

Computer Imaging Project

Sparsity and patch for image restoration.

22 March, 2022

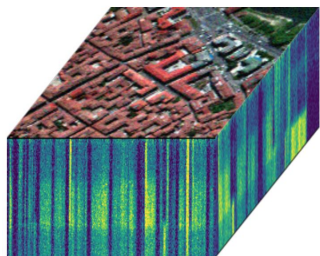
Presented by :
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Emmanuelle Bodji
Hervé Silué



CONTENT

- I. INTRODUCTION
- II. SELECTED APPROACH
- III. METHODOLOGY
- IV. RESULTS

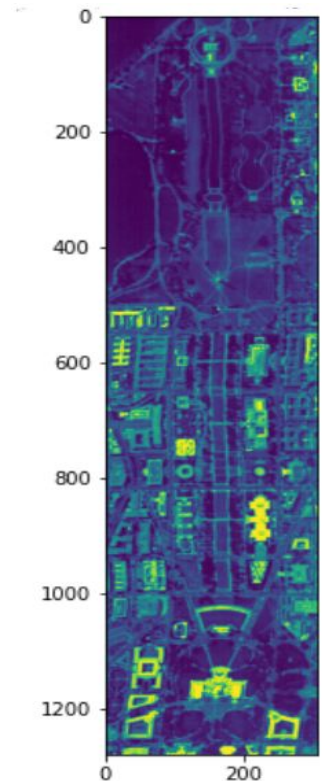




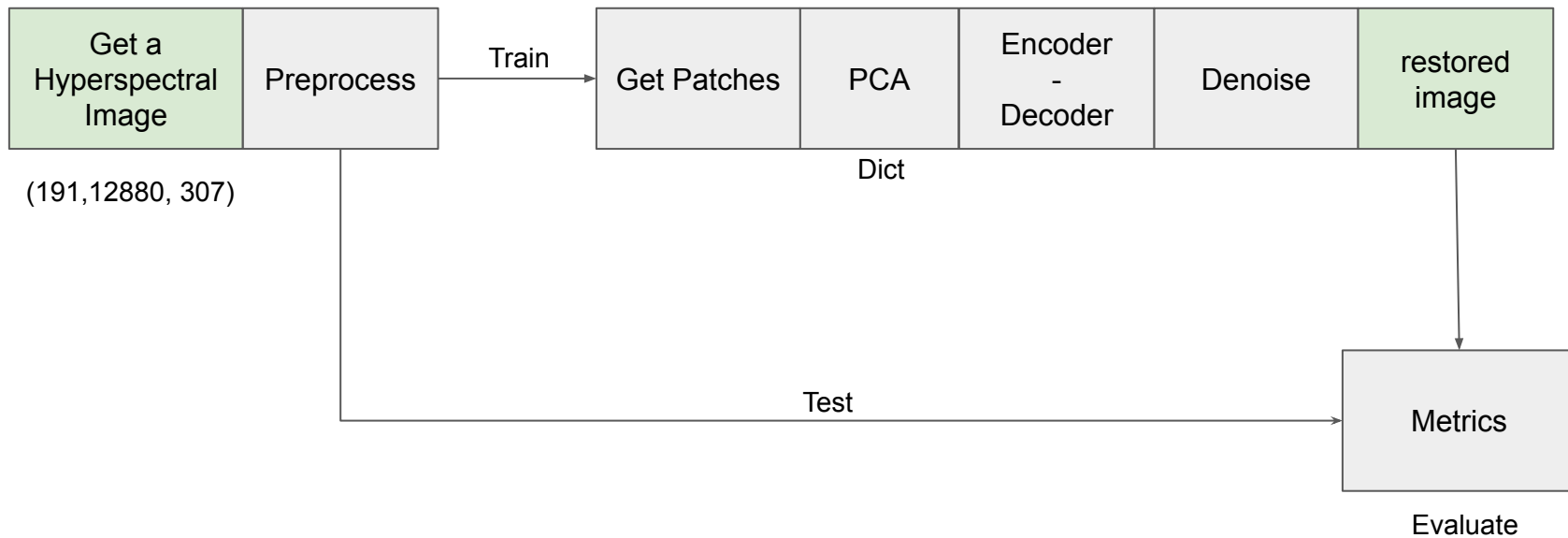
Hyperspectral
Image

- Learn-based approach :
Using dictionary.

