Project Proposal

**Advanced artificial intelligence techniques and systems
to support precision medicine**

Project Description

The proposed research topic is in the field of Information and Communication Technology for Health. It aims to develop artificial intelligence (AI) algorithms and systems for new diagnostic-therapeutic strategies to improve patients' quality of life and support physicians in decision-making. Among the actions required for the digital transition in the medical field is redefining patient care and better aligning it with adapting to various clinical situations, favouring the human-centred vision and providing a service that adapts to the user's needs. Such a vision allows for the enjoyment (pleasantness and comfort), effortless (ease of use) of the service, and at the same time, efficiency of the service.

The research programme will train a professional figure specialising in a high-tech sector of high socio-economic impact with transversal knowledge in engineering, information technology, artificial intelligence and biomedical science.

More specifically, the doctoral project aims to study innovative artificial intelligence (AI) techniques, particularly machine learning, artificial neural networks and deep learning, with application to the biomedical sector. The aim is to support doctors in their decision-making processes and improve treatment and disease prevention by exploiting increasingly precise, safe and reliable computational models. A further objective is to make it possible to use the algorithms developed and trained using devices with reduced computational and memory capacity.

One of the most significant research and innovation themes is Health, with a focus on Health Technologies, together with the sustainable development of society and human-centred services as its basis, considers artificial intelligence a top priority and identifies it as a research field with spin-offs in multiple areas. In particular, recent research focuses on artificial intelligence for people and Health. Artificial intelligence techniques define themselves as a tool that puts man at the centre, increasing his capabilities in cognitive and predictive terms to support decision-making, improving his well-being, Health and life. The research topics proposed will impact all the aspects mentioned above. It will allow the development of algorithms that will help the physician in the decision-making process (e.g. where to cut during an operation), help predicts postoperative outcomes, and improve the quality of life and thus the psychophysical well-being of the patient.

Research on e-health, advanced diagnostics, medical devices and minimally invasive medicine will enable fundamental advances in state of the art about incorporating artificial intelligence in electronic devices, sensors and medical techniques.

Supervisor(s), Lab/Group details, other additional info.
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The Augmented Reality for Health Monitoring Laboratory (ARHeMLab) is a laboratory of the Department of Electrical Engineering and Information Technology of Federico II the University of Naples. It was established in 2018 as part of the project "ICT FOR HEALTH" selected among 180 national projects of Departments of Excellence funded by the Italian Ministry of University and Research.

Its director is Prof Arpaia, Professor of Measures and Director of the Interdepartmental Research Center on Management and Innovation in Healthcare at Federico II . 30 elements among full professors, research associates and doctoral students belong to ARHeMLab.

The lab's equipment includes the latest versions of augmented and virtual reality Head Mounted Displays, as well as numerous systems for electroencephalographic signal acquisition and bioimpedance spectroscopy measurement.

The research lines currently operational are: eXtented-Reality Supported Surgery, Cyber Security in Health Care Systems, eeXtented-Reality Supported Rehabilitation, EEG-based Detection of Stress and Engagement.

The expertise in metrology, electronic instrumentation, and Artificial Intelligence permeate across the different lines of research listed before.