Infrared Image Colorization Using a S-shape Network

Ziyue Dong, Sei-ichiro Kamata, Toby P.Breckon
Graduate School of Information, Production and Systems, Waseda University
Engineering and Computing Science, Durham University

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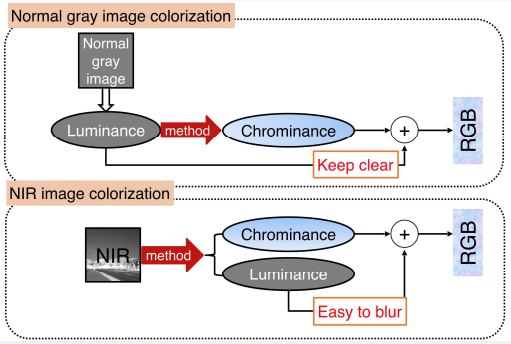
Motivation

Advantages of NIR images:

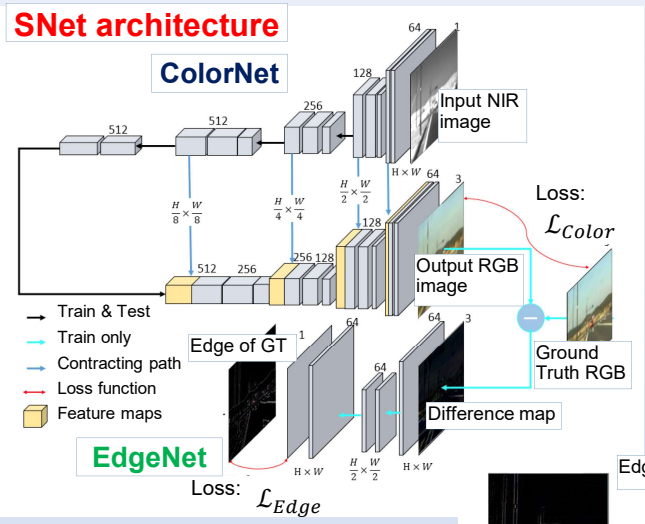
- Obtain more spectral information: The wavelength of NIR is larger than the maximum of visible light (700nm).
- Illuminate the scene in low light conditions, such as fog day. Improve the safety of diving in bad condition.

Existed Works problems:

- Easy to blur.
- Lack high frequency scene in detail.



S-shape Network (SNet)

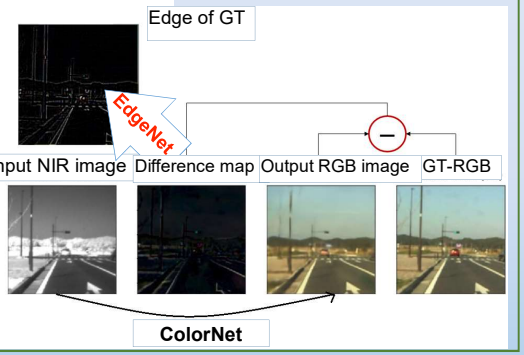


ColorNet

- **Encoder**:
  Input: NIR image
  Output: Latent feature maps
- **Decoder:**
  Input: Latent feature maps
  Output: RGB image
- Symmetrical skip connection to keep detail information and clear edges.

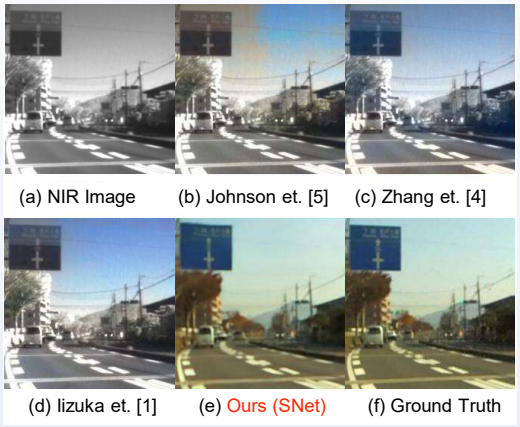
EdgeNet

- Enhance edges.
- Stabilize color regions.
- Become the most suitable 'loss function' of ColorNet.
  ColorNet + EdgeNet =
  S-shape Network (SNet)

