Visibility restoration for real-world hazy images via improved physical model and Gaussian total variation

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The dehazing effects on real-world hazy images. Credit: *Frontiers of Computer Science* (2024). DOI: 10.1007/s11704-023-3394-0

Under real-world haze conditions, captured images not only suffer from the haze but also are affected by the noise, which significantly deteriorates the visibility of images. However, most of existing haze removal methods mainly focus on haze degradation and fail to consider noise interference.

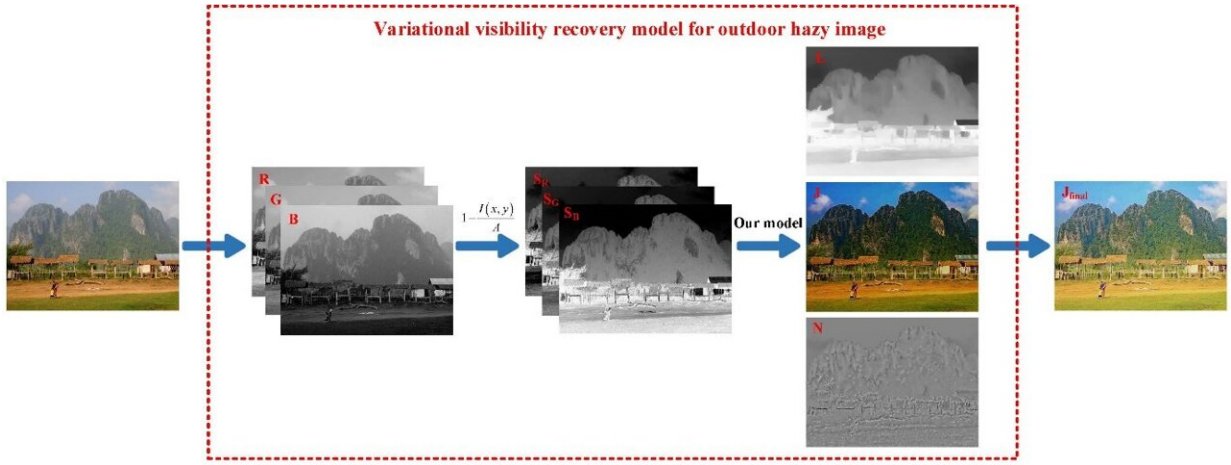
To address the above issue, a research team led by Hailing Xiong and Yun Liu published their new research on 15 Feb 2024 in *Frontiers of Computer Science*.

The team proposed a novel unified variational model consisting of

multiple effective constraints that simultaneously obtains the haze-free image, the transmission map and the noise map. The proposed model can achieve both haze removal and noise suppression. Compared to existing research results, the proposed algorithm guarantees visibility while suppressing the hidden noise.

In the research, they carefully devised a novel variational model which consists of total variation regularization term, Gaussian total variation regularization term and L2 norm regularization term to respectively constrain the scene radiance, the transmission map and the overall noise map.

By adopting the re-weighted optimization strategy, the proposed variational model is solved to obtain the haze-free image. Compared to previous dehazing methods, the proposed unified variational model can achieve haze removal while suppressing noise amplification.



The flowchart of the proposed visibility restoration method for real-world hazy images. Credit: Credit: *Frontiers of Computer Science* (2024). DOI: 10.1007/s11704-023-3394-0

The experiments are performed on real-world hazy images. Extensive experimental data demonstrate the proposed unified variational model can achieve superior dehazing effects, significantly improving the quality and visibility of real-world hazy images. In addition, the proposed model also shows the ability of noise suppression.

In future work, the researchers plan to explore the parameter-adaptive unified models or networks that can adaptively adjust the parameters or automatically learn the model parameters, thereby enhancing the robustness of the model.

More information: Chuan Li et al, Visibility restoration for real-world hazy images via improved physical model and Gaussian total variation, *Frontiers of Computer Science* (2024). DOI: 10.1007/s11704-023-3394-0