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Seeing the forest and the trees reveals heart problems

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A statistical analysis of publicly available heart rate data using three classification tools - Random Forests, Logistic Model Tree and Neural Network - could lead to a rapid and precise way to diagnose heart problems, according to research in the *International Journal of Electronic Healthcare*.

"Heart rate and Heart Rate Variability (HRV) are important measures that reflect the state of the cardiovascular system. HRV analysis has gained prominence in the field of cardiology for detecting cardiac abnormalities," explains C. Vimal and colleagues at the PSG College of Technology, in Coimbatore, India.

Vimal and his team in the Department of Biomedical Engineering have worked with V. Mahesh in the Department of Information Technology to investigate whether or not it might be possible to more quickly detect heart problems and possible indicators of imminent heart failure more quickly than with current techniques.

"Automated detection and classification of cardiac diseases can aid the physician in speedy diagnosis of cardiac abnormalities," the team explains, "The starting point of any study is usually an Electrocardiogram (ECG), which records the heart's electrical activity." The ECG is a basic but widely used non-invasive diagnostic tool.

Unfortunately, the ECG suffers from a major drawback, given that the heart's behavior can be inconsistent and symptoms of disease may show

up at any time. The heart rate variability signal monitored over a long period is more time-consuming but can be more productive in detecting abnormalities.

"The analysis of HRV data yields various features that have proved to be a better aid in classification," explains the team. Short-term variability in heart rate might be looked at or low and high frequency electrical changes. Indeed, the low frequency/high frequency ratio has been found to be the most influential HRV determinant of death and could help to identify patients at risk, the team adds.

The team sourced heart data from various heart disease databases on the Physionet website, a site dedicated to medical data of various diseases and their study, and processed the signals using three different approaches: Random Forests, Logistic Model Tree and Multilayer Perceptron Neural Network - to validate the diagnostic conclusions. The team was able to obtain a classification accuracy of 98.17%. "The validated system can assist physicians in the classification of heart diseases," the researchers say, " Future work will be aimed at studying the performance of the system using real-time patient data from hospitals to further validate the observations."

More information: "Cardiac disease classification using heart rate signals" in Int. J. Electronic Healthcare, 2010, 5, 211-230.

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