

Visible and Polarization Image Fusion Based on Deep Learning Neural Network

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Visible images contain rich texture and intensity information, and can directly represent scene appearance. In contrast, polarization images reveal object edges and surface material differences, thereby providing physical cues that are difficult to obtain from conventional intensity imaging. Therefore, the joint use of visible and polarization data can preserve natural visual appearance while enhancing weak target features. This is important for image interpretation and information retrieval in polarimetric remote sensing. However, the two modalities differ in imaging mechanism, feature distribution, and spatial detail. Existing methods still have limitations in modeling nonlinear feature relations and cross-modal complementary features in complex scenes. They often struggle to balance the texture representation of visible images with the edge information provided by polarization images [1, 2].

This work introduces a novel neural network-based multimodal fusion algorithm for visible and polarization images. By adaptively learning complementary features from the two modalities, the network aims to preserve natural visual appearance while enhancing object edges and structures. This work provides an end-to-end data-driven processing method for visible and polarization information fusion, which contributes to supporting target recognition, scene understanding, and advanced information retrieval.

References

- [1] Luo Y, Zhang J, Li C. CPIFuse: Toward realistic color and enhanced textures in color polarization image fusion[J]. *Information Fusion*, 2025, 120: 103111.
- [2] Yao M, Wang M, Tam K M, et al. Polarfree: Polarization-based reflection-free imaging[C]//*Proceedings of the Computer Vision and Pattern Recognition Conference*. 2025: 10890-10899.

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