Leaf: Hyperspectral Image Super-Resolution Using Deep Learning

MSDformer: Multiscale Deformable Transformer for Hyperspectral Image Super-Resolution

Reporters: Ye Tian

Time: 08/03/2024

Background

Practical application: **fusion-based method** require input LR hyperspectral images and HR auxiliary images are in the same scene and rigorously co-registered.

Some deep learning–based **SHSR algorithms** are proposed to achieve superior results, for example, 3-D con-volution spectral angle map (SAM) loss, and attention mechanisms.

Nevertheless, **2-D convolution** can only extract spatial information without considering spectral information. Although **3-D convolution** can extract the local spectral information, it ignores the long-range spatial-spectral dependencies that may contribute to the restoration of clear textures and structures and requires much memory, which is more evident at large-scale factors.

MSDFormer

A novel method called the Multiscale Deformable Transformer (MSDformer) for single hyperspectral image SR (SHSR).

The proposed method incorporates the strengths of the convolutional neural network (CNN) for local spatial-spectral information and the Transformer structure for global spatial-spectral information.

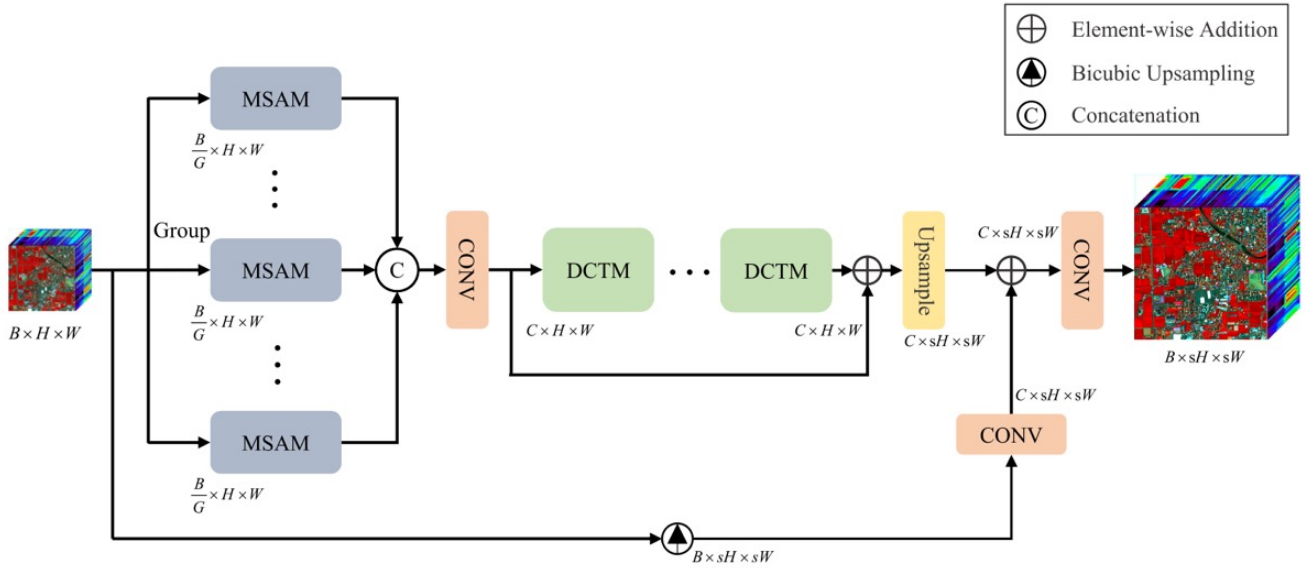

Fig. 1. Overall architecture of the proposed MSDformer consisting of the MSAM, DCTM, and upsampling module.

MSDFormer

A multiscale spectral attention module (MSAM)

