Effective Satellite Image Fusion Based on Deep Learning.

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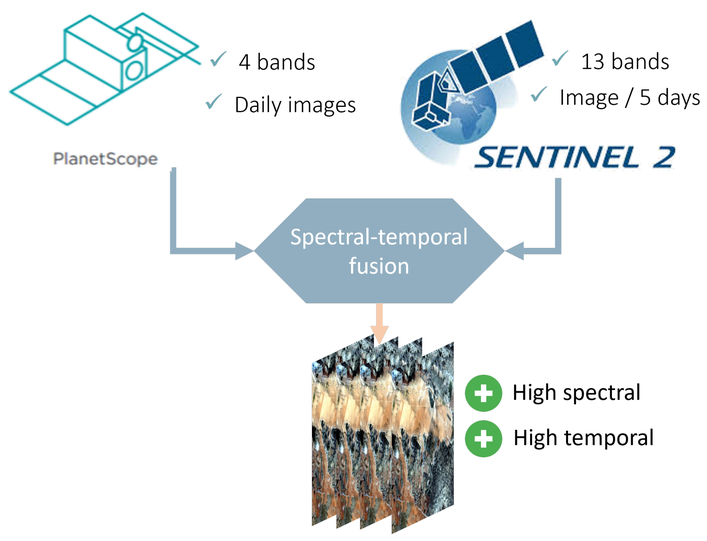
1. Introduction

- Most DL-based fusion techniques [1] regard the image fusion problems as black-box with no physical interpretation, which can alter the spectral signature leading to wrong prediction in subsequent applications.
- In our work, we addressed two main RS fusion problems: pansharpening [2] and multi-source multi-temporal fusion, which help us to fulfill our objectives by preserving the spectral information, as well as to provide adequate satellite images with the best aspects for agriculture, forestry and urban area monitoring and different other applications.
- Here, we present our regarding the second fusion problem, which aims to produce dense time-series (daily images) with very high spectral based on the attention mechanism.

2. Spectral-temporal Fusion

In this work, we defined a new fusion problem, which aims to combine Planetscope and Sentinel-2 satellite images, that have different but complementary characteristics.

