1. ABSTRACT

As the conventional activation functions such as ReLU, LeakyReLU, and PReLU, the negative parts in feature maps are simply truncated or linearized, which may result in unflexible structure and undesired information distortion. In this paper, we propose a simple but effective Bilateral Activation Mechanism (BAM) which could be applied to the activation function to offer an efficient feature extraction model. Based on BAM, the Bilateral ReLU Residual Block (BRRB) that still sufficiently keeps the nonlinear characteristic of ReLU is constructed to separate the feature maps into two parts, i.e., the positive and negative components, then adaptively represent and extract the features by two independent convolution layers. Besides, our mechanism will not increase any extra parameters or computational burden in the network. We finally embed the BRRB into a basic ResNet architecture, called BRResNet, it is easy to obtain state-of-the-art performance in two image fusion tasks, i.e., pansharpening and hyperspectral image super-resolution (HISR). Additionally, deeper analysis and ablation study demonstrate the effectiveness of BAM, the lightweight property of the network, etc.

2. INTRODUCTION

- pansharpening
  - Source: WorldView-3
  - LRGB (RGB imaging), i.e., [IL, RBG]
  - HRGB (RGB imaging), i.e., [IL, RBG]
  - SRK (RGB imaging), i.e., [IL, RBG]
- hyperspectral image super-resolution (HISR)
- CNNs-based approaches for pansharpening, e.g., PNN [1]

The current main improvement direction is to change the network structure, such as deepening of depth, increasing width, and multi-scale convolution operations.

4. EXPERIMENT SETTING

- HISR
- 1) Datasets:
  - CAVE dataset
  - Harvard dataset
- 2) Metrics: SAM, PSNR, SSIM, ERGAS
- Pansharpening
- 1) Datasets:
  - 4-band data: WorldView-3 (WV3)
    - reduced-resolution examples
    - full-resolution examples
- 2) Metrics:
  - Reduced-resolution: SAM, ERGAS, SCC, Q8
  - Full-resolution: QNR, D2, D3

7. CONCLUSIONS

- We introduce a simple but effective Bilateral Activation Mechanism (BAM) that not only retains the nonlinearity of the activation function but also avoids information distortion caused by inactivation.
- A network with residual structure using BAM with ReLU (BRResNet) is proposed, which significantly improves the efficiency of feature extraction in image fusion tasks.
- Proposed BRResNet achieves state-of-the-art performance in two fusion tasks. Especially, the given BRResNet holds a large margin among other CNNs-based methods in terms of the parameters, thus can be viewed as a lightweight network.