CENTER FOR MEDICAL PHYSICS
AND BIOMEDICAL ENGINEERING
MEDICAL UNIVERSITY OF VIENNA

Master Thesis:
ECG-Based Age Prediction with Explainable AI

Description:
The Electrocardiogram (ECG) is traditionally used to assess cardiovascular health. Its application has recently expanded to diagnosing various conditions and predicting physiological parameters, including biological age.
Despite these advances, current AI methodologies for biological age prediction from ECG data often operate as "black boxes", making the rationale behind predictions unclear. To address these limitations, we propose using explainable deep learning algorithms. This approach enhances the transparency and interpretability of predictions, potentially uncovering previously unrecognized ECG features associated with biological age. Such advancements could significantly increase the clinical relevance and acceptance of ECG-based biological age assessments. The primary objective is to classify biological age from ECG data using explainable artificial intelligence. The secondary objective is to identify the most important features contributing to correct classification. The application involves developing deep neural networks for classifying age based on ECG time series and utilizing explainable AI frameworks such as feature importance ranking, class activation maps, or local interpretable model-agnostic explanations to identify the most important features in ECG age classification.

Relevant knowledge/experience:
- A strong background in machine learning and artificial intelligence, particularly deep learning.
- Proficiency in programming languages such as Python, and experience with machine learning libraries (e.g., TensorFlow, Keras, etc..).
- Experience with explainable AI methods and frameworks.
- Familiarity with signal processing techniques, especially related to ECG data.
- A solid understanding of cardiovascular physiology and biomedical data analysis would be advantageous.
- Strong analytical and problem-solving skills, with the ability to work independently and as part of a multidisciplinary team.

How to apply:
Interested candidates are requested to send their CV, certificates and a short description of themselves to **Assoc. Prof. Francesco Moscato** (francesco.moscato@meduniwien.ac.at) and **DI Laurenz Berger** (laurenz.berger@meduniwien.ac.at)

Start date:
August 2024

Suggested literature:
Ansari et al. 2023. “Estimating Age and Gender from Electrocardiogram Signals: A Comprehensive Review of the Past Decade.” Artificial Intelligence in Medicine 146

Baek et al. 2023. “Artificial Intelligence-Estimated Biological Heart Age Using a 12-Lead Electrocardiogram Predicts Mortality and Cardiovascular Outcomes.” Frontiers in Cardiovascular Medicine 10: 1–10.

Theissler et al. 2022. “Explainable AI for Time Series Classification: A Review, Taxonomy and Research Directions.” IEEE Access 10: 100700–724.