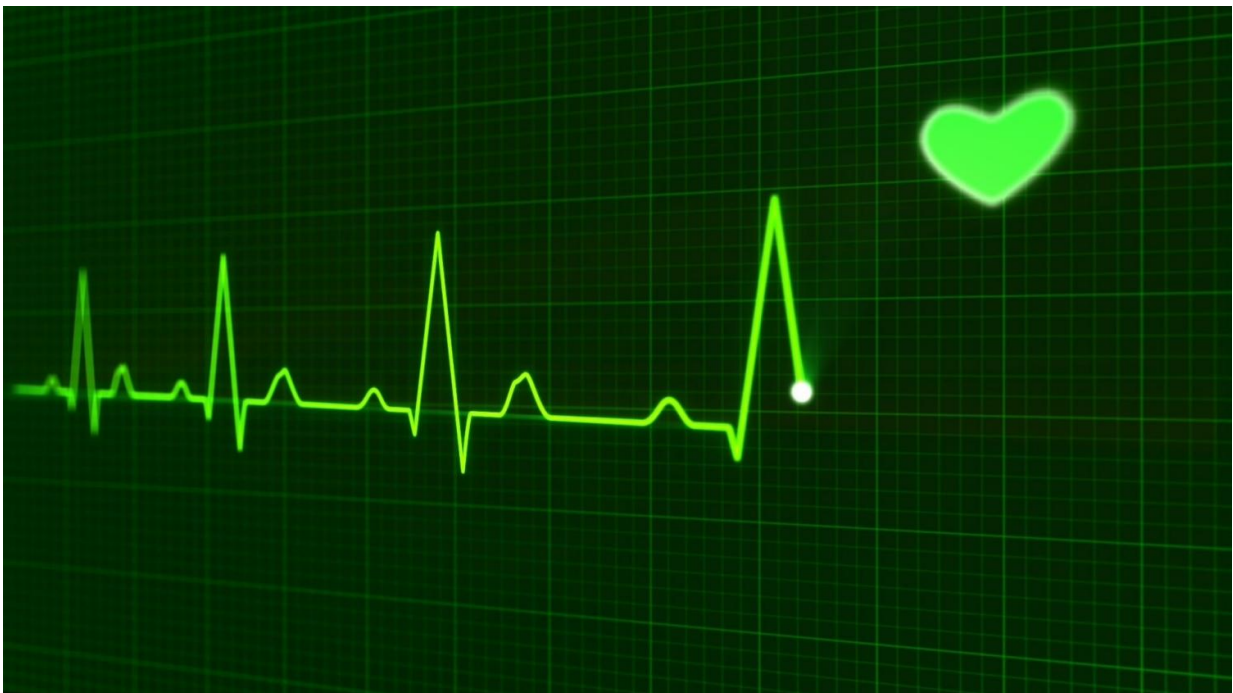


New AI neural network approach detects heart failure from a single heartbeat with 100% accuracy

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Credit: CC0 Public Domain

Researchers have developed a neural network approach that can accurately identify congestive heart failure with 100 percent accuracy through analysis of just one raw electrocardiogram (ECG) heartbeat, a new study reports.

Congestive heart failure (CHF) is a chronic progressive condition that affects the pumping power of the heart muscles. Associated with high prevalence, significant mortality rates and sustained healthcare costs, clinical practitioners and health systems urgently require efficient detection processes.

Dr. Sebastiano Massaro, associate professor of organizational neuroscience at the University of Surrey, has worked with colleagues Mihaela Porumb and Dr. Leandro Pecchia at the University of Warwick and Ernesto Iadanza at the University of Florence, to tackle these important concerns by using Convolutional Neural Networks (CNN) – hierarchical neural networks highly effective in recognizing patterns and structures in data.

Published in the *Biomedical Signal Processing and Control Journal*, their research drastically improves existing CHF detection methods typically focused on heart rate variability that, whilst effective, are time-consuming and prone to errors. Conversely, their new [model](#) uses a combination of advanced signal processing and machine learning tools on raw ECG signals, delivering 100 percent accuracy.

Dr. Massaro said, "We trained and tested the CNN model on large publicly available ECG datasets featuring subjects with CHF as well as healthy, non-arrhythmic hearts. Our model delivered 100 percent accuracy: by checking just one heartbeat we are able to detect whether or not a person has heart failure. Our model is also one of the first known to be able to identify the ECG's morphological features specifically associated to the severity of the condition."

Dr. Pecchia, president at European Alliance for Medical and Biological Engineering, explains the implications of these findings: "With approximately 26 million people worldwide affected by a form of [heart failure](#), our research presents a major advancement on the current

methodology. Enabling clinical practitioners to access an accurate CHF detection tool can make a significant societal impact, with patients benefiting from early and more efficient diagnosis and easing pressures on NHS resources."

More information: Mihaela Porumb et al. A convolutional neural network approach to detect congestive heart failure, *Biomedical Signal Processing and Control* (2019). [DOI: 10.1016/j.bspc.2019.101597](https://doi.org/10.1016/j.bspc.2019.101597)

Provided by University of Surrey

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