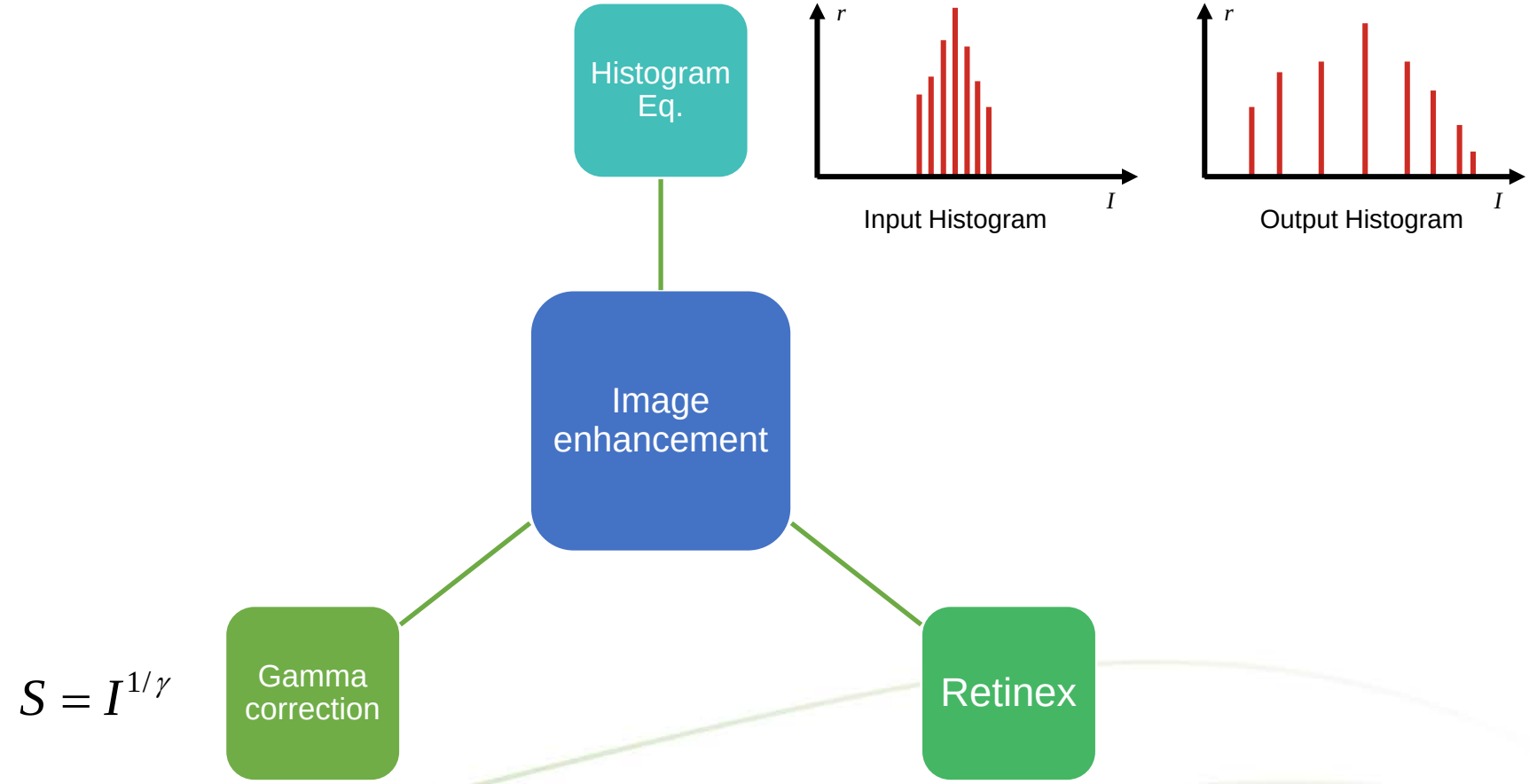






Introduction

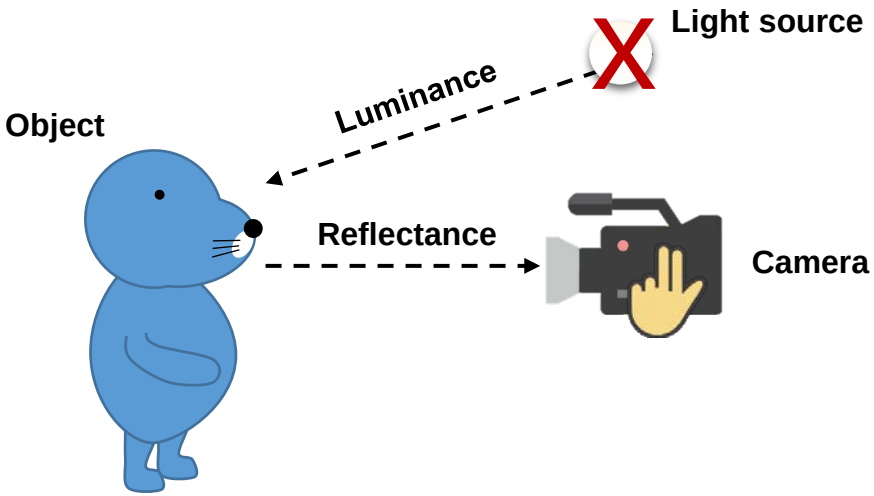
- Solutions

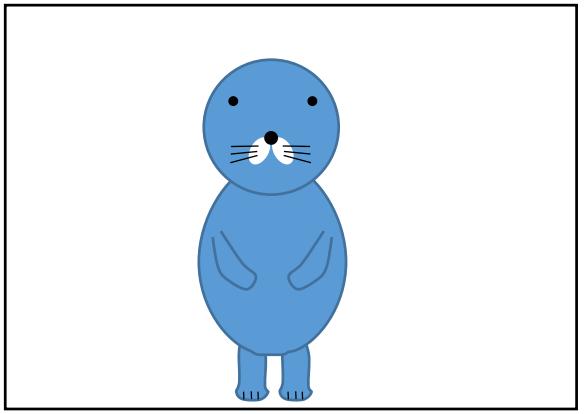


$$S = I^{1/\gamma}$$

Retinex

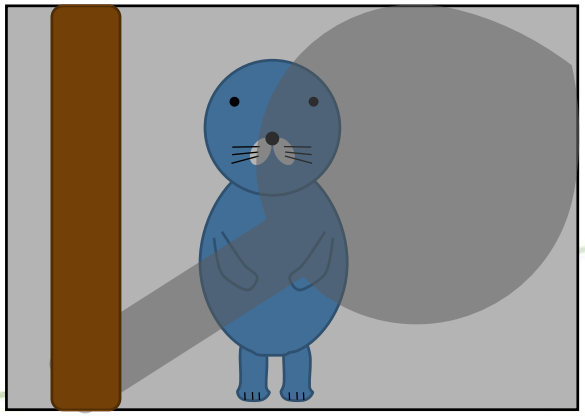
- Concept





$$I(x,y) = R(x,y) \times L(x,y)$$

Reduce the effects of light source



Retinex

- SSR

$$I_i(x,y) = R_i(x,y) \times L_i(x,y)$$

$$R_i(x,y) = I_i(x,y) / L_i(x,y)$$