$$\min_{\alpha_i \in \mathbb{R}^p} \frac{1}{2} \|\mathbf{y}_i - \mathbf{D}\alpha_i\|^2 + \lambda \|\alpha_i\|_1$$



Used Image

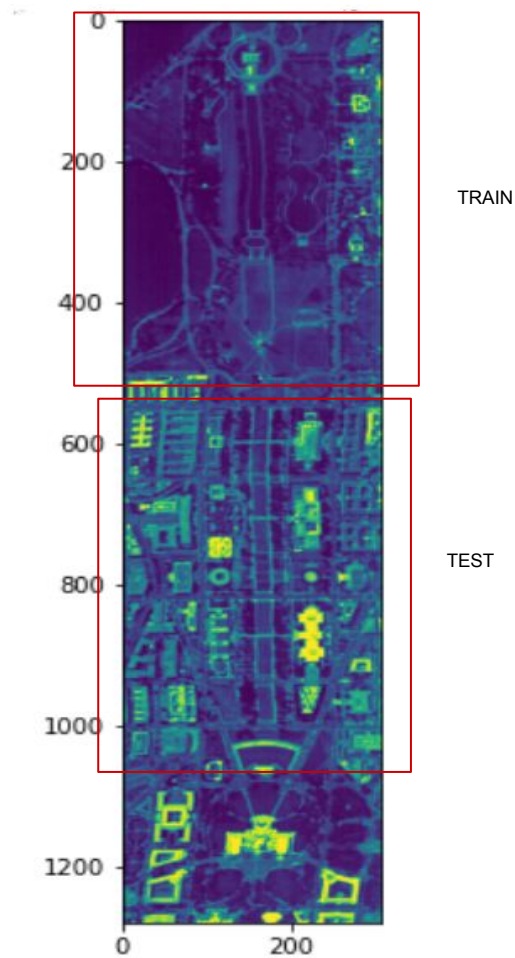


Get a Hyperspectral Image

Preprocess

Image Normalization

Split Data into train and test sets



Get a Hyperspectral Image

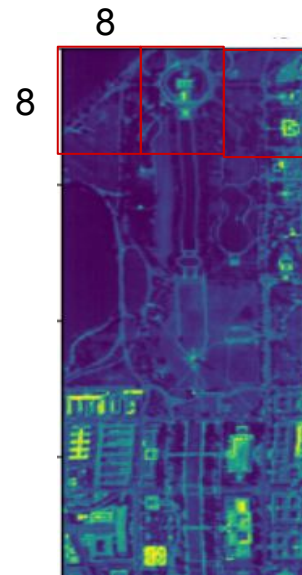
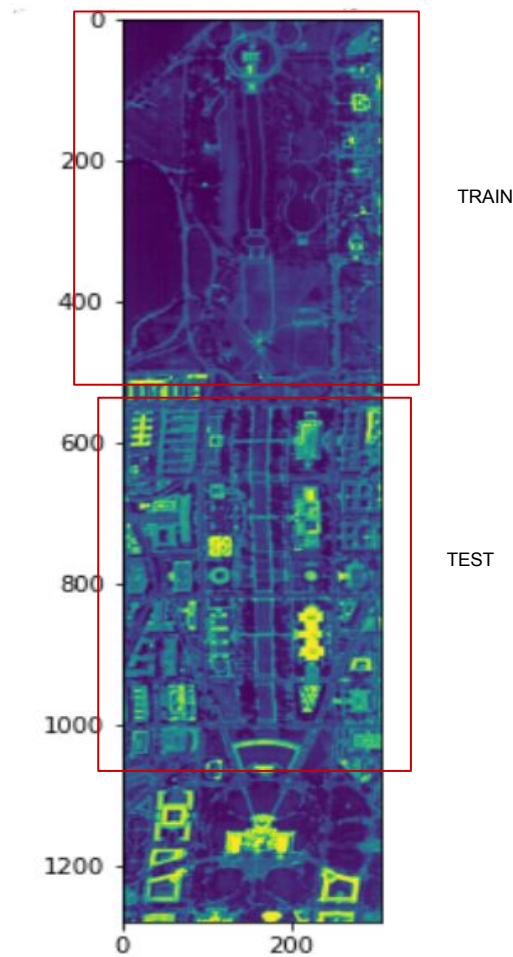
Preprocess

