Finanziato dall'Unione europea NextGenerationEU
Ministero dell'Università e della Ricerca
Italiadomani PIANO NAZIONALE DI RIPRESA E RESILIENZA
UNICAM Università di Camerino 1336
fidoka CONNESSI SICURI VELOCI

Missione 4 Istruzione e Ricerca

Advanced multi-omics Data Analysis for Precision Therapy Algorithms (ADAPTA)

Spoke 7

Tema 3: 3 - Artificial Intelligence and Machine Learning Services

03/12/2025

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ADAPTA: objectives and structure of the project

The goal of ADAPTA is to develop a secure, accurate, effective, flexible and explainable architecture for data analytics as an enabler of precision medicine. The data analytics algorithms will be centered on the combination of computational topology and explainable, multi-scale machine learning models.

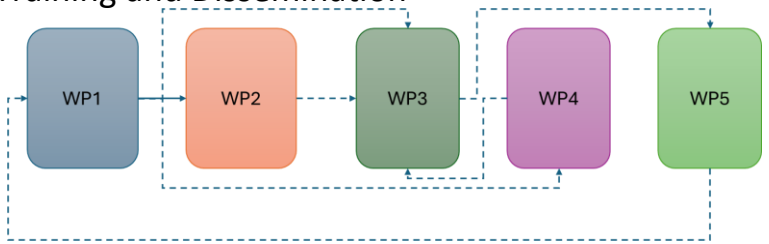
The features of security, effectiveness, flexibility and explainability will be included already in the design phase of the solution through the use of advanced software engineering cycles.

The consortium is composed of:

- FIDOKA – Administrative coordination. Development of communication channels, development of dashboards for data presentation and secure datacenters.
- UNICAM – Scientific coordination. Development of advanced software architecture for multi-scale data analysis

The project is divided into the following workpackages:

- WP1: Coordination, Design and Development of ADAPTA
- WP2: Validation and Optimization
- WP3: Pilot Implementation
- WP4: Development of secure communication channels and data center preparation
- WP5: Training and Dissemination



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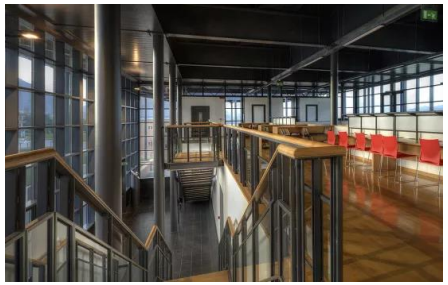
University of Camerino (UNICAM) – Development of algorithms and data structures for data analysis

UNICAM Università di Camerino 1336 UNIVERSITÀ DI CAMERINO

Bioscienze e Medicina Veterinaria

Architettura e Design



Giurisprudenza

Scienze del Farmaco e dei Prodotti della Salute

Istruzione e Ricerca

Science and Technology:

- Chemistry
- Physics
- Geology
- **Computer Science – involved in ADAPTA**
- Mathematics

Computer Research Laboratories

- **Bioshape and Data Science - involved in ADAPTA: Topological Data Analysis and Machine Learning, Biomedical applications and RNA structural analysis**
- Cybersecurity,
- Blockchain,
- Business Process,
- Quantitative Analysis

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FIDOKA - Development of infrastructures for secure data management and communication

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In the future, telecommunications will continue to play **a fundamental role**, not dictating fashions and needs but rather **responding to the concrete needs of the territory**, of the man who lives there and who works and produces there, according to technological but also cultural logics of "digital humanism". Precisely for this reason **Fìdoka wants to invest not only in services for the territory, but also in services that can provide "CARE" to the person**

CYBER SECURITY

Perimeter protection, End-point protection, backup resilience, protection against unauthorized access and disclosure of data, combating phishing and helping to create a security culture. **Everything you need to protect the intangible, but which has an inestimable value.**

IOT / TECNOLOGIA POSITIVA

We believe that the **Internet of Things and artificial intelligence** should provide positive support to society, facilitating collective well-being. The IOT can be used both by companies to improve their processes but also by public administrations in order to create smart, interconnected territories that are services to citizens. **Our dream is to create a Smartland that is attractive to tourists and that allows citizens to live well, increasing their quality of life.**

CONNETTIVITÁ

We provide FWA, fiber and satellite connectivity. Our profiles range from 30 Mbps up to 10 Gbps symmetrical. Our goal is to guarantee a quality connection to everyone, even those who live in the so-called "white zones" and where megabrands choose not to invest. **Our attention is focused on real performance delivery and continuity of service.**

ICT

We are especially appreciated in the field of IP switchboards, UTM (firewall), managed backup, wireless coverage, radio bridges, hyperconvergent systems. **We provide the technology that "you need", suitable for consumers, SMEs, artisans and all commercial realities, from large companies to freelancers, completely tailor-made and adaptable to every need.**

ADAPTA for Heal Italia

ADAPTA will overcome the limitations of current data analysis approaches applied to precision medicine by developing a new architecture obtained through the integration of innovative solutions that address current limitations during the design phase.

Limitations Category	Specific Limitations	Impact on Precision Medicine
Data Quality and Availability	• Data Sparsity Data Heterogeneity • Bias and Representativeness	• Insufficient data limits AI training and performance. • Variability in data can lead to inconsistent AI results. • Incomplete data can lead to unfair treatment decisions.
Algorithmic Challenges	• Data Complexity • Overfitting/underfitting • Interpretability and explainability	• AI may not fully capture the complexity of biological systems. • AI models may not generalize well or may be too simplistic. • The lack of clear decision paths can erode trust in AI systems.
Validation	• The ML models are validated only on the data collected in WP1 and WP4	• Scalability and Generability of Results
Integration with Health Systems	• Computing Technology Infrastructure • Data Transmission Infrastructure • Clinician Adoption and Trust	• Limited infrastructure can hinder AI implementation. • Insecure communication channels can compromise data quality and integrity. • If clinicians do not trust or adopt AI, its benefits will not be realized.

ADAPTA for Spoke 7 – Precision medicine

ADAPTA will be validated through data from WP1 and WP4:

Multi-omics and AI approach in rare diseases: ADAPTA, with its flexibility and ability to integrate and analyze heterogeneous data types through advanced and secure machine learning approaches, proves ideal to implement an innovative diagnostic pathway and precision medicine tools for fibrotic diseases.

Predictive Medicine for Head and Neck Oncology: ADAPTA is designed to manage and analyze complex omics data. The ability to combine computational topology with explainable, multi-scale machine learning enables the interpretation of omics data at a very detailed level, facilitating identification of clinical patterns crucial for predictive medicine.