Single-lead ECGs can now be captured outside clinical environments, providing opportunities to detect atrial fibrillation (AF) in the general population. However, they can be of lower quality than 12-lead ECGs, which may result in features such as P-waves being obscured. This study aimed to compare the performance of machine learning models to detect AF from single-lead ECGs which use either RR-intervals alone or the entire ECG signal.

Experiments were conducted using single-lead, 30-second ECG signals acquired using handheld ECG recorders, which are provided in two databases: the Computing in Cardiology 2017 dataset (public), and the Screening for Atrial Fibrillation with ECG to Reduce Stroke (SAFER) dataset (private). The models assessed in this study were: two models which used the entire ECG signal, both of which were top-performing models from the 2017 PhysioNet / Computing in Cardiology Challenge; and two RR-interval-based models - a state-of-the-art model and our proposed model which detects AF from a 2D representation of the differences between RR intervals. The performance of the models was evaluated separately on each dataset using the area under the Receiver-Operator Curve (AUROC) and Precision-Recall Curve (AUPRC).

The models showed comparable AUROCs of 0.93 - 0.99. The AUPRCs varied more widely, from 0.64-0.94. Our proposed RR-interval-based AF detection model achieved an AUPRC of 0.94 on the CinC 2017 dataset, outperforming the state-of-the-art RR-interval-based model (0.88) and the entire-signal-based models (0.68 and 0.64). However, two of the state-of-the-art models performed better on the SAFER database (AUPRC of 0.75 for the RR-interval-based method, and 0.66 and 0.79 for entire-signal-based models) compared to our proposed model (0.71).

This experiment demonstrated that AF detection models utilizing only RR intervals could achieve comparable performance to those utilizing the entire ECG signal. RR-interval-based models may have particular utility for the analysis of single-lead ECGs where features such as P-waves are obscured.