ASEC 2025 Conference

The 6th International Electronic Conference on Applied Sciences

09–11 December 2025 | Online

MDPI

Pixel reflectance estimation with deep learning pansharpening methods

Hind Hallabia

University Institute of Technology at Saint Etienne, Université Jean Monnet[1]

Hubert Curien Laboratory, France[2]

INTRODUCTION & AIM

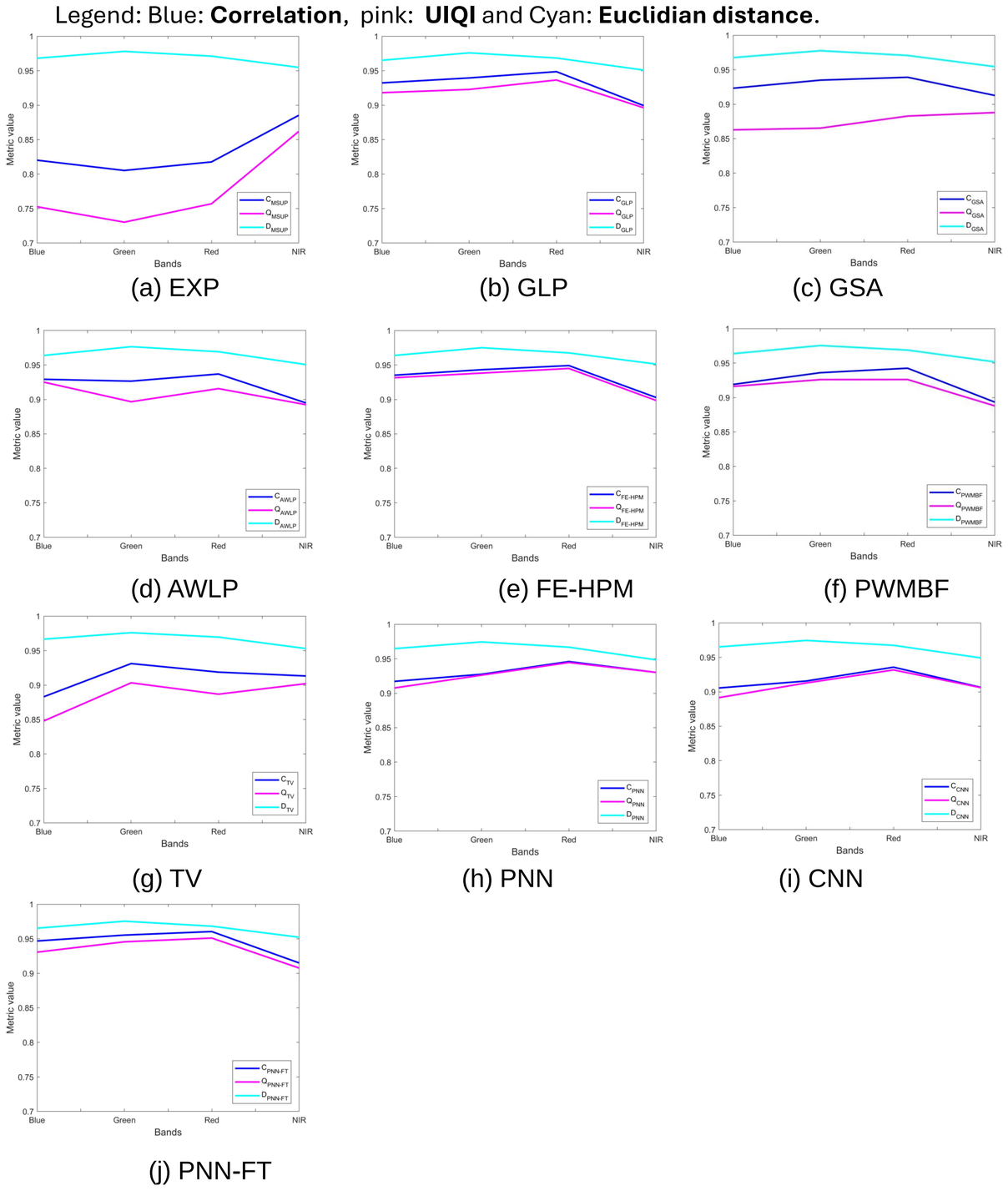
Diversity of remote sensing data are characterized by the richness and the variability of their pixel reflectance.

