Localization of Cardiac Arrhythmia Origins from ECG

Technology #20180010

Localizes origin of cardiac arrhythmias

A new technology localizes the origins of cardiac arrhythmia via clinically available 12-lead electrocardiography (ECG) enhanced by convolutional neural networks (CNNs) and a realistic computer heart model. After registering the cardiac model with individual patient’s heart, training datasets are generated and the origin(s) of focal cardiac arrhythmias are localized. ECG data is fed into one or more CNNs (one CNN classifies atrial applications; two CNNs classify ventricular sources). The applicable CNN identifies the segment of the heart where the arrhythmia originated and whether it has an epicardial or endocardial focus. This novel technology can not only map premature ventricular contraction (PVC) in patients, but may apply to other cardiac disorders (e.g., ventricular tachycardia and atrial arrhythmias). It may provide real-time monitoring and localization of cardiac arrhythmias origins which can be used to guide ablation treatment.

Non-invasive and accurate

Advanced imaging methods currently used for cardiac navigation (i.e., for ablation to treat atrial fibrillation) use algorithms to translate positioning data from a cardiac catheter into a 3D image. Pace mapping, a commonly used technique for localizing an ablation site, is invasive and may even damage healthy tissue. This new, non-invasive approach uses only 12-lead ECG, making it broadly applicable without additional hardware. CNN expedites localization and achieves accuracy comparable to those requiring high density body surface mapping.

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(B) Epi-Endo CNN. Cardiac Dipoles Located At Epicardium And Endocardium Were Selected And Multiplied By The Leadfield Of 12-lead ECG. Different Levels Of Gaussian White Noise Were Added And The First Half Of QRS Complexes Served As The Input For Epi-Endo CNN. 90% Of The Data Were For Training And The Other 10% Were For Testing. The Output Is A Probability Distribution Among Two Output Neurons, Either Neuron 1 (Epi) Or Neuron 2 (Endo) Would Have A Larger Probability.
Phase of Development

- Proof of Concept

Benefits

- Localizes origin of cardiac arrhythmia
- Achieves high accuracy localization
- May apply to other cardiac disorders (e.g., ventricular tachycardia and atrial arrhythmias)
- May provide real-time monitoring and localization of cardiac arrhythmias origins which can be used to guide ablation treatment

Features

- Uses 12-lead ECG, CNN and a heart-computational model
- Requires no additional hardware
- One or more CNNs (one CNN classifies atrial applications; two CNNs classify ventricular sources)
- Identifies whether arrhythmia has an epicardial or endocardial focus
- Maps premature ventricular contraction (PVC)

Applications

- Cardiac ablation to treat arrhythmia, premature ventricular contraction (PVC)
- PVC diagnosis
- Guiding ablation treatment
- Other cardiac disorders (e.g., ventricular tachycardia and atrial arrhythmias)

Interested in Licensing?

The University relies on industry partners to further develop and ultimately commercialize this technology. The license is for the sale, manufacture or use of products claimed by the patents. Please contact Kevin Anderson to share your business needs and licensing and technical interests in this technology.

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