



UNIVERSITÀ DEGLI STUDI DI NAPOLI
FEDERICO II

itee^{PhD}
information technology
electrical engineering



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Giuseppe Guarino

Deep Learning for Data Fusion in Remote Sensing

Tutor: Prof. Giovanni Poggi
co-Tutor: Prof. Giuseppe Scarpa (UniParthenope),
Gemine Vivone (CNR IMAA)

Cycle: XXXVIII

Year: Second

My background

- MSc degree in Automation Engineering and Robotics – Università degli Studi di Napoli Federico II
- Research group: GRIP (Image Processing Research Group)
- PhD start date: 1/11/2022
- Scholarship type: CNR Istituto di Metodologie per l'Analisi Ambientale (IMAA)

Summary of study activities

- **PhD Courses:**

- *IEEE-EURASIP Summer School on Signal Processing 2024*: A summer school focused on processing of several types of signals (audio, image, video) using both model based and data driven methodologies
- *DeepLearn 2024: 11th International School on Deep Learning*: A summer school focused on emerging applications in Deep Learning field.
- *Strategic Orientation for STEM Research & Writing* : A course that explains which soft skills can help a researcher to transmit his ideas more effectively, and how to develop them.

- **MSc Courses:**

- *None*

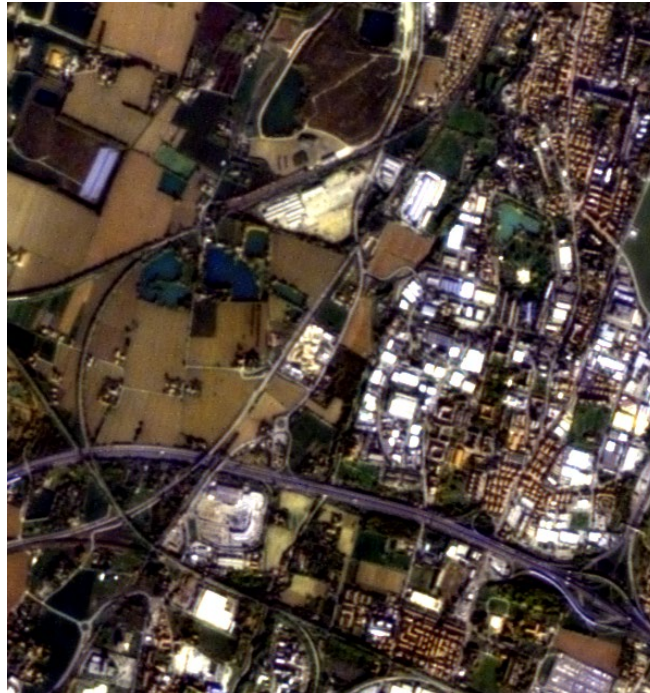
- **Conferences and Tutorials:**

- 18th European Conference on Computer Vision (ECCV) 2024.
- IEEE International Geoscience and Remote Sensing Symposium (IGARSS) 2024

