Finanziato dall'Unione europea NextGenerationEU
Ministero dell'Università e della Ricerca
Italiadomani PIANO NAZIONALE DI RIPRESA E RESILIENZA
ICSC Centro Nazionale di Ricerca in HPC, Big Data and Quantum Computing

PADDLE

Persistence Automatic Detection and correction with Deep LEarning

Andrea Masella, Datrix S.p.A.

Spoke 3 Progetti Bandi a Cascata, 09/01/2025

Datrix Group

Datrix is an Italian SME with headquarters in Milan and offices in Rome, Viterbo, Cagliari, and New York. It was founded in 2013 by former Google managers and today focuses on **artificial intelligence** and **software development**

Datrix SpA is listed on Euronext Growth Milan
~120 employees
~€14.5M turnover in 2023

The **R&D team** at Datrix has actively participated in numerous nationally and EU-funded projects, both past and present (total funding **€ 54+M**). These include **FET-Open**, **H2020**, **Horizon Europe**, and **MSCA-DN** programmes

PADDLE

Persistence Automatic Detection and correction with Deep LEarning

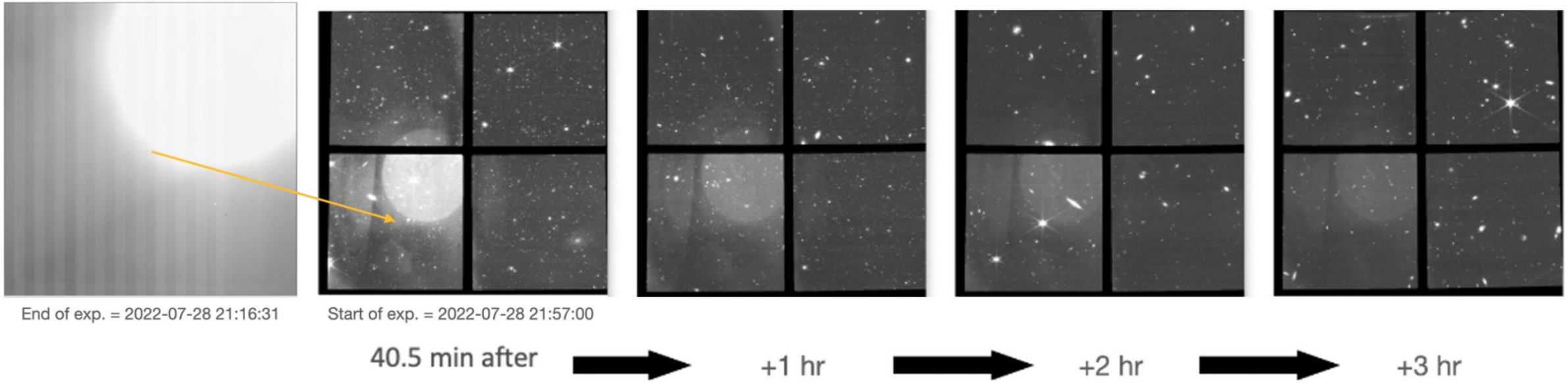
Area tematica **5**: Intelligenza Artificiale applicata a missioni spaziali

Sotto-tematica **d)**: Sviluppo e applicazione degli algoritmi di deep learning per l'analisi di dati astrofisici da missioni spaziali (es. Euclid). Implementazione di algoritmi per la riduzione di dimensionalità e identificazione di feature fisiche/strumentali predominanti. Analisi ed interpretazione dello spazio latente per individuazione delle componenti principali, per inferenza di parametri cosmologici e/o astrofisici. Generazione di dataset sintetici in diversi scenari astrofisici/cosmologici.

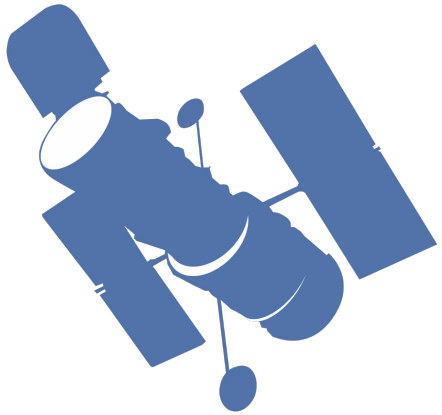
Project Overview

Deep learning model for the correction of the **persistence phenomenon** in IR detectors

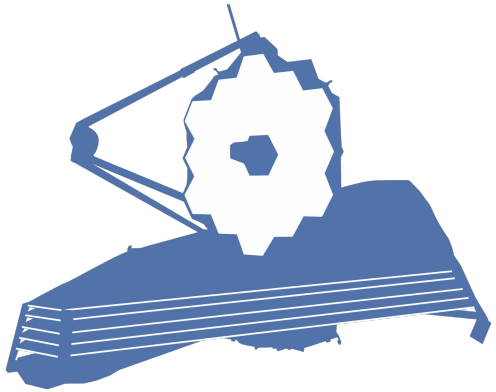
- corruption of images due to electrons from previous exposures that can be 'trapped' in the pixel substrate and only released over time. This is due to a property of NIR detectors



