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Heart Rate Variability Analysis for Early Stage Prediction of Sudden Cardiac Death

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Abstract : In present scenario, cardiovascular problems are growing challenge for researchers and physiologists. As heart disease have no geographic, gender or socioeconomic specific reasons; detecting cardiac irregularities at early stage followed by quick and correct treatment is very important. Electrocardiogram is the finest tool for continuous monitoring of heart activity. Heart rate variability (HRV) is used to measure naturally occurring oscillations between consecutive cardiac cycles. Analysis of this variability is carried out using time domain, frequency domain and non-linear parameters. This paper presents HRV analysis of the online dataset for normal sinus rhythm (taken as healthy subject) and sudden cardiac death (SCD subject) using all three methods computing values for parameters like standard deviation of node to node intervals (SDNN), square root of mean of the sequences of difference between adjacent RR intervals (RMSSD), mean of R to R intervals (mean RR) in time domain, very low-frequency (VLF), low-frequency (LF), high frequency (HF) and ratio of low to high frequency (LF/HF ratio) in frequency domain and Poincare plot for non linear analysis. To differentiate HRV of healthy subject from subject died with SCD, k –nearest neighbor (k-NN) classifier has been used because of its high accuracy. Results show highly reduced values for all stated parameters for SCD subjects as compared to healthy ones. As the dataset used for SCD patients is recording of their ECG signal one hour prior to their death, it is therefore, verified with an accuracy of 95% that proposed algorithm can identify mortality risk of a patient one hour before its death. The identification of a patient’s mortality risk at such an early stage may prevent him/her meeting sudden death if in-time and right treatment is given by the doctor.

Keywords : early stage prediction, heart rate variability, linear and non-linear analysis, sudden cardiac death
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