Research field of interest



Enhancement of satellite images resolution

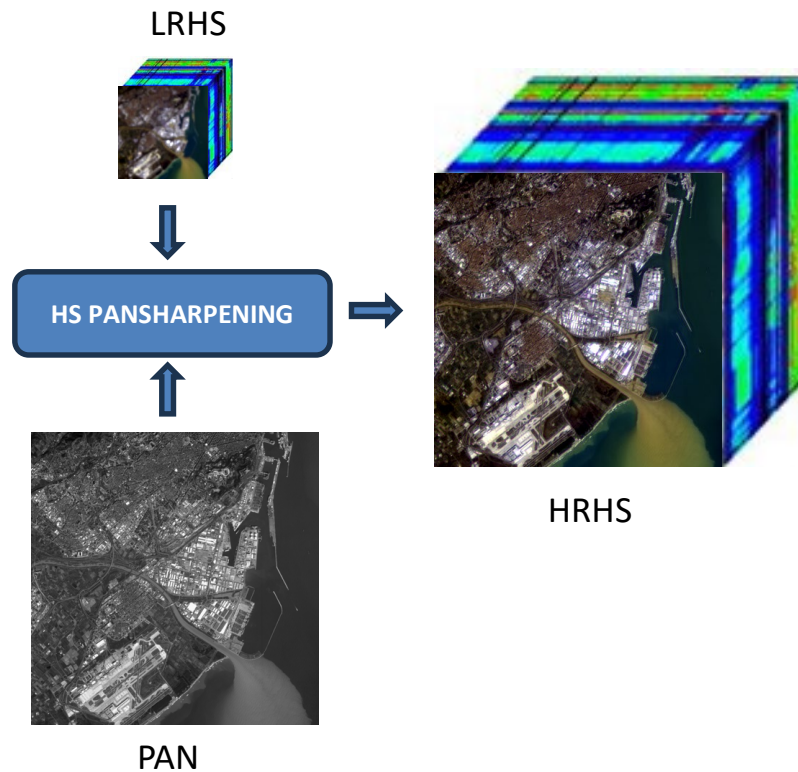


30m

5m

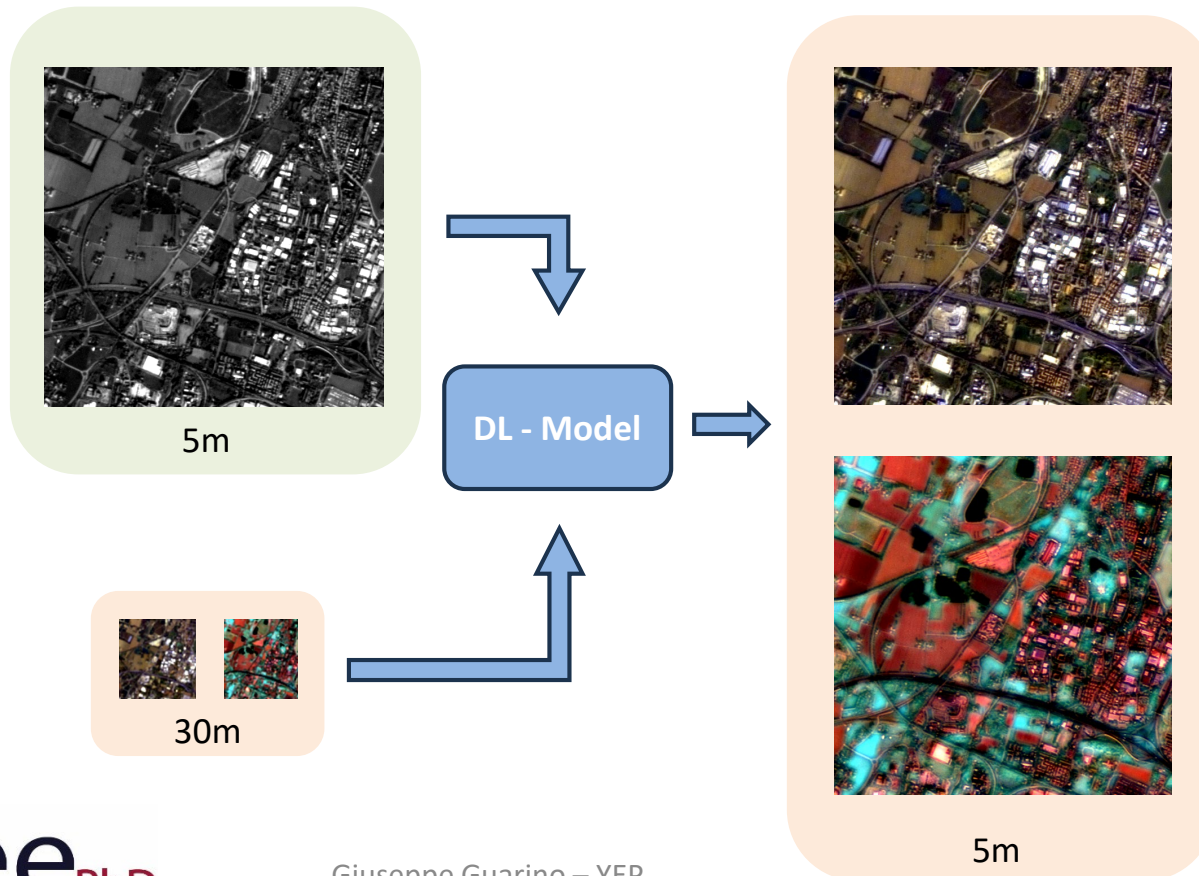
Research activity: Problem

What is Hyperspectral Pansharpening?