Image Normalization

Split Data into train and test sets

Get Patches

Crop the HI into several
patches (20,8,8)



1

Get a Hyperspectral Image

Preprocess

Image Normalization

Split Data into train and test sets

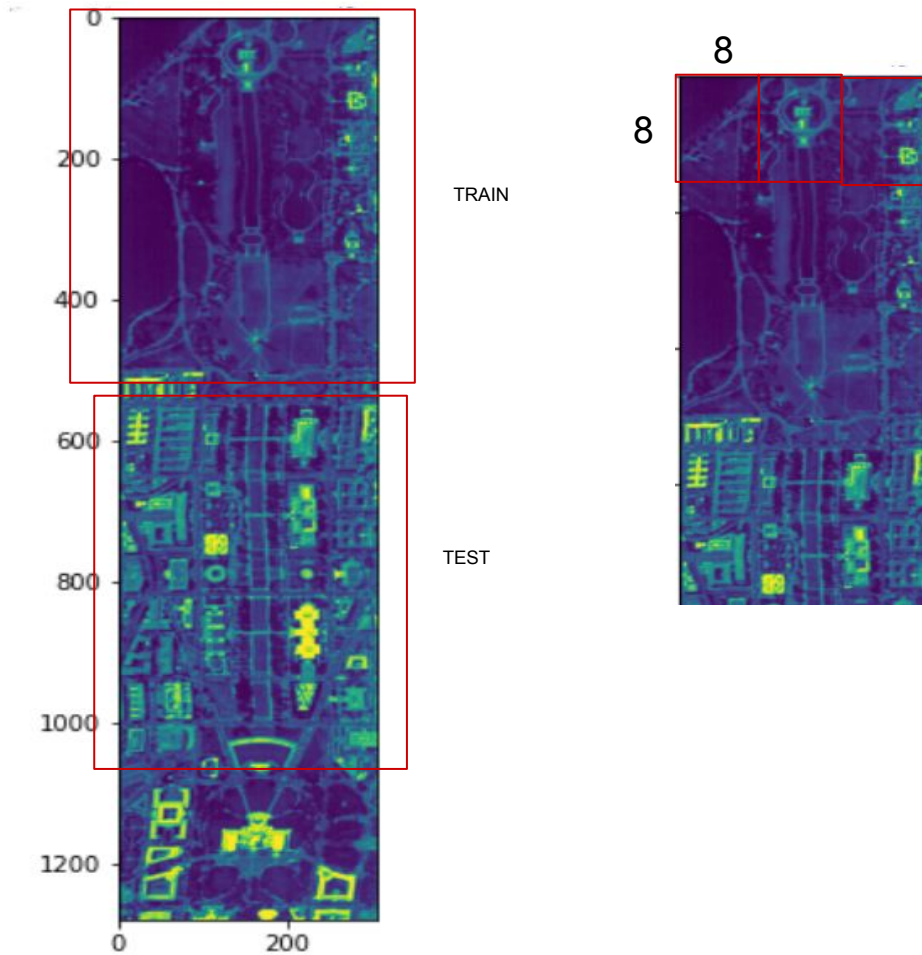
Get Patches

Crop the HI into several
patches (20,8,8)

