



RESEARCH TOPIC DASMEN4

AI for early detection of clinical deterioration in critically ill patients Curriculum DASMEN Standard

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Abstract

Critically ill patients are continuously monitored, integrating hemodynamic, respiratory, pharmacological and medical evaluation/clinical data into Electronic Health Records (EHR). Patients in ICUs are on life-saving treatments and are susceptible to rapid deterioration, which can result in high mortality, complications and prolonged ICU stay. Early detection of clinical deterioration and impending organ failure (acute kidney injury, respiratory, liver, neuro- and heart failure) is of paramount importance for early action and reversal, and to start appropriate medical treatment. The goal of the PhD is to use the clinical data available in the intensive care medical records and high-resolution data from waveform analysis to develop supervised and unsupervised predictive models for predicting clinical deterioration in intensive care. These models will then be internally validated, and externally validated using international public ICU databases.

Main technical approaches

We will commence by leveraging SQL for the acquisition and preprocessing of the dataset, employing specific queries to select, join, and cleanse the data according to our project requirements. Following data acquisition, we will turn to Python for exploratory data analysis and feature engineering, harnessing pandas for data manipulation, seaborn for visualizations, and scikit-learn. We will explore deep learning approaches using TensorFlow, and leverage HPC system provided by Humanitas University. Several prediction algorithms will be evaluated, including balanced and unbalanced logistic regression, random forest and gradient boosting, as well as deep learning models through neural networks (NN). Model

fine-tuning will be conducted through hyperparameter optimization, and model performance will be assessed using the best standards. Techniques such as bootstrapping, repeated cross-validation, and internal-external validation will be employed.

Scientific references

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Type of contract

PhD scholarship of € 18.000 gross per year awarded by Humanitas University. This sum is exempt from IRPEF income tax according to the provisions of art. 4 of Law no. 476 of 13th August 1984, and is subject to social security contributions according to the provisions of art. 2, section 26 and subsequent sections, of Law no. 335 of 8th August 1995 and subsequent modifications.

Borsa di dottorato pari a € 18.000 annui lordi erogata da Humanitas University. Importo non soggetto a tassazione IRPEF a norma dell'art. 4 della L. 13 agosto 1984 n. 476 e soggetto, in materia previdenziale, alle norme di cui all'art. 2, commi 26 e segg., della L. 8 agosto 1995, n. 335 e successive modificazioni.