Automated localization of accessory pathway by deep neural network interpretation of surface electrocardiography

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Introduction: The deep neural network has been proved might be useful in assisting automated rhythm recognition and fatal arrhythmia detection. We hypothesized that more than rhythm, other information may also be processed within neural network and jointly assisted in clinical practice. Therefore, our aim was to develop the model that may learn information from Wolff–Parkinson–White pattern electrocardiography (ECG) and localize site of accessory pathway in heart.

Methods: Retrospectively, we collected all patients underwent paroxysmal supraventricular tachycardia (PSVT) ablation performed from 2010 to 2017 in National Cheng-Kung hospital. Atrioventricular reentrant tachycardia (AVRT) cases were selected, and final localization of accessory pathway confirmed by electrophysiology study were recorded as the ground-truth. All patients’ surface ECG during tachycardia and part of baseline ECG that has WPW pattern manifested were collected and preprocessed into numeric arrays for matrix computations. The location of accessory pathway were classified into left lateral, left posterior, right free wall, and septal wall. We then developed a convolutional neural network (CNN) model that accept the input of surface ECG and output the final classification of accessory pathway localization.

Result: In total, we collected 208 cases that was documented to be AVRT after electrophysiology study with ablation during 2010-2017. Within these patients, 73 have surface ECG that have WPW pattern (delta wave) manifested. The final accuracy of our model to localize accessory pathway was 84%.

Conclusion: Deep neural network application in accessory pathway localization is feasible and may madicate further investigation to improve performance and help in clinical decision making.