Progetto ID: 2023-UNBACLE-0245454

Titolo: "Biomes data Integration with Low-Rank models" (BiLoRa)

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ABSTRACT PROGETTO:

This research project addresses emerging health challenges, such as new allergies and diseases, through the development of low-rank mathematical models that integrate environmental and human data. The problem is formulated as a constrained optimization on low-rank structures, leveraging advanced techniques in matrix factorization, network-based modeling, and hyperparameter optimization.

A key focus is the theoretical study of joint low-rank models, including their mathematical properties, optimization formulations, and the development of efficient numerical algorithms. By incorporating physical constraints and domain-specific priors, the project aims to improve data harmonization across disciplines, enabling the extraction of meaningful patterns from high-dimensional datasets.

Applications include the integration of omics data from the human microbiome (e.g., genomic, transcriptomic, lipidomic data) with environmental biomes, using advanced mathematical tools to merge multi-source data, including Earth observation (EO) data. This interdisciplinary approach strengthens the link between mathematical modeling, biomedical research, and environmental science, enhancing precision medicine and sustainable resource management.

By fostering transdisciplinary collaboration, the project aspires to advance global health solutions and support data-driven decision-making across multiple fields.