Statistical pansharpening experiments have been proposed to study the diversity of high resolution remote sensing images.

Quality assessment experiments have been studied in the pixel level (correlation, UIQI and Euclidian distance) with respect to WALD and QNR protocols.

METHOD

Figure 1. Band based quality metrics estimated on HOBART dataset at reduced scale.
Legend: Blue: **Correlation**, pink: **UIQI** and Cyan: **Euclidian distance**.



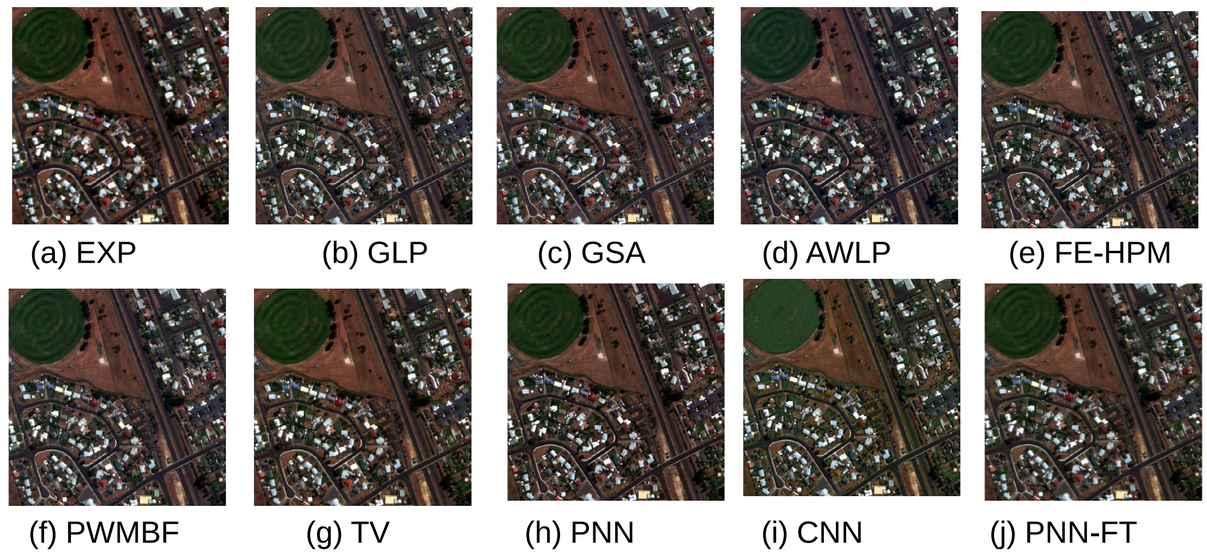
(a) EXP (b) GLP (c) GSA

(d) AWLP (e) FE-HPM (f) PWMBF

(g) TV (h) PNN (i) CNN

(j) PNN-FT

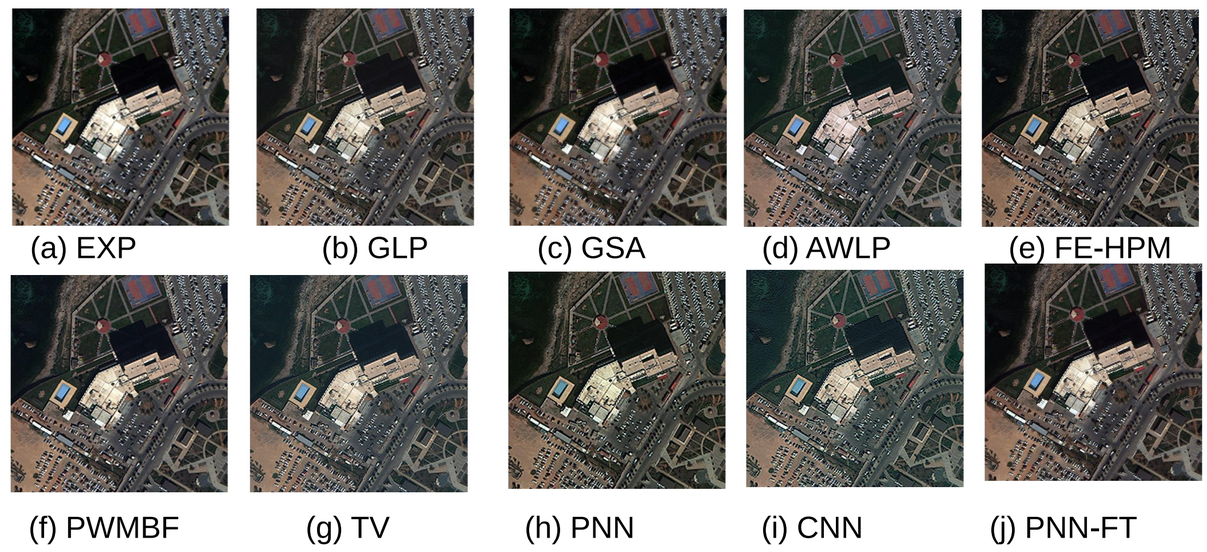
RESULTS & DISCUSSION



(a) EXP (b) GLP (c) GSA (d) AWLP (e) FE-HPM

(f) PWMBF (g) TV (h) PNN (i) CNN (j) PNN-FT

Figure 2. Fusion results conducted on HOBART dataset.
The **bold** is ranked first. The *italic* is ranked the second.



(a) EXP (b) GLP (c) GSA (d) AWLP (e) FE-HPM

(f) PWMBF (g) TV (h) PNN (i) CNN (j) PNN-FT

Figure 3. Fusion results conducted on TRIPOLY dataset.
The **bold** is ranked first. The *italic* is ranked the second.

Table 1. Numerical results of pansharpening methods estimated on HOBART dataset.
The **bold** is ranked the first. The *italic* is ranked the second.

Method	Q4	SAM	ERGAS	SCC	SSIM	PSNR	QNR
EXP	0.778	5.370	5.510	0.445	0.820	-34.106	0.946
GLP	0.921	5.085	3.697	0.681	0.908	-31.434	0.795
GSA	0.875	5.266	4.199	*0.700*	0.894	-32.143	0.860
AWLP	0.913	5.522	3.936	0.663	0.900	-31.767	0.817
FE_HPM	*0.930*	5.060	3.550	0.697	0.910	-31.157	0.797
PWMBF	0.916	5.591	3.828	0.684	0.898	-31.733	0.816
TV	0.882	4.920	4.490	0.585	0.886	-32.294	*0.952*
