Seminars in Biotechnology BTEC 591 & BTEC 691

"ECG Signal Analysis and Classification of Cardiovascular Diseases"

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13:30

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Eftal Şehirli was born in Safranbolu in 1989. He completed his bachelor studies in 2012 at the Department of Computer Engineering at Doğuş University. He completed his master studies in 2014 and his PhD studies in 2018 at the Department of Computer Engineering, at Karabük University under Dr. Muhammed Kamil Turan's supervision in the field of medical image processing and artificial intelligence. In 2013, he worked on his master thesis in Ilmenau Technical University, Germany. He worked for Karabük University as Res. Asst. at the Department of Biomedical Engineering between 2012 and 2019. He has worked as Asst. Prof. Dr. at the Department of Medical Engineering since 2019. His main research interests are image processing, artificial intelligence, database systems, data science, machine learning, signal processing and software development. He is the author of 7 articles and 10 conference papers. Eftal Şehirli has served as table tennis coach for Karabük University table tennis team since 2012. He is a table tennis referee and has served for Turkish Table Tennis Federation since 2015.

Abstract

Automated-detecting intelligent programs and methods are developing to find out diseases in medicine in recent years [1-3]. Developing new methods and improving existing ones are currently ongoing research [4-6]. One of the most important health problems is heart diseases for all people in the world. Electrocardiography (ECG) is a diagnosis tool that gives substantially functional information about heart and cardiac system [7,8]. In this work, it is primarily aimed at developing an intelligent system based on ECG signal processing, analysis, and classification via a hybrid machine learning model. This work uses 837 ECG signal fragments that includes 7 different classes shared in MIT-BIH Arrhythmia database for one lead [9]. The ECG signals are applied on a preprocessing to smooth signals and correct baselines. Q, R and S waves (QRS) complex on ECG signals are segmented based on k-means clustering and tracking local extrema points. Feature extraction and selection are then performed, and a dataset is created by calculating measurement parameters for each QRS points separately. Training sets and test sets based on 8-fold cross validation are generated. A hybrid model based on machine learning models including decision tree (DT), k-nearest neighbor (KNN), random forest (RF), naïve bayes (NB), linear discriminant analysis (LDA), support vector machines (SVM) and quadratic discriminant analysis (QDA) is developed to classify cardiovascular diseases (CVD) into 7 different classes such as normal sinus rhythm (NSR), atrial premature beat (APB), atrial fibrillation (AFIB), premature ventricular contraction (PVC), ventricular bigeminy (VB), left bundle branch block beat (LBBBB) and right bundle branch block beat (RBBBB). Sensitivity, specificity, accuracy, and Matthews correlation coefficient (MCC) of detection of QRS complex are obtained respectively as 94.75%, 95.96%, 95.57% and 0.90. Sensitivity, specificity, accuracy and MCC of classification of CVD classes are obtained respectively as 92.33%, 92.50%, 92.41%, 0.85.

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