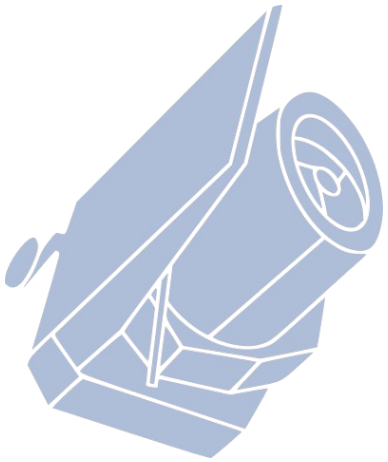
https://jwst-docs.stsci.edu/jwst-near-infrared-camera/nircam-performance/nircam-persistence



HST



JWST



Euclid

Roman

Technical Objectives and Methodologies

Main objective: Develop a DL model for the correction of persistence in IR detectors

Technical Objectives and Methodologies

Main objective: Develop a DL model for the correction of persistence in IR detectors

Methodology and steps:

1. Collection of the data set
   - Experimental data from MAST (WFC3/IR from HST/NIRCAM from JWST)
     i. persistence-free data to be used for synthetic data generation
     ii. persistence & persistence-corrected image pairs from current processing pipelines
   - Generation of synthetic data via the simulation of persistence via phenomenological models (e.g., A-γ or Fermi)
2. Development of the deep learning model
   - deep learning architecture (U-Net, GAN, ViT, exploring PINNs)
   - training and validation of the model

Expected Results

1. Deep learning model at TRL 5 to assess and eventually correct persistence in NIR images from space missions to produce science-ready images
   a. Aim is to provide a simpler, faster, and more accurate correction than current pipelines
2. Releasing the model to the public (GitHub/Hugging Face)
3. Basic model to be extended and fine-tuned for different space missions / sensor arrays

Involved Staff and New Recruitments

Matteo Bregonzio
Senior Data Scientist
CTO

Alsu Shakirzyanova
Data Engineer
Full stack Developer

Andrea Masella
Data Scientist

Elia Broggio
Data Scientist

Aapo Perakorpi
Data Scientist

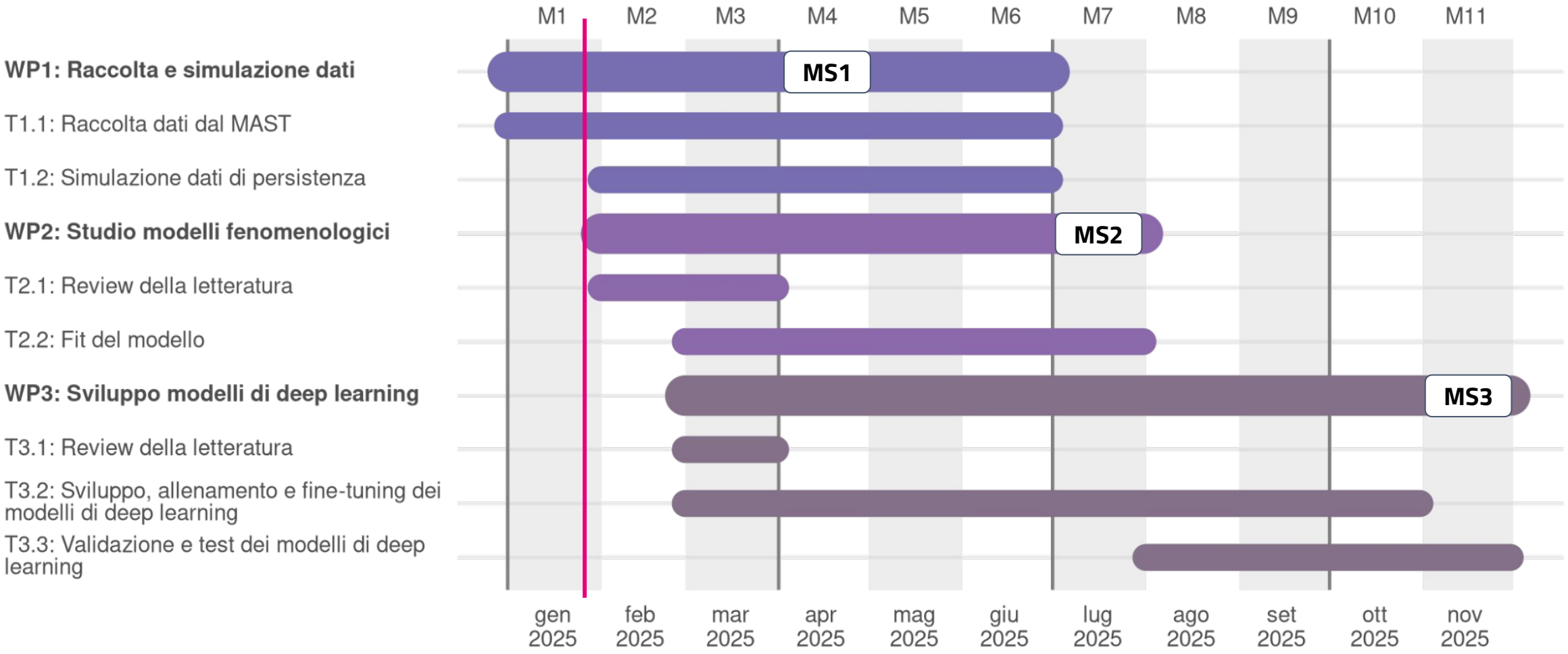
Yuliia Sobko
IT and Data Project Manager

Giovanni Di Noia
Backend Developer

Lorenzo Venieri
Data Scientist

\+

synergy with UniMiB

UNIVERSITÀ DEGLI STUDI DI MILANO BICOCCA

Timescale, Milestones, SAL