Research activity: Objective

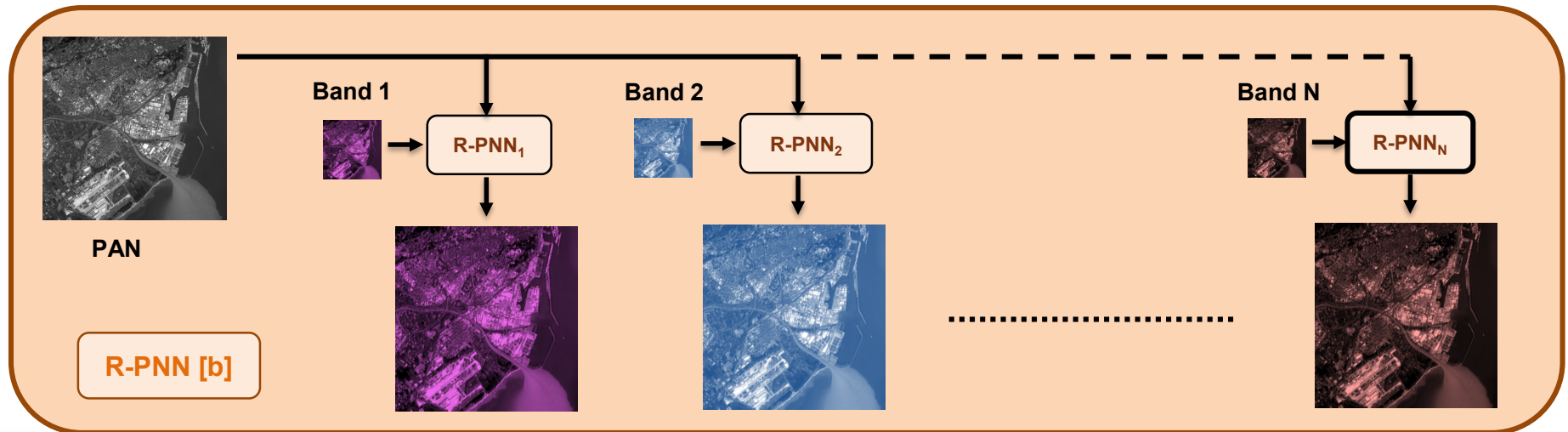
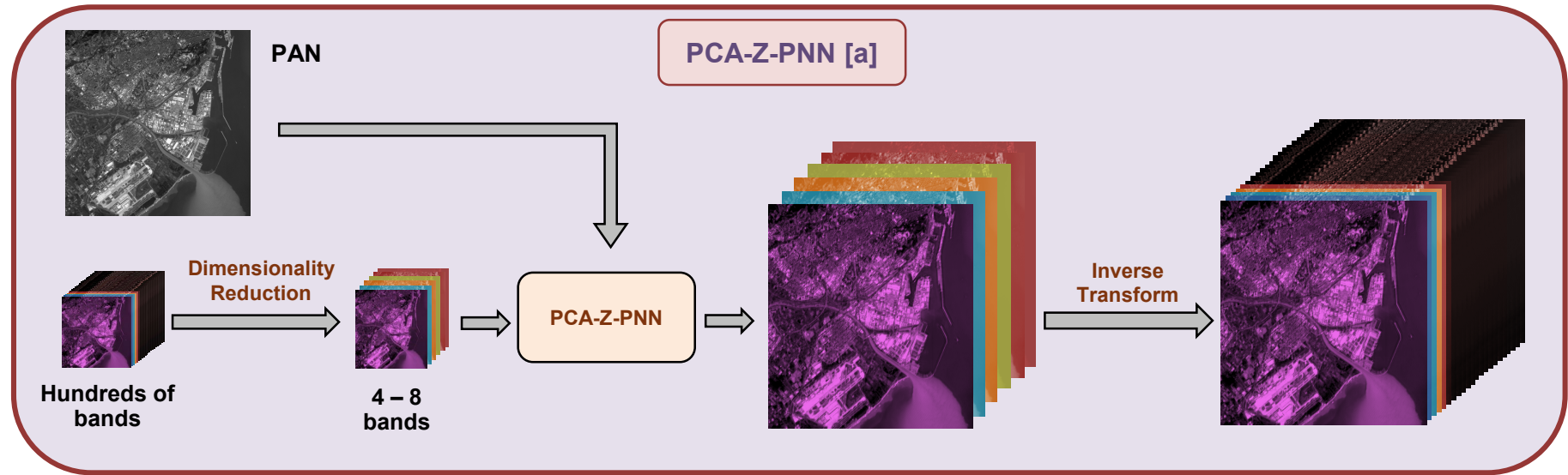
Our objective is to investigate Deep Learning approaches to address this task, aiming for solutions that are not only faster but also more computationally efficient compared to model-based techniques.



