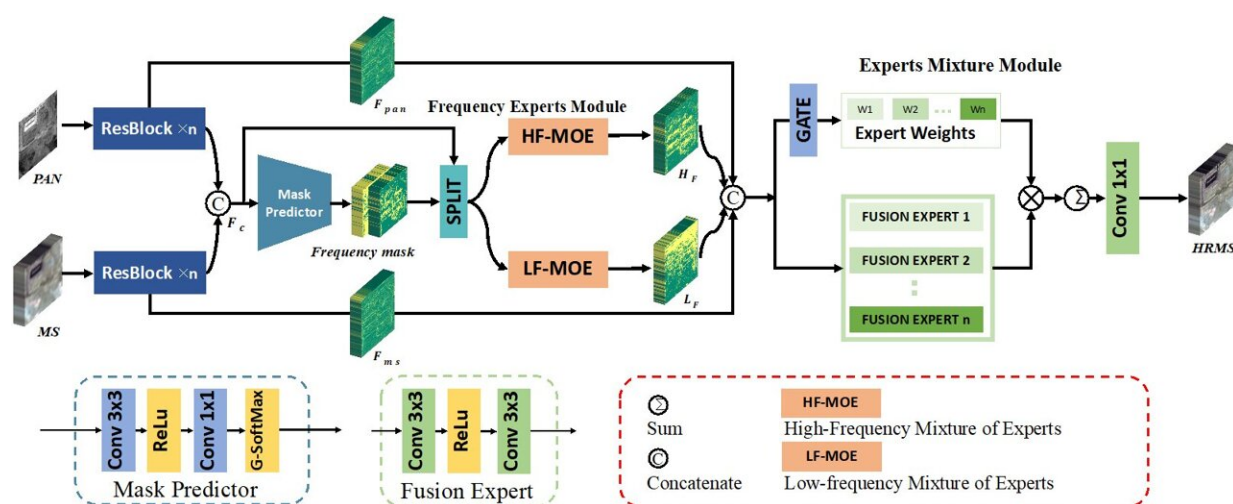


# Novel frequency-adaptive methods enhance remote sensing image processing

January 18 2024, by Zhang Nannan



The overall structure of FAME-Net. Credit: Zhang Jie

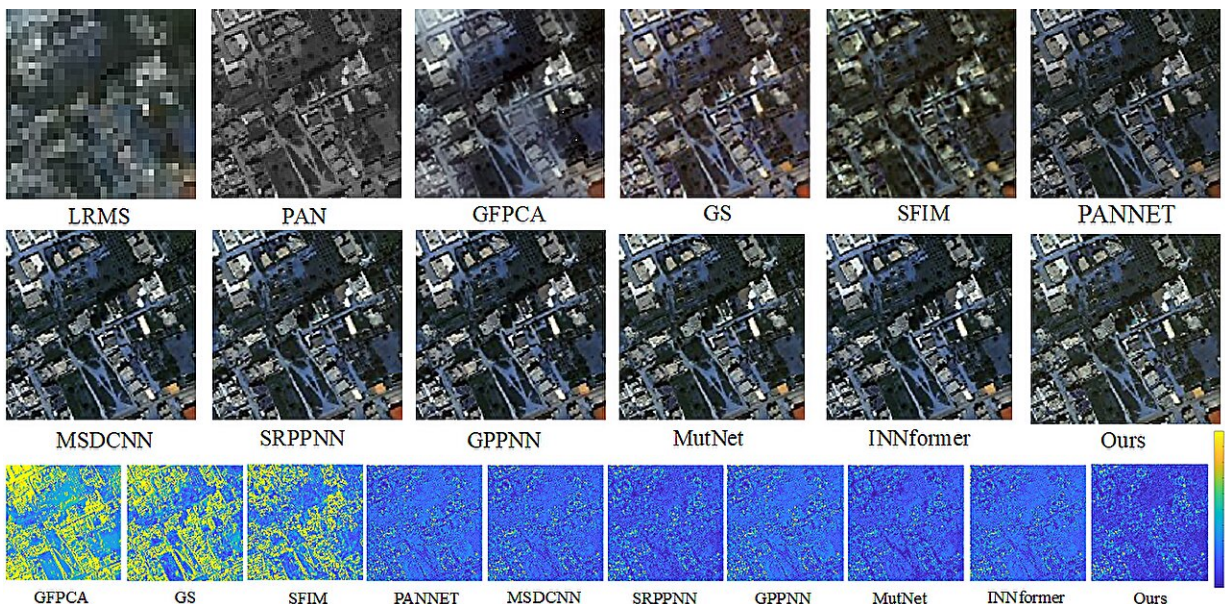
Researchers led by Prof. Xie Chengjun and Associate Prof. Zhang Jie at the Hefei Institutes of Physical Science of the Chinese Academy of Sciences have developed a novel deep learning-based method for satellite imagery.

Their method, called the Frequency-Adaptive Mixture of Experts Network (FAME-Net), has been accepted for publication in the 2024 Proceedings of the Association for the Advancement of Artificial Intelligence (AAAI). It is [posted](#) to the *arXiv* preprint server.

High-resolution multispectral imagery is essential for agriculture, mapping, and [environmental protection](#). However, direct acquisition of such images faces technological limitations. To overcome this challenge, pan-sharpening techniques combine high-resolution panchromatic (PAN) and low-resolution multispectral images. Recent advances in [deep learning](#) have improved spectral and spatial detail in pan-sharpening, but [neural networks](#) still struggle with frequency bias and adaptation to diverse remote sensing content.

Based on the discrete cosine transform and the Mixture of Expert concepts, the researchers proposed the FAME-Net, which uses a frequency mask predictor for adaptive high- and low-frequency masking.

Different expert networks process these frequency-specific features, allowing focused attention on different frequency ranges. FAME-Net dynamically adapts its masks to different image contents by integrating multiple expert outputs through a gating mechanism.



The result of FAME-Net was compared against nine other methods on WorldView-III dataset. Credit: Zhang Jie

In comparative analyses with existing state-of-the-art methods, FAME-Net not only demonstrates superior performance in preserving spectral quality and enhancing [spatial resolution](#) but also shows excellent performance in full-resolution remote sensing imagery.

This study provides new insights into the field of image processing and demonstrates the effectiveness of integrating dynamic network structures and frequency domain information.

**More information:** Xuanhua He et al, Frequency-Adaptive Pan-Sharpening with Mixture of Experts, *arXiv* (2024). [DOI: 10.48550/arxiv.2401.02151](#)

Provided by Chinese Academy of Sciences

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