Apply PCA

Use PCA to construct the
dictionary => select 50
principal component

Get the Dictionary D

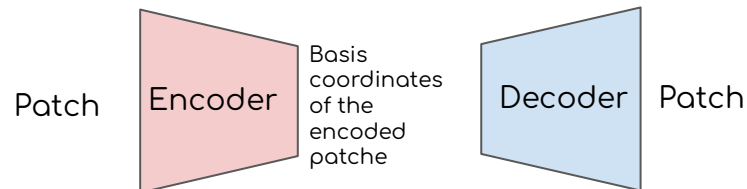


2

Encoder - Decoder

Encoder : Get the coordinates of the patch in the new orthogonal basis.

Decoder : Reconstruct the patch from the projection coefficients



2

Encoder - Decoder

Encoder : Get the coordinates of the patch in the new orthogonal basis.

Decoder : Reconstruct the patch from the projection coefficients

Denoising

Test set
+ Noise

Restored image

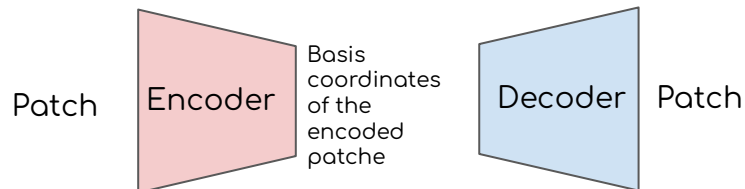
Evaluation (metrics)

Test set

$$\min_{\alpha_i \in \mathbb{R}^p} \frac{1}{2} \|\mathbf{y}_i - \mathbf{D}\alpha_i\|^2 + \lambda \|\alpha_i\|_1 \quad \alpha_i^{(t+1)} = S_\lambda \left[\alpha_i^{(t)} + \eta \mathbf{D}^\top (\mathbf{y}_i - \mathbf{D}\alpha_i^{(t)}) \right]$$