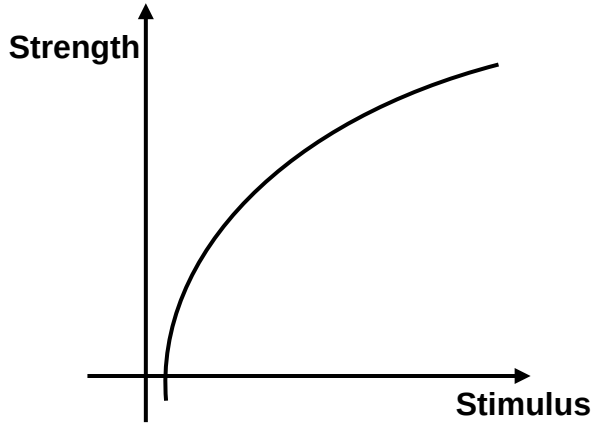
Weber-Fechner's law

$$R_i(x,y) = \log\left(I_i(x,y) / L_i(x,y)\right)$$

$$R_i(x,y) = \log\left(I_i(x,y)\right) - \log\left(L_i(x,y)\right)$$

Surround function

$$R_i(x,y) = \log\left(I_i(x,y)\right) - \log\left(F(x,y) * I_i(x,y)\right)$$



- Surround function by E.Land'86 (Inverse square spatial surround)
- Surround function by Hurlbert'89(Gaussian)