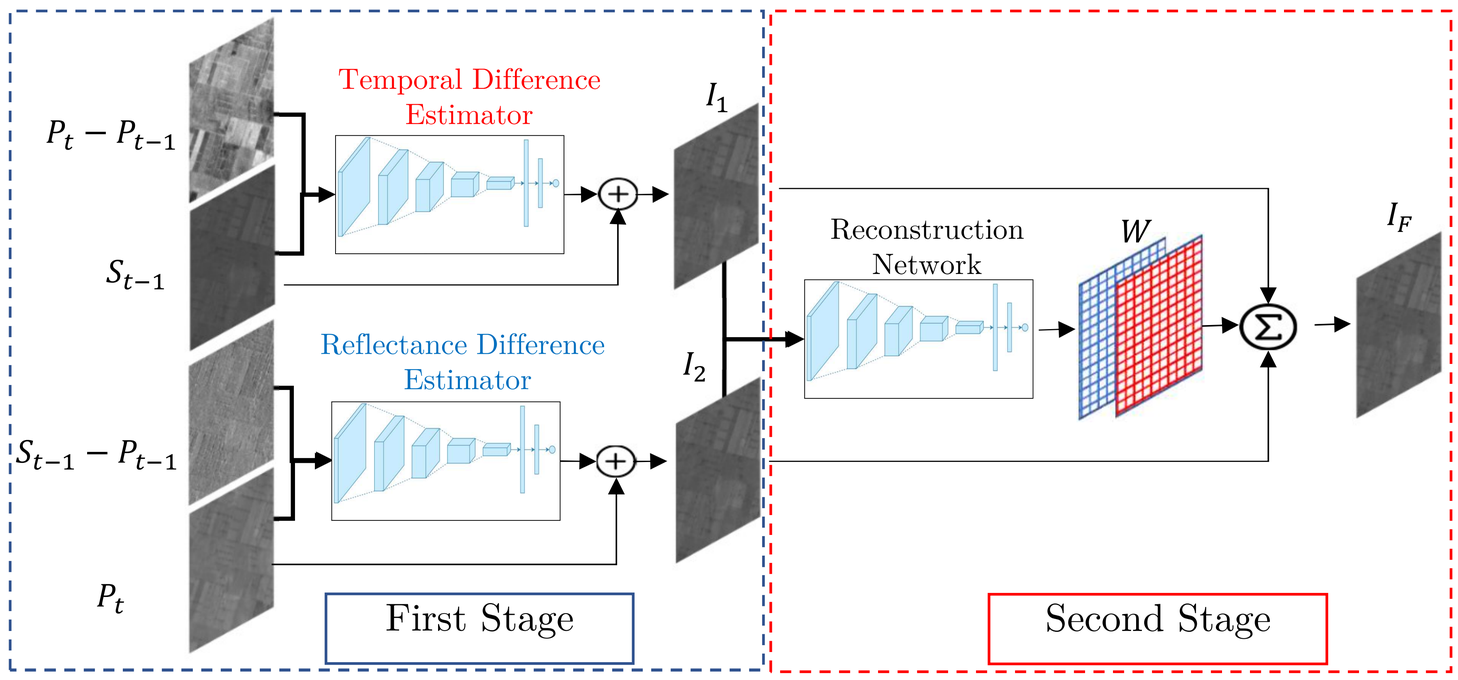
The spectral Temporal Fusion



3. The proposed Method STA-Net

- Spectral-temporal fusion Sentinel-2 et Planetscope based on Deep Learning
- Two-stream architecture based on the attention mechanism
- Generation of series of Sentinel-2 like images
- Pionnering work dealing with this fusion problem

The overall framework of STA-Net.



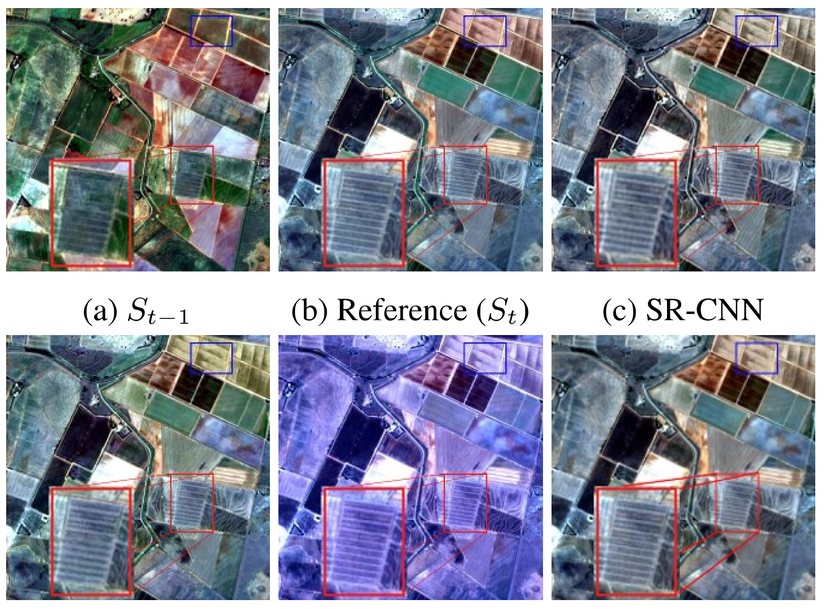
4. Results

- The proposed technique was compared to several literature methods.
- The results show that the proposed technique offers the best fused products in terms of spatial, spectral, and radiometric resolutions.

Quantitative scores of the fused images on Colemabally Dataset.

Metric	SR-CNN	StfNet	GAN-STFM	STA-Net
RMSE	0.0149	0.0099	0.0175	**0.0068**
CC	0.9195	0.9597	0.9690	**0.9814**
SAM	0.1019	0.0365	0.0321	**0.0247**
SSIM	0.9321	0.9610	0.9682	**0.9790**
UIQI	0.9947	0.9991	0.9968	**0.9996**

Visual comparison of the fused images.



(a) S_{t-1} (b) Reference (S_t) (c) SR-CNN

(d) StfNet (e) GAN-STFM (f) STA-Net (Ours)

5. Conclusions and Future works

We proposed STA-Net, an end-to-end two-stream fusion technique based on residual attention blocks via an effective loss function to integrate Plaetscope and Sentinel-2 images.

1. Pionnering work that addresses the spectral-temporal fusion
2. STA-Net yielded the best fusion performances
3. The generation of daily Sentinel-2 images allowing early crop monitoring practices.
4. Evaluation of the fused data on real-word agricultural tasks.
5. Extend STA-Net to integrate spatial, spectral, and temporal resolution via a single framework.

6. References

[1] Scarpa et al. Target-adaptive cnn-based pansharpening. *IEEE Trans. on Geosc. and Rem. Sens.*

[2] Benzenati et al. Pansharpening approach via two-stream detail injection based on relativistic gan. *Expert Sys. with Appl.*