Project Proposal

Project Title

EXplainable Artificial Intelligence (XAI) based Decision Support Systems for early detection and diagnosis of cancer

Project Description

The advances on Artificial Intelligence (AI) in the last century have allowed us to develop systems that provide decision-based support in clinical practice. However, AI applications are still relatively novel and are not yet used routinely in clinical decision-making. In order to reach this goal, in this project we propose to develop an AI based decision support system for the analysis and integration of genomics, transcriptomics and other omics data for early detection and diagnosis of cancer. The decisions derived from algorithmic-based clinical solutions should be explainable and transparent so that the healthcare professionals can understand the rationale behind the predictions. EXplainable AI (XAI) has experienced significant growth over the last few years aiming to allow users to understand why a system has produced a given output. One area that needs XAI is that of clinical decision support systems for ethical and fair decision-making. The AI system proposed in this project aim to start by using an XAI model using as input a panel of selected urinary ultraconserved-long non-coding RNAs (lncRNAs) data [1,2]. One first aim is to develop a methodology, based on XAI methodologies, for the selection of a predictive signature for bladder cancer onset analyzing the expression profiles of a special class of lncRNAs, namely Transcribed-Ultraconservative Regions (T-UCRs) [3,4]. Successively, ante-hoc and a post-hoc methodologies are compared for obtaining the eXplainable AI-based (XAI-based) decision making model [5,6]. In the first case a model based on fuzzy inference rules will be considered that can simulate human decision-making process by performing human approximate reasoning in order to achieve a desired risk assessment. In the second case, a post-hoc methodology (e.g., Anchor), is used for explaining an artificial Neural Network model (i.e., Multi-Layer Perceptron that has universal approximation properties). Once the model is selected and trained, the AI system can be used giving urinary ultraconserved-lncRNAs data of new patients, which will be processed by the AI that will return a qualitative and quantitative risk index of cancer diagnosis risk. In this evolving context, the project's results will address to develop a Decision Support System (DSS) for performing a quantitative and qualitative prevision of the bladder cancer a by using clinical parameters and lncRNAs in urine of patients. The methodology could be applied to other forms of cancer which are characterized for abnormal expression of T-UCRs, such as in hematopoietic tissues (leukemia).

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

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Lab:

Computational Intelligence and Smart Systems Lab (http://cisslab.uniparthenope.it).

The Computational Intelligence and Smart Systems Lab (CI&SSLab) is a research laboratory of the Department of Science and Technology at the University of Naples "Parthenope". Main activities are involved in fundamental and applied researches in the field of Artificial Intelligence (AI) and, in particular, in Computational Intelligence (CI). CI is the theory, design, application and development of biologically and linguistically motivated computational paradigms.

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