Retinex

- MSR & MSRCR

$$R_{SSR_i}(x,y) = \log\left(I_i(x,y)\right) - \log\left(F(x,y) * I_i(x,y)\right)$$

$$R_{MSR_i}(x,y) = \sum_{n=1}^{N} W_n R_{n_i}(x,y), \ \sum_{n=1}^{N} W_n = 1$$

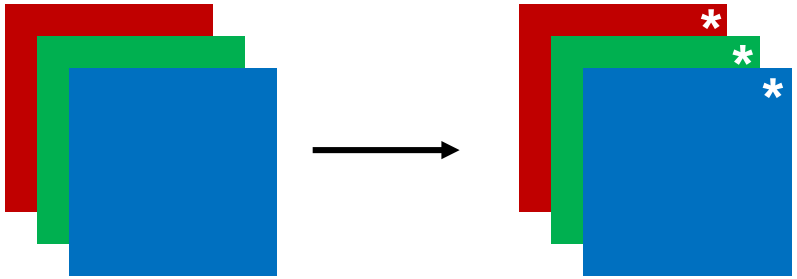
Since the channels are operated independently, the colors are unnatural.

$$R_{MSRCR_i}(x,y) = G[C_i(x,y) \times R_{MSR_i}(x,y) + b]$$ **Gain-Offset**

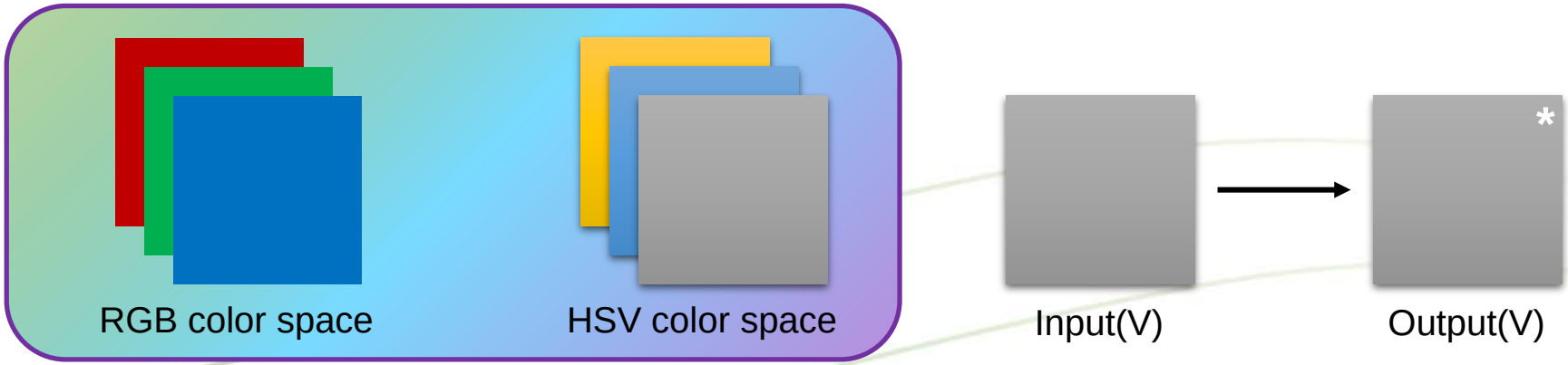
Proposed method

- Concept

Conventional Retinex



