NEAR-INFRARED GUIDED COLOR IMAGE DEHAZING

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WHY NEAR-INFRARED (NIR) HELPS?

Visible image    NIR Image

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 \( \Omega \):

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

Optimization framework:

\[ (\hat{J}, \hat{t}) = \arg \min_{(J, t)} \| t J + (1 - t) A - I^{RGB} \|^2 + \lambda_1 \| \nabla J - \nabla I^{NIR} \|^2 + \lambda_2 \| \nabla J \|^2 + \lambda_3 \| t \|^2 \]

WORKFLOW

RGB – NIR Image Pair    Airlight Color Estimation    Image Dehazing (Optimization)    Haze-free Color Image

RESULTS & COMPARISON


References