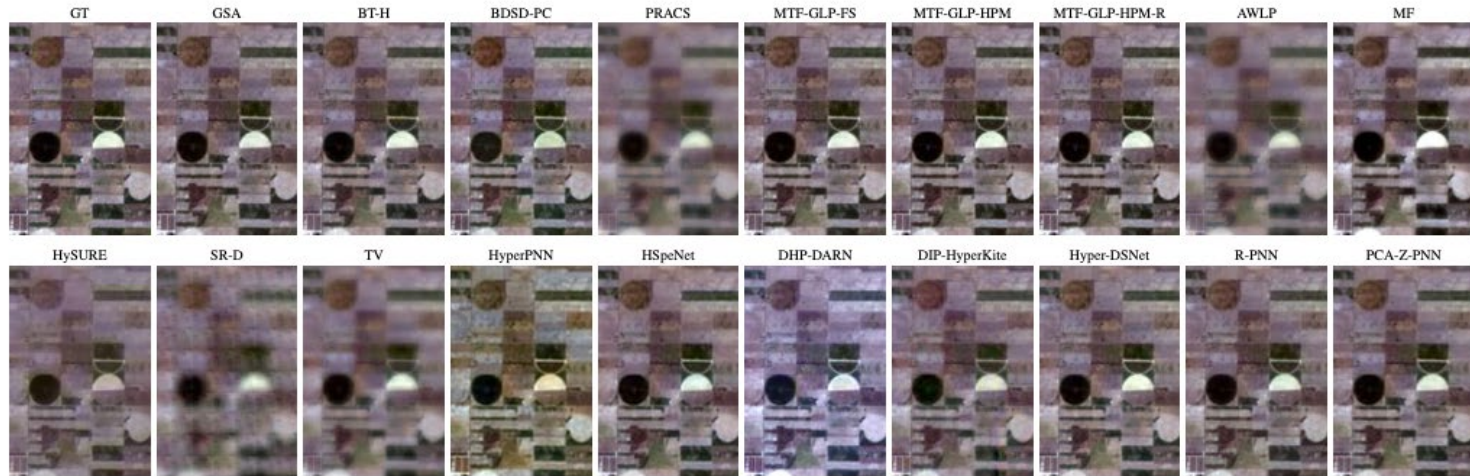
Challenges:

- Lack of satellite data
- No reference
- High volume of data

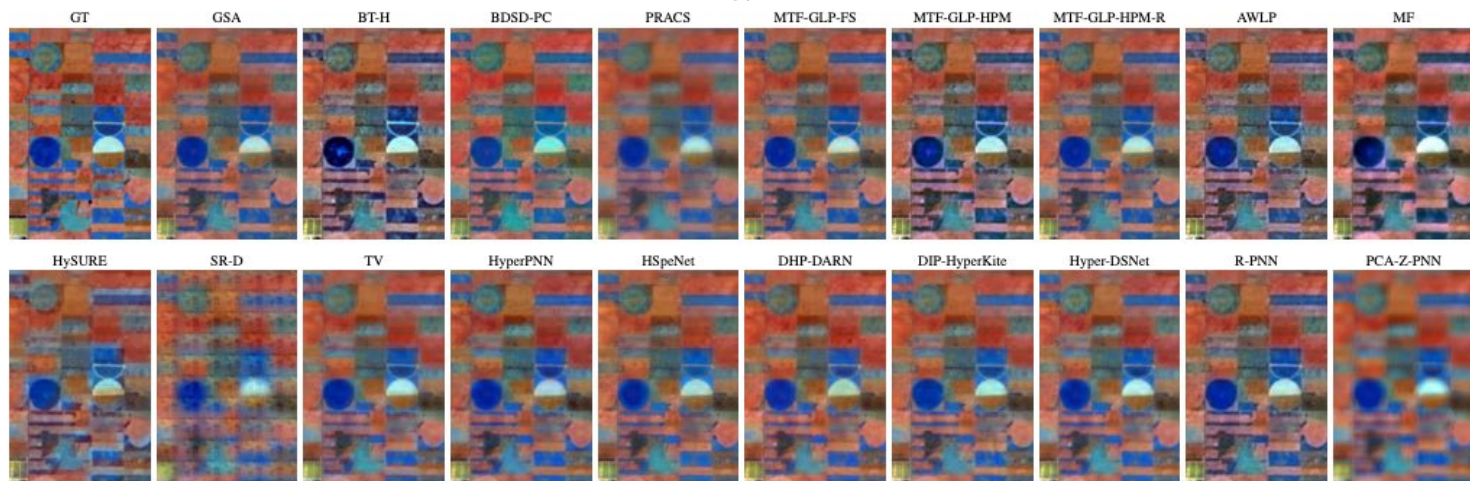
Research activity: Proposed Solutions



Research activity: HS Toolbox



(a)



(b)

Ciotola, M., **Guarino, G.**, Vivone, G., Poggi, G., Chanussot, J., Plaza, A., & Scarpa, G.,
 “Hyperspectral Pansharpening: Critical Review, Tools and Future Perspectives”, 2024. IEEE Geoscience and Remote Sensing Magazine (Major Review).

Giuseppe Guarino – YEP

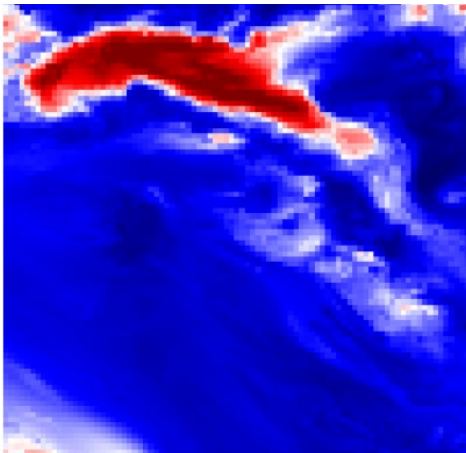
Products

[C1]	G. Guarino , M. Ciotola, G.Poggi, G. Vivone, G. Scarpa, “Hybrid GSA-CNN Method for Hyperspectral Pansharpening”, <i>IEEE IGARSS 2024</i> , pp. 901-904, 2024
[C2]	G. Guarino , A. Mazza, G. Di Giuseppe, G.Poggi, G. Vivone, G. Scarpa, “CNN-Based NO2 Estimation from Sentinel-5P Data: A Proof-of-Concept”, <i>IEEE IGARSS 2023</i> , pp. 5744-5747, 2024
[C3]	M. Ciotola, G. Guarino , G. Vivone, J. Chanussot, A. Plaza, G. Scarpa, “Hyperspectral Pansharpening: Review and Future Perspectives”, <i>IEEE IGARSS 2024</i> , pp. 1231-1234, 2024
[C4]	M. Ciotola, G. Guarino , G.Poggi, G. Scarpa, “Balancing Spectral and Spatial Quality in CNN-Based Unsupervised Pansharpening”, <i>IEEE IGARSS 2024</i> , pp. 1091-1094, 2024
[J1]	M. Ciotola, G. Guarino , G. Vivone, G. Poggi, J. Chanussot, A. Plaza, G. Scarpa, “Hyperspectral Pansharpening: Critical Review, Tools and Future Perspectives”, <i>IEEE Geoscience and Remote Sensing Magazine</i> (In review – “Major Review” received)
[J2]	M. Ciotola, G. Guarino , G. Scarpa, “An Unsupervised CNN-Based Pansharpening Framework with Spectral-Spatial Fidelity Balance”, <i>Remote Sensing</i> , 2024

Next Year

📍 *Centre Inria d'Université Côte d'Azur, Montpellier* 

Explore new CV solutions for high resolution image applications



Air pollutant
estimation



Semantic
segmentation

Ng, Virginia, and Daniel Hofmann 2018.



Object
detection

xView dataset

Thank you for the attention!