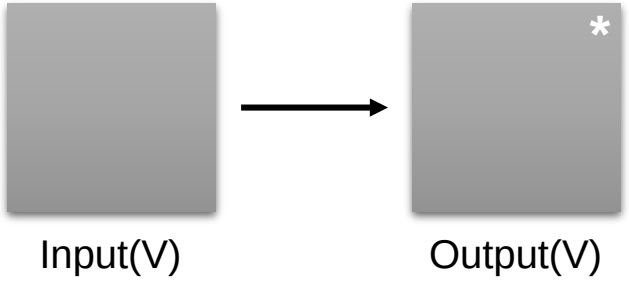
MSRMS

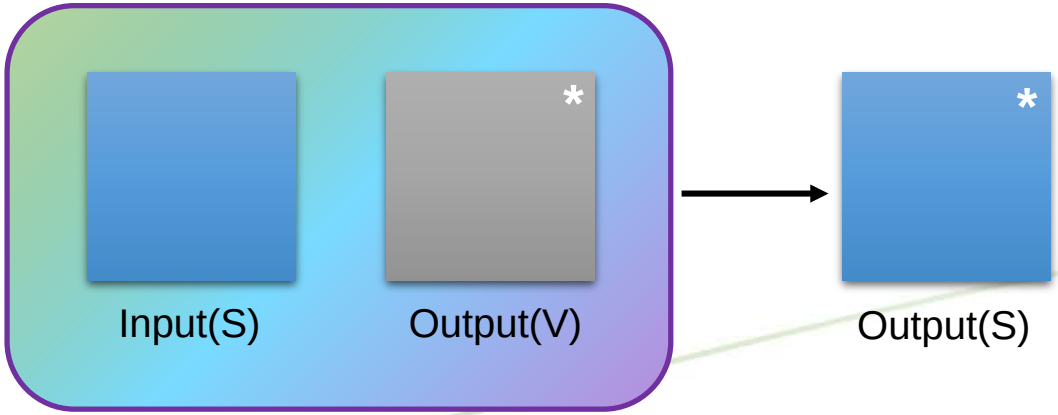


Proposed method

- Concept

MSRMS





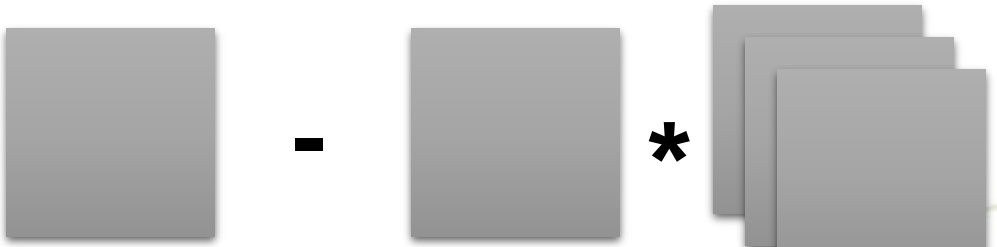
Proposed method

- MSR for V channel

$$H = \cos^{-1}\left\{\frac{0.5[(R-G)+(R-B)]}{\sqrt{(R-G)^2+(R-B)(G-B)}}\right\}$$

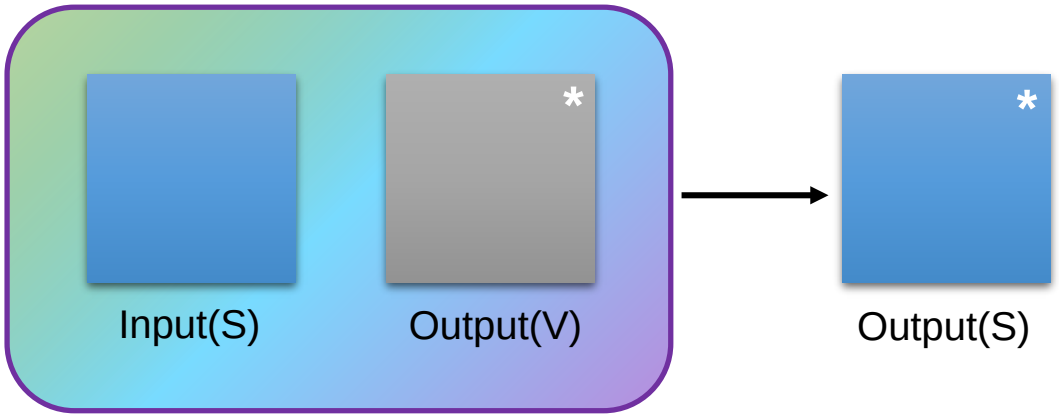
$$S = \frac{\max(R,G,B)-\min(R,G,B)}{\max(R,G,B)}$$

$$V = \frac{\max(R,G,B)}{255}$$



Proposed method

- Saturation correction(Modified Saturation)



