PROFILE

PhD PROGRAMME IN "DIGITAL INNOVATION AND e-HEALTH"

CUN Scientific Areas: 01 - Mathematical and Computer Sciences, 03- Chemical Sciences, 05 - Biological Sciences, 06 - Medical Sciences, 09 - Industrial and Information Engineering, 11 - Historical, Philosophical, Pedagogical, Psychological Sciences, 13 - Economics and Statistics.

Scientific Subject Codes: INF/01 – Informatics; CHIM/12 - Chemistry of the environment and cultural heritage; BIO/12 - Clinical biochemistry and clinical molecular biology; BIO/14 – Pharmacology; MED/09 - Internal Medicine; MED/13 – Endocrinology; MED/14 – Nephrology; MED/48 - Nursing Sciences and Neuropsychiatric and Rehabilitative Techniques; ING-INF/05 - Information Processing Systems; M-PSI/01 - General Psychology; M-PSI/08 - Clinical Psychology; SECS-S/01 – Statistics; SECS-P/10 - Business Organization

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Coordinator: Prof. Monica MONTAGNANI

Administrative office: Department of Precision and Regenerative Medicine and Ionian Area (DiMePRe-J)

PEC: direzione.dimeprej@pec.uniba.it

Duration: 3 years

Curricula: NO

Total number of positions with fellowships: n. 10, as follows:

Project: *PNRR- general 4.1*
- ***Investigation of biological and environmental bases of risk for major psychiatric disorders, of their response to treatment and of related collateralities***
  - **Call for tender** D.M. N. 118 A.A. 2023/2024, PNRR - Missione 4, componente 1 "Potenziamento dell'offerta dei servizi di istruzione: dagli asili nido all'Università": M4C1 - Investimento 4.1 "Estensione del numero di dottorati di ricerca e dottorati innovativi per la pubblica amministrazione e il patrimonio culturale"
  - **Title** *Investigation of biological and environmental bases of risk for major psychiatric disorders, of their response to treatment and of related collateralities*
  - **Research activity description**: The project aims at using an integrated computational, clinical and bio-molecular approach, to investigate the risk for major psychiatric disorders, the mechanisms implied in the response of such disorders to pharmacological treatment, and the subject-specific sensitivity to the development of iatrogen collateralities.

Project: *PNRR – general 4.1*
  - **Call for tender**: D.M. N. 118 A.A. 2023/2024, PNRR - Missione 4, componente 1 "Potenziamento dell'offerta dei servizi di istruzione: dagli asili nido all'Università": M4C1 - Investimento 4.1 "Estensione del numero di dottorati di ricerca e dottorati innovativi per la pubblica amministrazione e il patrimonio culturale"
- **Title** *Identification of molecular markers and targets for the treatment of rare diseases using omics approaches*
  - **Research activity description**: The research topics will concern the study with omics methods of rare diseases in the Health field. Rare diseases are defined as all those diseases that have a prevalence of less than 5 cases/10,000 people. These pathologies present a high degree of biomedical complexity, often with multi-organ expression which therefore require the convergence of different skills and the use of orthogonal bio-medical scientific approaches.

- ### Project: PNRR- general 4.1

- **Call for tender**: D.M. N. 118 A.A. 2023/2024, PNRR - Missione 4, componente 1 "Potenziamento dell'offerta dei servizi di istruzione: dagli asili nido all'Università": M4C1 - Investimento 4.1 "Estensione del numero di dottorati di ricerca e dottorati innovativi per la pubblica amministrazione e il patrimonio culturale"
- **Title** *Innovative multi-parametric methodological approaches in breathomics as e-health tools for early diagnosis and management of chronic and oncologic diseases*
- **Research activity description:** The project proposal aims at promoting digital and technological innovation in breathomics research field addressed at the development of integrated and innovative systems serving as health-tools for the detection of various physio-pathological conditions of human body and for the early diagnosis of both chronic and oncologic diseases, through the chemical characterization of human breath volatile fraction and the identification of pathology-related biomarker patterns.

- ## Project: PNRR- *TRANSIZIONI DIGITALI E AMBIENTALI 3.4*
  - **Call for tender**: D.M. N. 118 A.A. 2023/2024, PNRR - Missione 4, componente 1 "Potenziamento dell'offerta dei servizi di istruzione: dagli asili nido all'Università": M4C1 - Investimento 3.4 "Didattica e competenze universitarie avanzate"
  - **Title** *Development and application of machine learning algorithms for the prediction of the properties of small organic molecules*
  - **Research activity description:** The research will focus on the development and application of machine learning algorithms to predict the toxicity and biological activity of xenobiotics, including biologically active compounds. Physicochemical descriptors and molecular fingerprints will be calculated for each compound in the database. A chemoinformatics platform will be developed, following the Human-Centered Artificial Intelligence, to derive highly predictive classifiers using various machine learning algorithms.

