

Deep Graph Embeddings for the Analysis of Short Heartbeat Interval Time Series

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Abstract : Sudden cardiac death (SCD) constitutes a large proportion of cardiovascular mortalities, provides little advance warning, and the risk is difficult to recognize based on ubiquitous, low cost medical equipment such as the standard, 12-lead, ten second ECG. Autonomic abnormalities have been shown to be strongly predictive of SCD risk; yet current methods are not trivially applicable to the brevity and low temporal and electrical resolution of standard ECGs. Here, we build horizontal visibility graph representations of very short inter-beat interval time series, and perform unsupervised representation learning in order to convert these variable size objects into fixed-length vectors preserving similarity relations. We show that such representations facilitate classification into healthy vs. at-risk patients on two different datasets, the Multiparameter Intelligent Monitoring in Intensive Care II and the PhysioNet Sudden Cardiac Death Holter Database. Our results suggest that graph representation learning of heartbeat interval time series facilitates robust classification even in sequences as short as ten seconds.

Keywords : sudden cardiac death, heart rate variability, ECG analysis, time series classification

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