YouForAll

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YouForAll

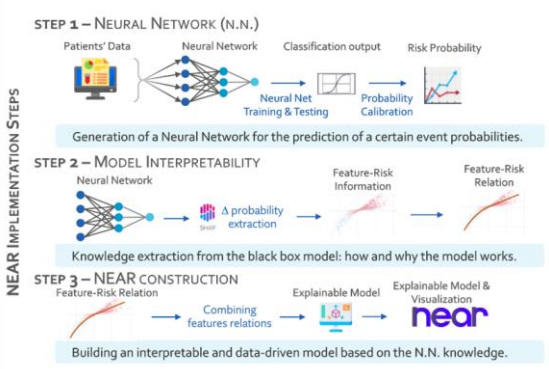
Your digital twin for allowing a healthy society

The current healthcare system does not take full advantage of the huge potential of new technologies, which could revolutionise patient care and treatment. The YouForAll project undertakes the challenge to move a first step towards this revolution. Indeed, its goal is to realise a Clinical Decision Support System (CDSS) based on Artificial Intelligence (AI). However, while most of the existing AI-based CDSSs behave as black boxes, i.e. they provide suggestions without justifications, ours generates clear and easy-to-understand explanations for its predictions, making it easier for doctors to integrate it in their decision process.

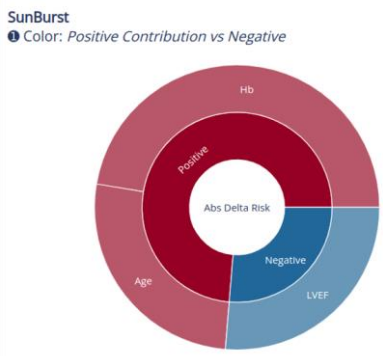
The current approach to patient care still relies, for the most part, on clinical guidelines, sets of rules defining the clinical decisions for some predefined situations (e.g. diagnoses or additional exams to perform given the patient's health status). However, these guidelines fail to personalise the therapies and procedures to the specificities of each patient, leading to suboptimal treatments; moreover, they often need to be manually consulted by doctors, resulting in poor healthcare efficiency.

In this context, YouForAll proposes NEAR (Neural imputed Explainable and Adaptive Risk score), an AI-based explainable score to predict the risk of a clinical event. As proof of concept, NEAR is implemented to predict the risk of death and bleeding events for patients who have already suffered from cardiac disease, but the approach can be effortlessly extended to other clinical conditions for which sufficient patients' data are available. Moreover, NEAR provides easy-to-interpret explanations about its predictions, thanks to which a practitioner can immediately understand the clinical variables that contribute more to the score. Additionally, NEAR suggests actions to mitigate the risk or to have a more accurate prediction of the likelihood of the clinical event. Therefore, NEAR acts as a CDSS for practitioners, who may integrate its suggestions with their professional experience to improve their diagnoses.

In conclusion, NEAR is thought to be easily integrated into the healthcare ecosystem. Indeed, it supports worldwide standards for healthcare data representation, thus guaranteeing its compatibility with existing clinical infrastructures, and it provides risk scores even with some missing input variables, making it effective also in the common situation of partial availability of information for a patient.



Main implementation steps behind the development of NEAR: from a neural network to classify the patient's health status based on the clinical information, to the use of the SHAP (SHapley Additive exPlanations) explainer and the subsequent definition of the final interpretable model for the risk prediction.



Example of explanation provided by NEAR: features contribution plot. The plot shows that the Age and the Haemoglobin level (Hb) of the patient contribute to a higher risk (red) for the considered clinical outcome, while the Left Ventricular Ejection Fraction (LVEF) mitigates the risk (blue).