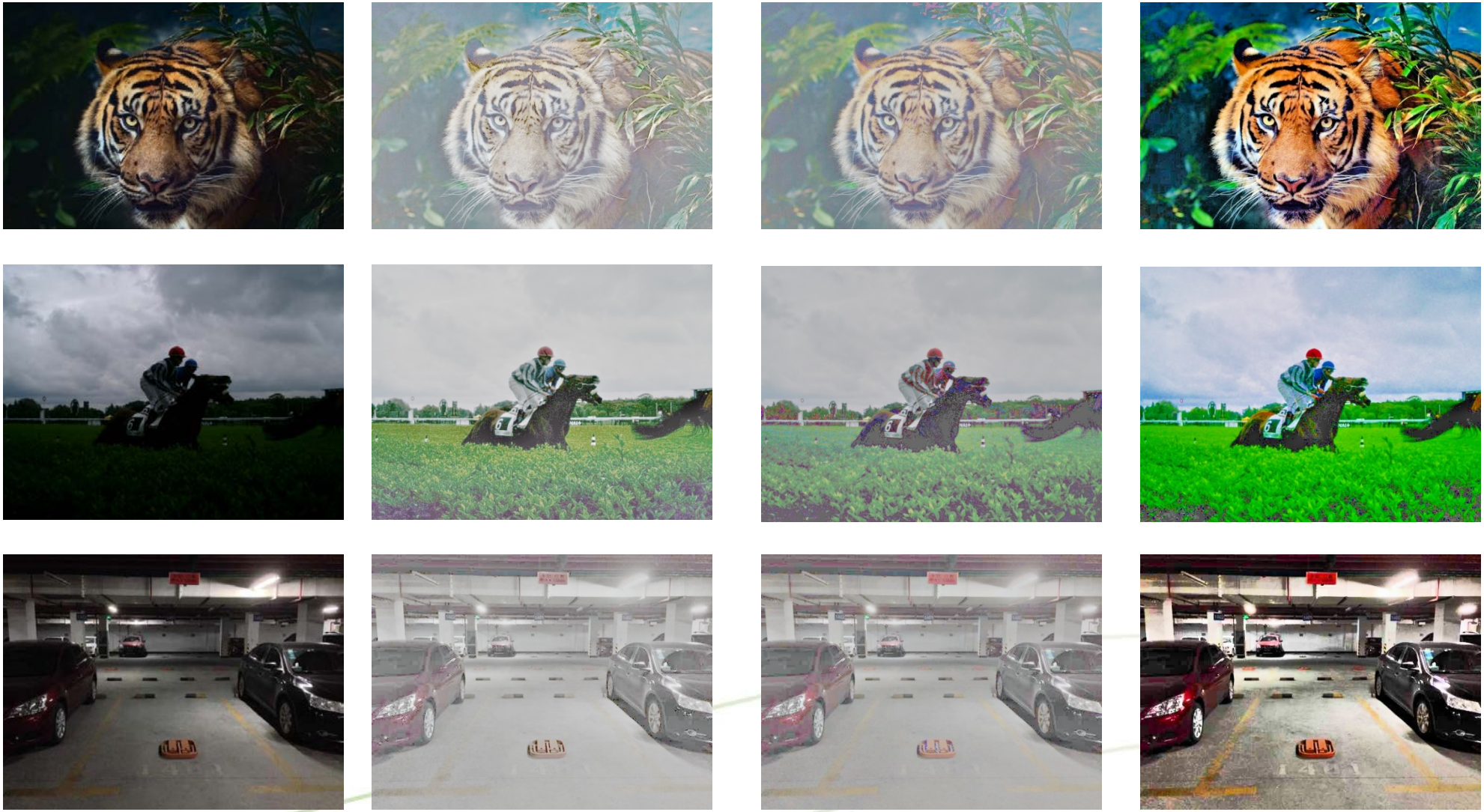
$$S^*(x,y) = (1+\delta)S(x,y) \quad \delta = \begin{cases} (V^*(x,y) - V(x,y))/255 & (V^*(x,y) > V(x,y)) \\ 0 & (V^*(x,y) \le V(x,y)) \end{cases}$$

Proposed method

- Contrast enhancement (HE)

$$V^{**}(x,y)=\begin{cases} HE(V^{*}(x,y)) & (Std(V^{*}(x,y))<\alpha) \\ V^{*}(x,y) & (Std(V^{*}(x,y))\geq\alpha) \end{cases}$$

Results



Results

Results

Results

Table 1. Comparison of processing time of the proposed method with those of MSR and MSRCR

Resolution	Algorithm		
	MSR	MSRCR	MSRMS
600x394	0.523 sec	0.536 sec	0.186 sec
1280x720	2.642 sec	2.674 sec	0.974 sec
1920x1080	8.672 sec	8.842 sec	3.528 sec

Conclusions

- We proposed MSRMS algorithm(MSR with Modified Saturation)
- Image quality is improved than the conventional method.
- We expect it to be applicable to video when using parallel processing.

Q & A

Thank You!!!