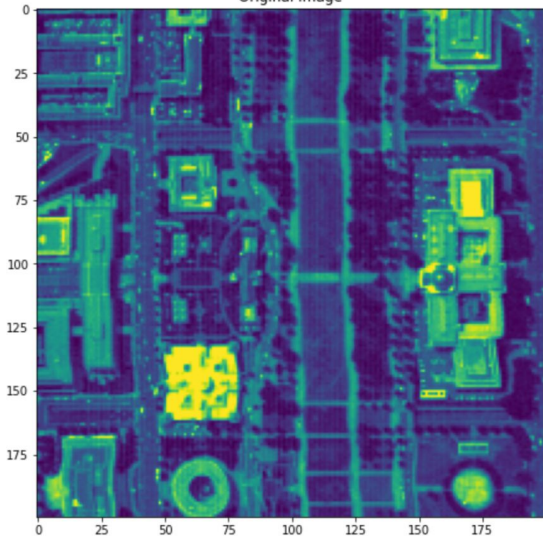
MPSNR : Mean Peak Signal to Noise Ratio

MSSIM : Mean Structure Similarity Index Metric

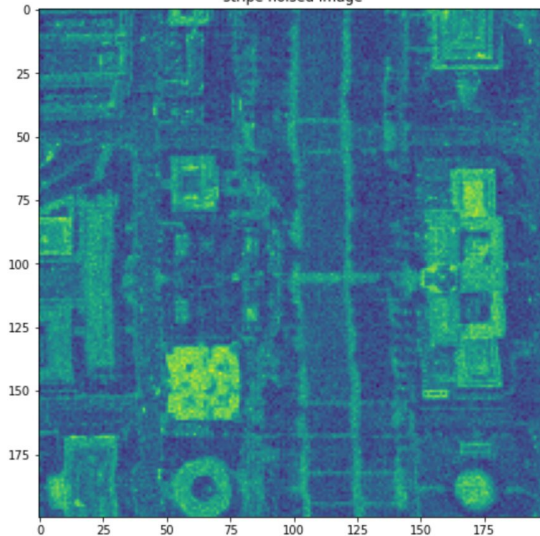


With random initialization

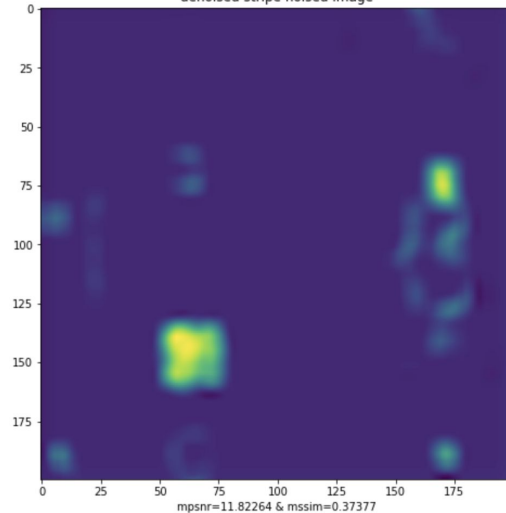
Original Image



stripe noisy image



denoised stripe noisy image

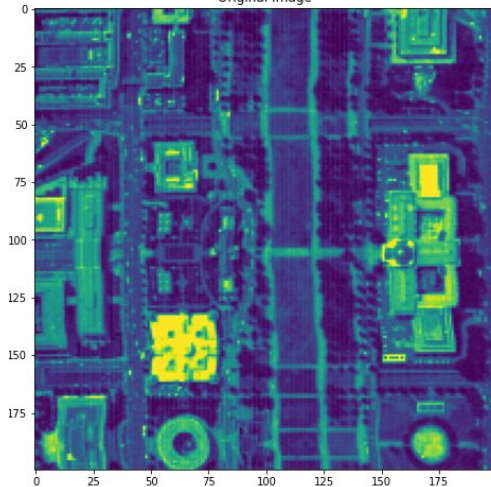


MPSNR : 11.82264

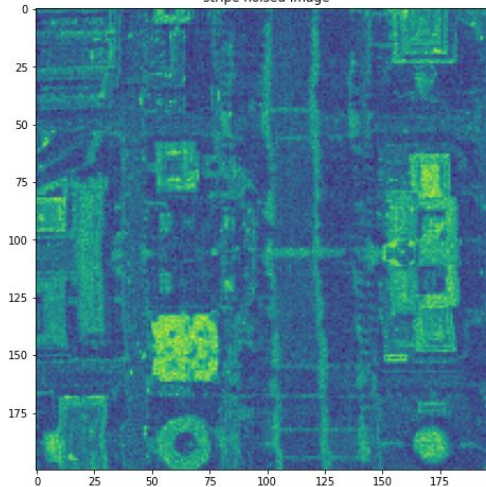
MSSIM : 0.37377

With the projection of the patch as initialization

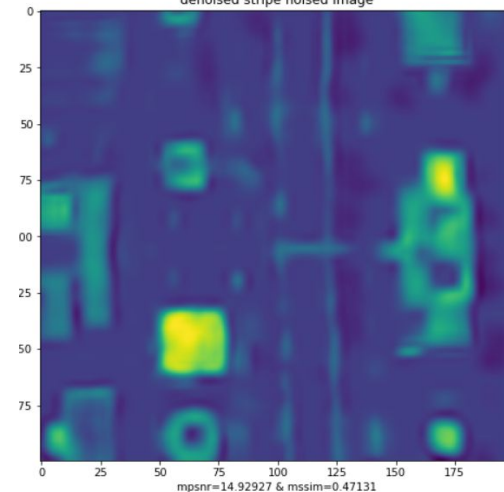
Original Image



stripe noised image



denoised stripe noised image



MPSNR : 14.92927

MSSIM : 0.47131

THANK YOU FOR YOUR ATTENTION