PNN	0.928	**4.367**	*3.537*	0.665	**0.920**	*-30.856*	**0.972**
CNN	0.912	5.594	3.899	0.645	0.894	-31.823	0.943
PNN_FT	**0.934**	*4.790*	**3.354**	**0.742**	*0.917*	**-30.647**	0.893

Table 2. Numerical results of pansharpening methods estimated on TRIPOLY dataset.
The **bold** is ranked the first. The *italic* is ranked the second.

Method	Q8	SAM	ERGAS	SCC	SSIM	PSNR	QNR
EXP	0.688	6.575	7.424	0.218	0.684	-42.645	0.875
GLP	0.878	**6.090**	**4.819**	0.749	*0.871*	-38.861	0.827
GSA	0.860	6.532	5.073	0.749	0.858	-39.315	0.873
AWLP	0.875	6.299	4.868	0.748	*0.871*	*-38.824*	0.858
FE_HPM	0.881	6.200	4.845	0.746	0.869	-38.930	0.824
PWMBF	*0.888*	6.496	4.863	*0.758*	*0.871*	-38.939	0.779
TV	**0.903**	*6.168*	4.596	**0.759**	**0.892**	**-38.447**	*0.895*
PNN	0.863	6.726	5.348	0.634	0.839	-39.736	**0.943**
CNN	0.857	8.005	5.629	0.641	0.788	-40.181	0.847
PNN_FT	0.852	6.348	5.313	0.674	0.839	-39.714	0.884

CONCLUSION & FUTURE WORK

✓ Reduced- and full-scale experiments have been conducted on two remote sensing data (HOBART and TRIPOLY).

✓ Quality assessment have been proposed by considering the pixel reflectance.

Future work: More areas will be investigated (as desert, ocean and land) in pansharpening purpose.

REFERENCES

[1] "A New Benchmark Based on Recent Advances in Multispectral Pansharpening: Revisiting Pansharpening With Classical and Emerging Pansharpening Methods"; G. Vivone, M. Dalla Mura, A. Garzelli, R. Restaino, G. Scarpa, M.O. Ulfarsson, L. Alparone, and J. Chanussot; IEEE Geoscience and Remote Sensing Magazine, vol. 9, no. 1, pp. 53-81, March 2021, doi: 10.1109/MGRS.2020.3019315.