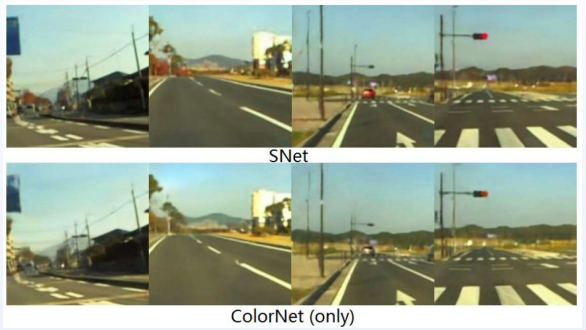


Competition Results

Results for our Hibikino Dataset:



- Compare SNet with other grayscale colorization methods.

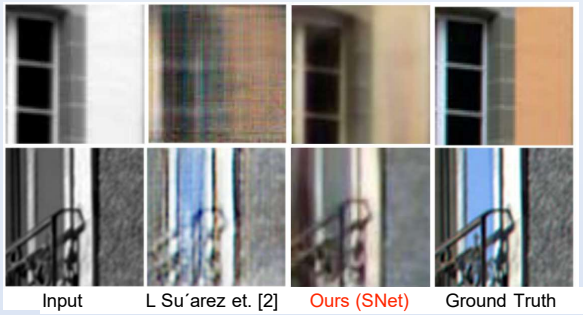


- Compare SNet with ColorNet (only).

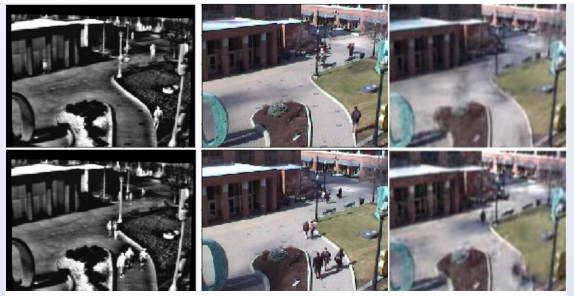
Table 1. Comparison results with other methods.

	(a) NIR Image	(b) [5]	(c) [4]	(d) [1]	SNet
cosine()	0.9211	0.9164	0.9158	0.9144	0.9080
PSNR	13.89	14.09	14.03	14.07	22.53

Results for other Datasets:



- L Su´arez et. [2] published on CVPRW 2017 used a triplet DCGAN architecture to colorize NIR images in dataset of Brown et. [7].



- The Qayynm et.[3] published on IBCAST 2018 used a deep encoder-decoder CNN architecture to colorize thermal images in dataset of J.Davis et. [6].

Conclusion

- We proposed a novel architecture, SNet, for the colorization of NIR image, which consists of ColorNet and EdgeNet.
- It is a novel way to use the EdgeNet in SNet to only enhance the edges but also stabilize color regions.
- We can see from the results that the SNet is able to obtain colorful and clear RGB images from the given NIR image.

References

[1] S.Iizuka, et al, Let there be color!: joint end-to-end learning of global and local image priors for automatic image colorization with simultaneous classification, ACM TOG, 2016. **[2]** P.L Su´arez, et al. Infrared image colorization based on a triplet dcgan architecture. CVPRW, 2017. **[3]** U.Qayynm, et al. Thermal colorization using deep neural network. Applied Sciences and Technology (IBCAST), 2018. **[4]** Richard Zhang, et al, Colorful image colorization, ECCV 2016. **[5]** J.Johnson, et al, Perceptual losses for real-time style transfer and super resolution, ECCV 2016. **[6]** J.Davis, et al, Background subtraction using contour based fusion of thermal and visible imagery, CVIU, 2007. **[7]** M.Brown et al, Multi-spectral sift for scene category recognition. CVPR 2011.