



Integrative bioinformatics for Trans-omics networks representation and image analysis

Project Description

The aim of this proposal is to define novel integrative bioinformatics tools to provide a global view of different biological data sources and to unravel control systems of the cells. These tools will support the representation and analysis of biological processes by leveraging trans-omics networks, deep learning techniques and imaging analysis.

The collection of biological data serves as a means to catalog the elements of life, but to truly understand a system, it requires the integration of these data using mathematical and relational models. These models can mechanistically describe the relationships between the components of the system, including the control systems of the cells and imaging data.

Through advanced analysis of these datasets, we have made significant progress in understanding biological regulations, uncovering both generic rules and exceptions to these rules. These generic rules are observed as trends in the data, but there are often variations that deviate from these patterns.

To overcome the limitations of comprehensiveness and information gaps in interactions across multiple omic layers, we propose a trans-omics approach. This approach involves constructing a network structure that represents the biochemical trans-omics network, capturing causality and the input-output relationships at a molecular level. By incorporating control systems of the cells and imaging data into this network, we can gain deeper insights into biological processes.

Deep learning techniques offer promising tools for integrating multi-omics datasets and conducting various analyses based on the trans-OWAS approach and trans-omics representations. These techniques enable the identification of complex patterns and relationships within the integrated data, allowing us to uncover novel insights into cellular control systems and imaging analysis.

Prospective Students

Possible candidates are expected to have different backgrounds in artificial intelligence, big data, image analysis and bioinformatics.

Supervisor(s), Lab/Group details, other additional info

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The **Intelligent Knowledge Systems Research Unit** works in the field of knowledge representation, reasoning and retrieval of multimedia information using Artificial Intelligence techniques and Big Data technologies.

The IKNOS aim is the study, the specification, design, development, testing, and maintenance of systems which can represent, analyze, and retrieve knowledge.



Different methodologies, techniques and technologies are in the core of the IKNOS research framework and they are mainly related to semantic artifacts, knowledge graph, deep neural networks and multimodel NoSQL databases.

IKNOS-RU is a part of the Pattern Analysis and Intelligence Computation for mUltimedia System (PICUS) research group (UNINA-DIETI) and COmputational SySteM BiOlogy (COSMO) Laboratory (CNR-IEOS Second Unit).

Website: <https://iknos.dieti.unina.it/>

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