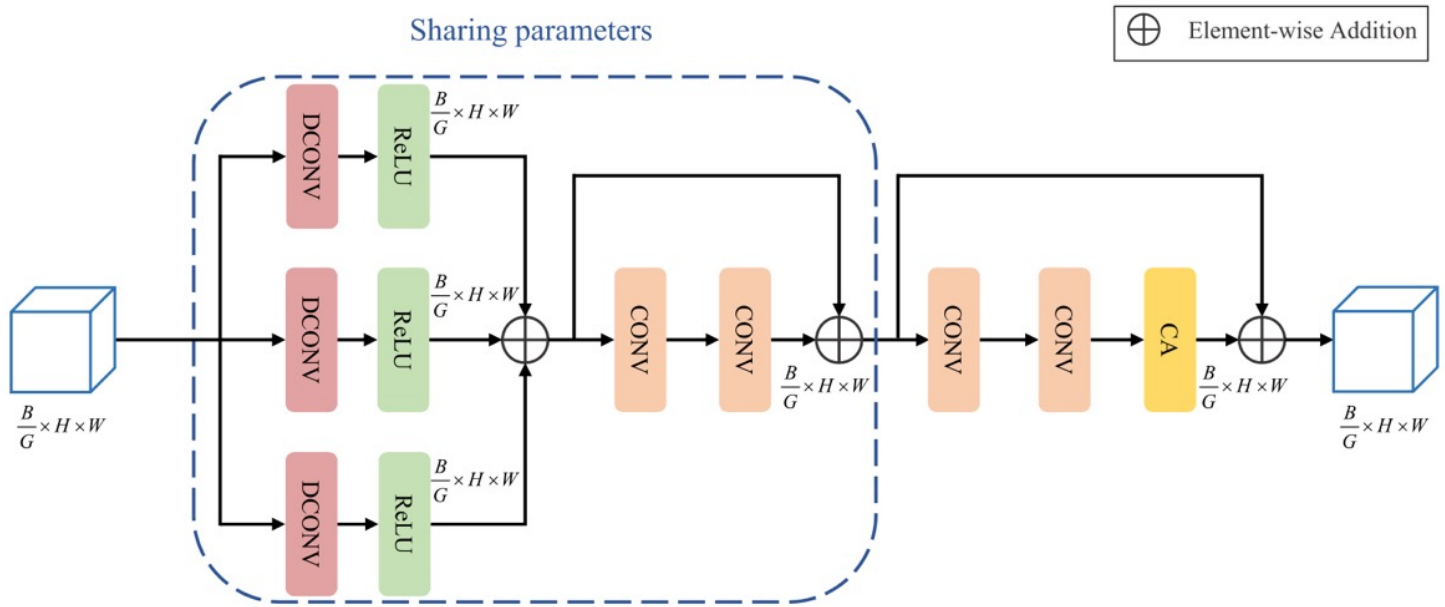

Fig. 2. Structure of the designed MSAM.

MSDFormer

A deformable convolution-based Transformer module (DCTM)

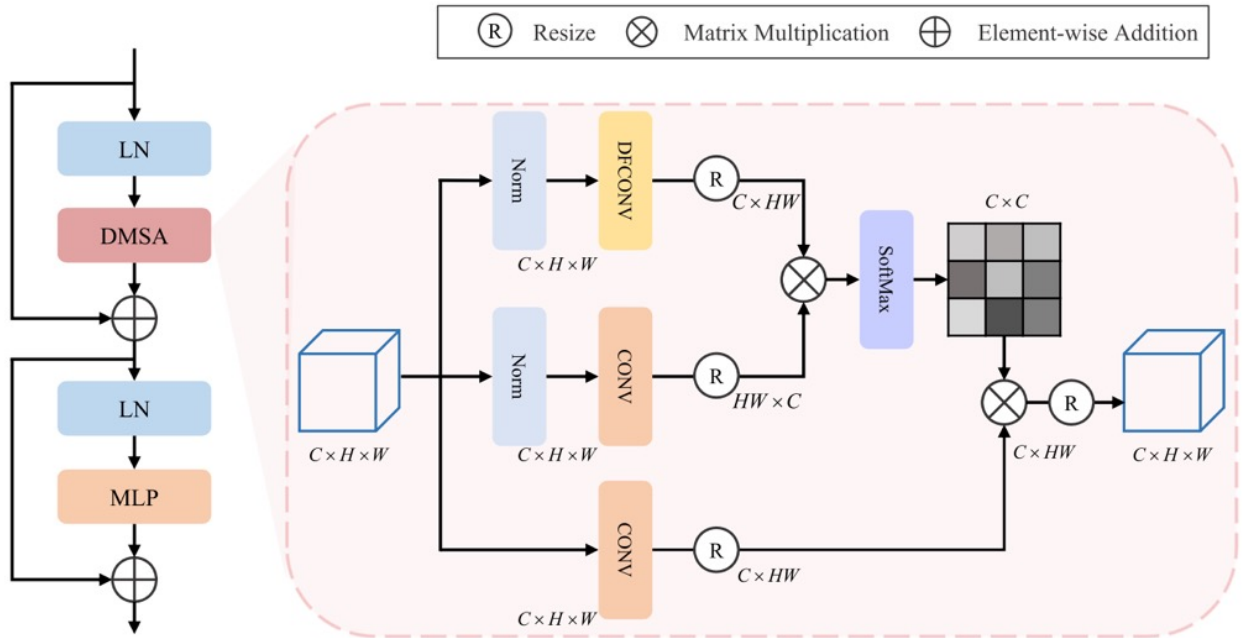

Fig. 3. Structure of the designed DCTM.

