A Deep Learning Approach for Real-Time Detection of Atrial Fibrillation

Goal: To develop a robust and real-time approach for automatic detection of Atrial Fibrillation (AF) in long-term electrocardiogram (ECG) recordings using deep learning (DL). Method: An end-to-end model combining the Convolutional- and Recurrent-Neural Networks (CNN and RNN) was proposed to extract high level features from segments of RR intervals (RRIs) in order to classify them as AF or normal sinus rhythm (NSR). Results: The model was trained and validated on three different databases including a total of 89 subjects. It achieved a sensitivity and specificity of 98.98% and 96.95% respectively, validated through a 5-fold cross-validation. Additionally, the proposed model was found to be computationally efficient and it was capable of analyzing 24 hours of ECG recordings in less than one second. The proposed algorithm was also tested on the unseen datasets to examine its robustness in detecting AF for new recordings which resulted in 98.96% and 86.04% for specificity and sensitivity, respectively. Conclusion: Compared to the state-of-the-art models evaluated on standard benchmark ECG datasets, the proposed model produced better performance in detecting AF. Additionally, since the model learns features directly from the data, it avoids the need for clever/cumbersome feature engineering.

General information
Publication status: Published
Organisations: Department of Applied Mathematics and Computer Science, Cognitive Systems, Department of Electrical Engineering, Biomedical Engineering
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Number of pages: 9
Pages: 465-473
Publication date: 2019
Peer-reviewed: Yes

Publication information
Journal: Expert Systems with Applications
Volume: 115
ISSN (Print): 0957-4174
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
Original language: English
Keywords: Electrocardiogram (ECG), Atrial Fibrillation, Deep Learning, Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), Long Short-Term Memory (LSTM)
DOIs: 10.1016/j.eswa.2018.08.011
Source: FindIt
Source ID: 2438393340
Research output: Contribution to journal › Journal article – Annual report year: 2019 › Research › peer-review