NEAR-INFRARED GUIDED COLOR IMAGE DEHAZING

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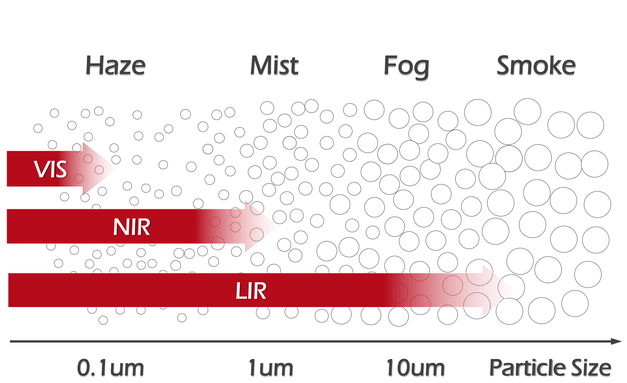
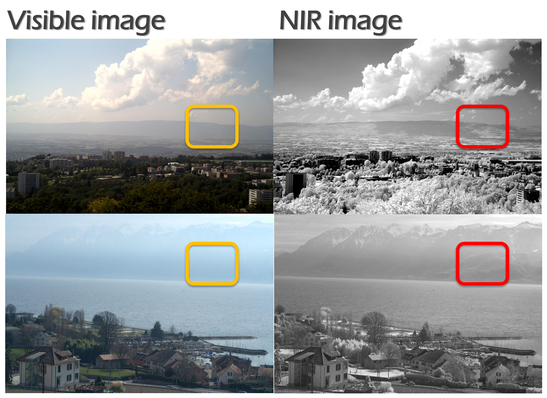
WHY NEAR-INFRARED (NIR) HELPS?





NIR penetrates deeper into the atmosphere and preserves more details of distant objects.

CONTRIBUTIONS

- An optimization framework that resolves the image de-hazing problem guided with NIR gradient constraints.
- Better airlight color estimation by exploiting the differences between NIR and RGB channels.

PROBLEM FORMULATION

Haze model

$$I_p = t_p J_p + (1 - t_p) A$$

Air-light color estimation

$$A = \arg \min_{\forall (x,y) \in \Omega} C(J,t)^2$$

Criteria for finding local patch Ω:

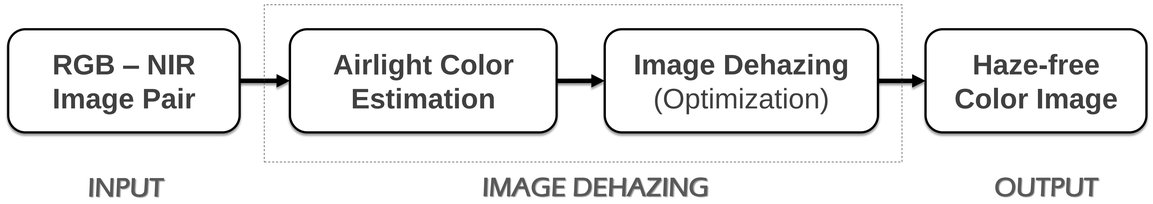
$$H = \min\{ \min_{k \in \{R,G,B\}} (I^k), D\} \quad D = N\{ | \max_{k \in \{G,B\}} (I^k) - I^{NIR} | \}$$

$$t_1 < R_{c,n} < t_2 \quad \& \quad t_3 < I^{NIR} < t_4 \quad \& \quad \| pt - pt_0 \|^2 <= t_5$$

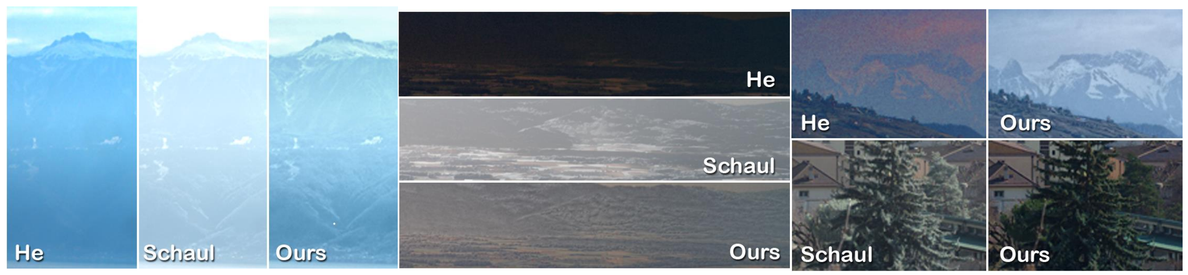
Optimization framework:

$$(\hat{J}, \hat{t}) = \arg \min_{(J,t)} \| tJ + (1-t)A - I^{RGB} \|^2 + \lambda_1 w | \nabla J - \nabla I^{NIR} |^{\alpha} + \lambda_2 | \nabla J |^{\beta} + \lambda_3 \| \nabla t \|^2$$

WORKFLOW



RESULTS & COMPARISON



References
[1] K.M. He, J. Sun, and X.O. Tang, “Single image haze removal using dark channel prior,” IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2009.
[2] L. Schaul, C. Fredembach, and S. Süsstrunk, “Color image dehazing using the near-infrared,” Proc. IEEE International Conference on Image Processing (ICIP), 2009.

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