Artificial Intelligence tool successfully predicts fatal heart rhythm

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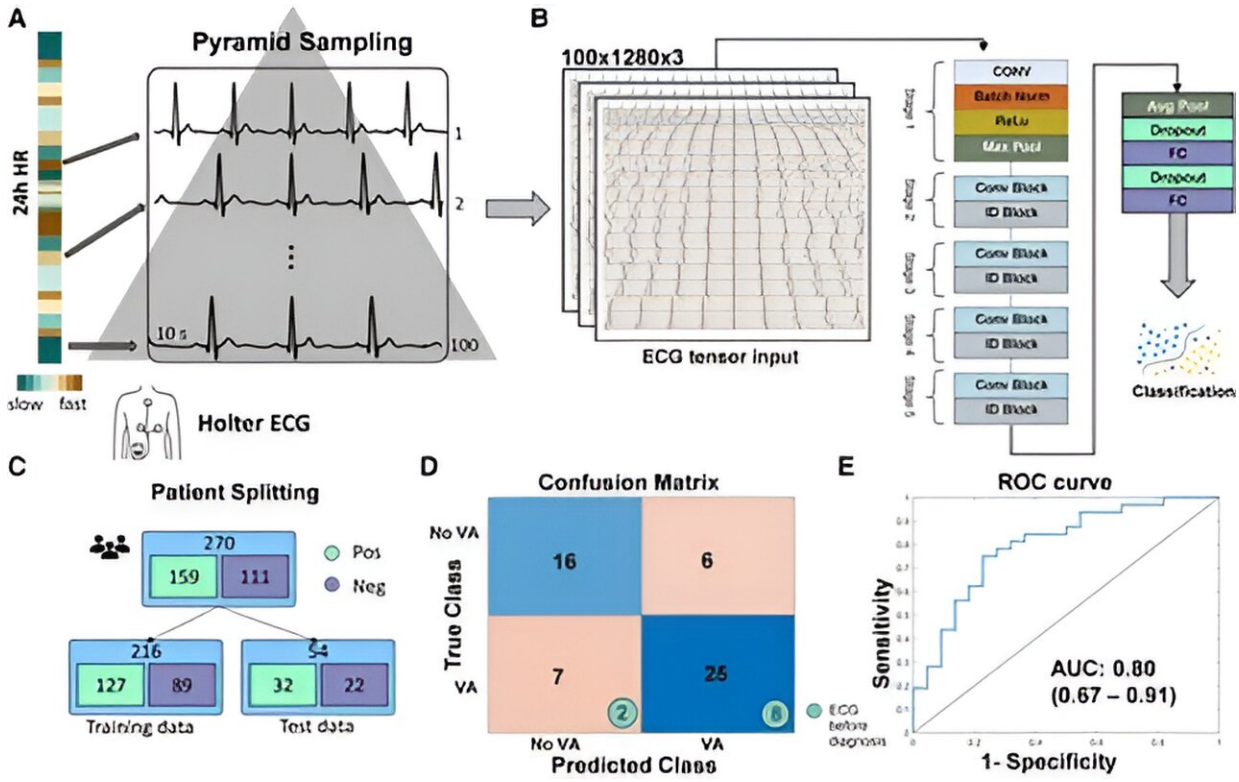

(A) A pyramid sampling schematic demonstrating 100 samples at various heart rates over a 24 h period. (B) VA-ResNet-50 architecture. (C) Patient flow. (D) Confusion matrix including participants before and after electrocardiogram. (E) Receiver operator characteristic curve. Credit: *European Heart Journal - Digital Health* (2024). DOI: 10.1093/ehjdh/ztae004

In a Leicester study that looked at whether artificial intelligence (AI) can

be used to predict whether a person was at risk of a lethal heart rhythm, an AI tool correctly identified the condition 80% of the time.

The findings of the study, led by Dr. Joseph Barker working with Professor Andre Ng, Professor of Cardiac Electrophysiology and Head of Department of Cardiovascular Sciences at the University of Leicester and Consultant Cardiologist at the University Hospitals of Leicester NHS Trust, have been published in the *European Heart Journal—Digital Health*.

Ventricular arrhythmia (VA) is a heart rhythm disturbance originating from the bottom chambers (ventricles) where the heart beats so fast that blood pressure drops which can rapidly lead to loss of consciousness and sudden death if not treated immediately.

NIHR Academic Clinical Fellow Dr. Joseph Barker coordinated the multicenter study at the National Institute for Health and Care Research (NIHR) Leicester Biomedical Research Center, and co-developed an AI tool with Dr. Xin Li, Lecturer in Biomedical Engineering, School of Engineering. The tool examined Holter electrocardiograms (ECGs) of 270 adults taken during their normal daily routine at home.

These adults had the Holter ECGs taken as part of their NHS care between 2014 and 2022. Outcomes for these patients were known, and 159 had sadly experienced lethal ventricular arrhythmias, on average 1.6 years following the ECG.

The AI tool, VA-ResNet-50, was used to retrospectively examine 'normal for patient' heart rhythms to see if their heart was capable of the lethal arrythmias.

Professor Ng said, "Current clinical guidelines that help us to decide which patients are most at risk of going on to experience ventricular

arrhythmia, and who would most benefit from the life-saving treatment with an implantable cardioverter defibrillator are insufficiently accurate, leading to a significant number of deaths from the condition.

"Ventricular arrhythmia is rare relative to the population it can affect, and in this study we collated the largest Holter ECG dataset associated with longer term VA outcomes.

"We found the AI tool performed well compared with current medical guidelines, and correctly predicted which patient's heart was capable of ventricular arrhythmia in four out of every five cases.

"If the tool said a person was at risk, the risk of lethal event was three times higher than normal adults.

"These findings suggest that using artificial intelligence to look at patients' electrocardiograms while in normal cardiac rhythm offers a novel lens through which we can determine their risk, and suggest appropriate treatment; ultimately saving lives."

He added, "This is important work, which wouldn't have been possible without an exceptional team in Dr. Barker and Dr. Xin Li, and their belief and dedication to novel methods of analysis of historically disregarded data."

More information: Joseph Barker et al, Artificial intelligence for ventricular arrhythmia capability using ambulatory electrocardiograms, *European Heart Journal—Digital Health* (2024). DOI: 10.1093/ehjdh/ztae004

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