Prediction of Sex From a 12-lead ECG Using Deep Learning: External Validation and Interpretation

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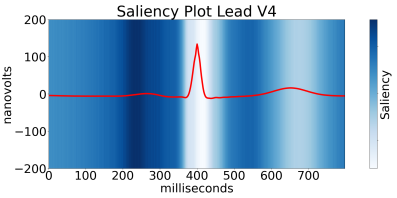
Introduction Sex-related information might be encoded in the morphology of the ECG given the inherent biological and anatomical distinctions between sexes. An AI-ECG algorithm has shown to identify sex from a raw 10s 12-lead ECG. The aim of this study was to externally validate these findings and uncover the representation of sex within the morphology of the ECG waveform.

Methods A binary convolutional neural network is used to identify sex on 10 seconds 12-lead ECGs from patients of a single center. Saliency plots were calculated to highlight predictive regions for sex within the ECG. In a secondary analysis, we compared outcomes for different rhythms (sinus rhythm (SR) and atrial fibrillation (AF)) and different age groups.



Saliency plot of the median waveform in lead V4. Dark shades indicate regions with the greatest influence on the prediction.

Results 150 052 patients were included with a mean age of 59.2 ± 16.5 years of which 52% were males. Of all ECGs included, 92% were in SR, 3.9% were in AF and 3.6% had other diverging rhythms. The overall model resulted in an area under the receiver operator curve (AUC) of 0.959. Saliency plots highlight different parts of the P-wave across leads as the most predictive region. The subgroup analysis shows relative differences in AUC values, with increased values observed for sinus rhythm (SR) ECGs and patients under 40 years (0.966 and 0.984 respectively), and decreased values for AF ECGs and patients over 60 years (0.860 and 0.934 respectively). The disturbed P wave, a characteristic of AF and more prevalent in the older population, likely contributes to this pattern. These results highlight the role of the P wave in sex classification from 12-lead ECGs.

Conclusion An AI ECG algorithm can identify sex from a 12-lead ECG. Saliency plots and subgroup analysis suggest that sex information is concentrated in the P-wave.