- ## Project: PNRR- PUBBLICA AMMINISTRAZIONE 4.1 PA
  - **Title** *Deception detection in contexts of discomfort, marginality, and deviance*
  - **Call for tender**: D.M. N. 118 A.A. 2023/2024, PNRR - Missione 4, componente 1 "Potenziamento dell'offerta dei servizi di istruzione: dagli asili nido all'Università": M4C1 - Investimento 4.1 "Estensione del numero di dottorati di ricerca e dottorati innovativi per la pubblica amministrazione e il patrimonio culturale"
  - **Research activity description:** The present research project is focused on the study of deceptive behavior affecting health and well-being of individuals and communities with innovative digital methodologies. The availability of new technologies, such as complex vocal analysis and verbal analysis through AI tools, enables the development of complex and predictive models of deception detection. A multimodal approach will be used to provide an accurate deception detection in contexts in which communicative interactions are have a strong impact in terms of: (i) individual well-being, such as work contexts, recruitment processes, customer satisfaction, and therapeutic settings, and (ii) collective adjustment, as in the legal context.

- ## Project: "DARE - Digital Lifelong Prevention"CUP B53C22006420001
  - **Title**: *Digital Tools for psychiatric and cognitive disorders: identify subjects at risk for conversion from preclinical conditions to psychosis*
  - **Research activity description**: Psychosis risk trajectories are complex and heterogeneous. Indeed, genetic and environmental factors, interacting with each other, may lead to neurobiological and cognitive alterations which, in turn, are associated with psychotic symptoms, even attenuated or intermitted. Within this complex pathophysiological framework, identifying markers of psychosis in an accurate and generalizable way is of pivotal importance in order to build effective individualized interventions. The project is therefore aimed at generating machine learning algorithms predicting clinical outcomes in individuals at risk for psychosis using a different data sources (neurobiological, cognitive, behavioral, clinical) within a longitudinal perspective in an accurate and generalizable way.

- ## Project: "DARE - Digital Lifelong Prevention"CUP B53C22006420001
  - **Title** *Data mining, artificial intelligence, and machine learning approaches to identify subnetworks of cancer associated with early prediction, survival, metastasis or phenotypes in cancer subtypes focusing on myeloma*
  - **Research activity description**: While several progression multiple myeloma (MM) risk stratifications have been employed and validated, new, interpretable, and reliable machine learning tools are greatly needed to account for disease complexity and improve personalized MM medicine. The project aims to address these unmet needs to provide healthcare professionals with quantitative indicators to identify and monitor people at high risk of developing and/or at risk of progression of this pathology and associated conditions. Objectives are to develop novel ML methods that support the personalized follow-up and treatment of target patients; leading in MM the two-fold concept of 'Clinician in-the AI loop/AI in-the clinical decision loop' and follow up of patients

using the interaction tools typical of distance medicine.

- **<u>Project</u>**: "DARE - Digital Lifelong Prevention"CUP B53C22006420001
  - **Title**: *Artificial intelligence approaches to identify early, survival, metastasis or phenotypes in multiple myeloma*
  - **Research activity description**: In clinical practice, the amount of data that can be collected is enormous, and often this numerosity is not exploited given the difficulty of data analysis. Defining a standardized method for data collection and developing artificial intelligence approaches are fundamental to analyse and understand such amount of data. To date, the assessment of disease progression and life expectancy are obtained with the analysis of indicators that provide an approximate stratification, however taking into consideration only the specifics of the individual patient. It is necessary to study and plan new tests and relevant experimental protocols AI based, to add to traditional clinical and instrumental assessments, to identify those patients at high risk of Multiple Myeloma and obtain a more precise stratification

- **<u>Project</u>**: DARE - Digital Lifelong Prevention"CUP B53C22006420001
  - **Title***: Meta-analysis and decision making processes in Healthcare*
  - **Research activity description**: Researches aim to encourage the application and adaptation of methods and tools capable of managing the organizational processes of healthcare organizations but also to develop innovative methods aimed at directing and supporting decision-making processes in various areas of the healthcare world. In this context, the development of researches in a multidimensional, multidisciplinary and multistakeholders logic is encouraged, capable of being translated into integrated, clinical-economic-organizational-technological, governance models that pay particular attention to the analysis of the state of health and real needs of the patient but at the same time to improve the healthcare processes of diagnosis, treatment and rehabilitation.

- **<u>Project</u>**: "DARE - Digital Lifelong Prevention"CUP B53C22006420001
  - **Title**: *Transitioning AI models into eHealth systems*
  - **Research activity description**: The success of AI models, and data-driven methods in general, does not exclusively depend on their accuracy, but also on the quality of their integration with non-AI software, as part of sizeable AI-based systems. Achieving this integration is particularly challenging in the context of eHealth systems, characterized by demanding non-functional requirements. This research project aims at defining approaches for transitioning ML models, developed by data scientists, into AI-based software systems. The focus will be on MLOps, including online monitoring to assure the quality of both data and models after their deployment into eHealth systems.

Method of admission: The selection will be made following the art. 6 typology B of the call.
The examination will be based on the evaluation of candidate qualification, proposed project, oral interview, and foreign language knowledge checking English.

Admission exam dates and time for the ordinary competition:
Qualification: **July 31st , 2023 – 9:30 a.m.**
Proposed project: **July 31st , 2023 – 3:00 p.m.**
Oral interview: **August 2nd, 2023 – 9:30 a.m.** – **Department of Computer Science**, **VII Floor – Department Head Room Campus Universitario "Ernesto Quagliariello" - Via E. Orabona, 4 - Bari 70125**

For candidates who make a justified request for the online oral exam, the aforementioned oral exam will take place on the Microsoft Teams platform **on August 3, 2023, at 9:30 am,** if the same request is accepted by the Commission of selection.