Automated Detection of Pacemakers in ECGs Using Deep Learning

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Aim and Background

Electrocardiograms (ECGs) are vital tools in cardiac diagnostics. At Sheba Medical Center, over 1.5 million retrospective ECG recordings are available, yet they lack labels for pacemaker presence a visually distinct and critical feature for model training and evaluation. Detecting pacemakers from ECGs could also facilitate sample selection for advanced machine learning workflows.

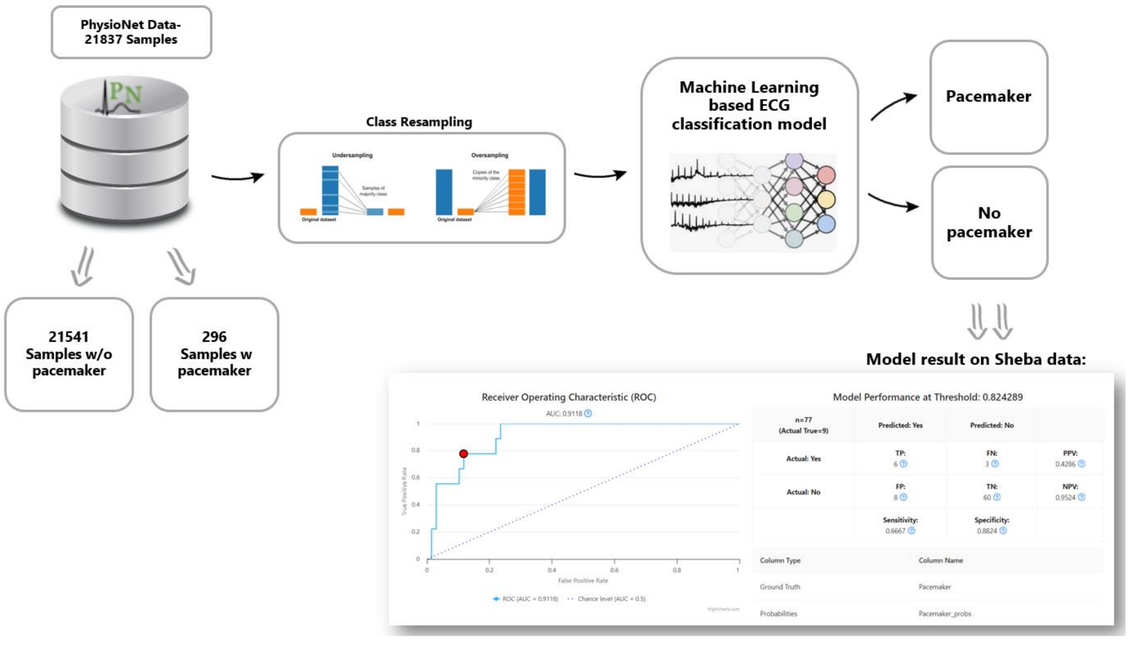
This study aimed to develop a deep learning (DL) model to automate labeling pacemaker presence in ECG recordings, enabling efficient sample selection in Sheba Medical Center's large dataset.

Methods

The study adapted the first-place PhysioNet 2020 Challenge model, initially designed for detecting 27 cardiac abnormalities, into a binary classification model for pacemaker detection. Training was conducted on the PhysioNet dataset (21,837 ECGs) and validated on Sheba's dataset (77 ECGs; 53.2% female, mean age: 65, 9 with paced rhythms).

Results

Despite significant class imbalance (296 of 21,837 labeled as pacemaker in PhysioNet), the model achieved an accuracy of 86% on the PhysioNet dataset and 73% on Sheba's dataset. Classification metrics, including precision, recall, and F1-scores, underscored the challenges of class imbalance while highlighting the model's potential



Conclusions

This DL model successfully identified pacemaker presence in ECG recordings, serving as a foundation for advanced modeling workflows. Future work will focus on training with larger, more balanced datasets to further optimize performance and assess broader applicability.