

PROBLEM STATEMENT

Classification of Arrhythmia by Using Deep Learning with 2-D ECG Spectral Image Representation

DEFINITION:

More than four million of people, mostly over age sixty, are suffering from various kinds of arrhythmias that cause discomfort or even sudden cardiac death (SCD). Fast and accurate classification of large set of Electrocardiogram (ECG) beats containing both normal and arrhythmic categories is still a challenging task for the state-of-the art classification algorithms. The ECG signals can capture the heart's rhythmic irregularities, commonly known as arrhythmias. A careful study of ECG signals is crucial for precise diagnoses of patients' acute and chronic heart conditions. A two-dimensional (2-D) convolutional neural network (CNN) model is helpful for the classification of ECG signals into eight classes. The one-dimensional ECG time series signals are transformed into 2-D spectrograms through short-time Fourier transform. The 2-D CNN model consisting of four convolutional layers and four pooling layers is designed for extracting robust features from the input spectrograms. Using Deep Learning CNN we can enhance the accuracy of diagnosis algorithms in the fusion of medicine and modern machine learning technologies. The proposed CNN-based classification algorithm, using 2-D images, can classify eight kinds of arrhythmia.

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- Cardiologists by using various values which occurred during the ECG recording can decide whether the heart beat is normal or not. Since observation of these values are not always clear, existence of automatic ECG detection system is required.
- Some recent studies reported sub-optimal ECG interpretation skills of the emergency health care providers with low accuracy in most of the ECG based critical diagnosis.

- Therefore, a reliable automated ECG classifications system will be helpful to marginalize the burden of ECG misinterpretation.

QUESTION	DESCRIPTION
Who does the problem affect?	People over the age of 60 are more likely to develop a more serious arrhythmia. Older people are at increased risk for heart disease and often take medications that affect the heart's rhythm.
What are the boundaries of the problem?	There may be no symptoms. Alternatively, symptoms may include a fluttering in the chest, chest pain, fainting or dizziness.
What is the issue?	In general, complications of heart arrhythmias may include stroke, sudden death and heart failure. Heart arrhythmias are associated with an increased risk of blood clots. If a clot breaks loose, it can travel from the heart to the brain, causing a stroke.
When does the issue occur?	A heart arrhythmia is an irregular heartbeat. Heart arrhythmias occur when the electrical signals that coordinate the heart's beats don't work properly. The faulty signaling causes the heart to beat too fast (tachycardia), too slow (bradycardia) or irregularly.
Where is the issue occur?	An arrhythmia can occur in the sinus node, the atria, or the atrioventricular (AV) node. These are called supraventricular

	<p>arrhythmias. Arrhythmias can also occur in your ventricles and are caused by an abnormal electrical focus within your ventricles. Sometimes called as heart attack.</p>
<p>Why is it important that we fix the problem?</p>	<p>The most effective way to diagnose an arrhythmia is with an electrical recording of your heart rhythm called an electrocardiogram (ECG). If the ECG doesn't find a problem, you may need further monitoring of your heart. This may involve wearing a small portable ECG recording device for 24 hours or longer.</p>