MSDFormer

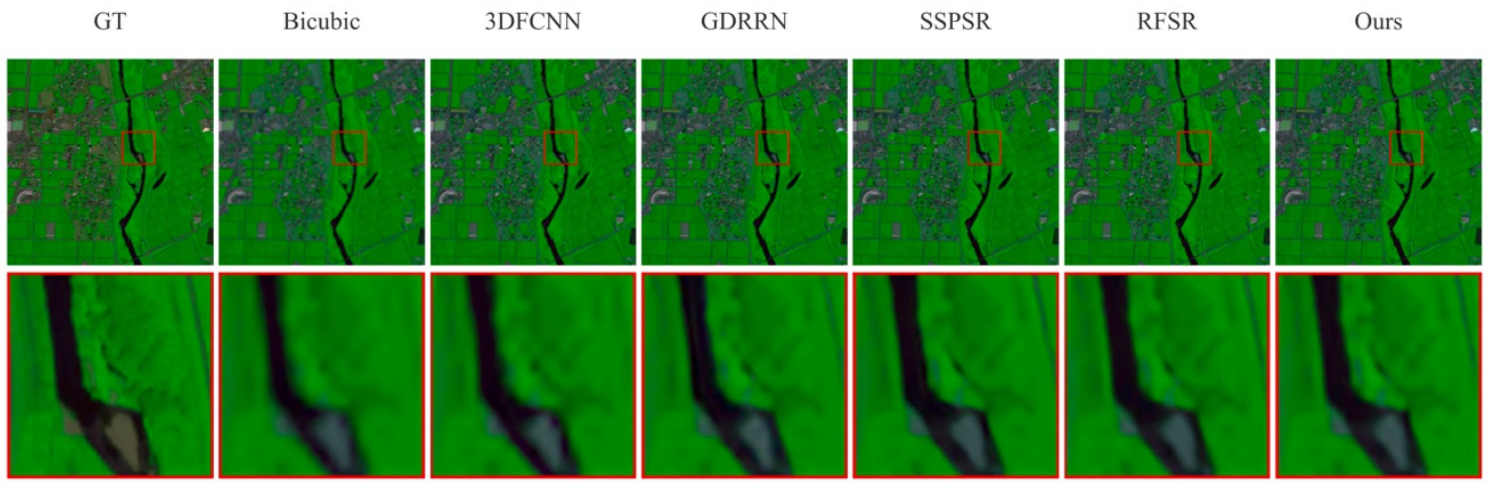

Fig. 4. Reconstructed test hyperspectral image in the Chikusei dataset with spectral bands 31-98-61 as R-G-B at scale factor ×4. (From Left to Right) Ground truth, results of bicubic, 3DFCNN [17], GDRRN [22], SSPSR [25], RFSR [26], and the proposed MSDformer method.

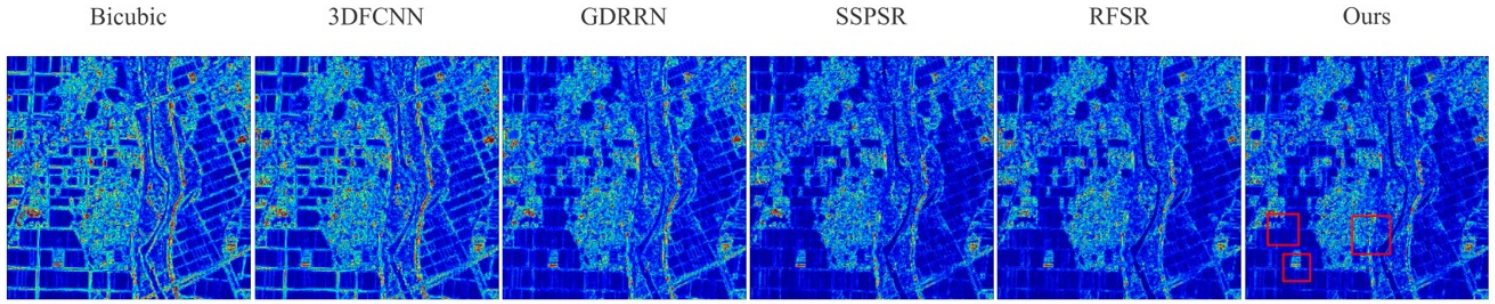

Fig. 5. Error maps of the test hyperspectral image in the Chikusei dataset at the scale factor ×4.

Code: https://github.com/Tomchenshi/MSDformer

Thanks