Related paper for anomaly detection on ECG Data
Related Work

This document illustrates some of the previous work related to our subject. In this part, we try to answer the following questions:

- What did the paper do?
- What was the main finding or advancement?
- What were the limitations of that work?
- The future work.

01.Title: (Authors AND venue (e.g., conference, journal, other).	**Real-Time Ultra-Low Power ECG Anomaly Detection Using an Event-Driven Neuromorphic Processor.** Felix Christian Bauer; Dylan Richard Muir; Giacomo Indiveri **Published in:** IEEE Transactions on Biomedical Circuits and Systems (Volume: 13, Issue: 6, December 2019) 46 citations Link: https://ieeexplore.ieee.org/abstract/document/8896021
Main finding:	Suggested an ultra-low power system that can identify anomalies in real time on a multi-channel ECG. Developed a spiking recurrent neural network and showed that it was capable of accurately identifying abnormal ECG patterns.
Limitation:	According to the author, there are some limitations in the readout and weight quantization part.
Future Work:	The required fan-in can be reduced by variable selection methods and regularization.
Comments:	

02.Title:	**Anomaly Detection in ECG Time signals via Deep Long Short-Term Memory Networks.**
	Sucheta Chauhan; Lovekesh Vig;
	Published in: 2015 IEEE International Conference on Data Science and Advanced Analytics (DSAA).
	Citations:192
	Link: https://ieeexplore.ieee.org/abstract/document/7344872
Main finding:	They used features extraction on ECG signal and then used deep learning method to detect anomalies.
Limitation:	The data has an **imbalance** with around 2919 examples of normal cases and 2079 examples of aberrant cases.
Future Work:	Balancing the dataset might help to improve the result.
Comments:	

03.Title: Authors AND venue (e.g., conference, journal, other).	**ECG Signal Preprocessing and SVM Classifier-Based Abnormality Detection in Remote Healthcare Applications**
	C. Venkatesan; P. Karthigaikumar; Anand Paul; S. Satheeskumaran; R. Kumar
	Publisher: IEEE 2018
	Citation :127
	Link: https://ieeexplore.ieee.org/abstract/document/8264685
Main finding:	ECG signal preprocessing and support vector

	machine-based arrhythmic beat classification is performed to categorize the ECG data. Moreover, authors used discrete wavelet transformation on the preprocessed signal for HRV feature extraction and different machine learning techniques.
Limitation:	92.5% accuracy with ECG data and they used a total of 200 data.
Future Work:	Can be used deep learning model or some new machine learning techniques with high amount ECG data.
Questions	

04.Title:	**ECG Anomaly Detection via Time Series Analysis**
(Authors AND venue (e.g., conference, journal, other).	Mooi Choo Chuah & Fen Fu
	Conference paper
	1392 Accesses
	35 Citations
	Link : **https://link.springer.com/chapter/10.1007/978-3-540-74767-3_14**
Main finding:	An adaptive window-based discord discovery (AWDD) scheme for detecting abnormal patterns in the heartbeat related time series. The different with third paper is that here they used adaptive window size rather than discrete wavelet window.
Limitation:	They used only six patients' data for their work.

Future Work:	They are building code-blue medical sensors for collecting heart-beat data and they are planning to do the same work on those data. Further details can find on the paper.
Questions/comments:	

5.Title: Authors AND venue (e.g., conference, journal, other).	**Adaptive noise removal of ECG signal based on ensemble empirical mode decomposition** Zhao Zhidong, Luo Yi and Lu Qing Submitted: October 7th, 2010 Published: July 5th, 2011 Link: https://www.intechopen.com/chapters/16116
Main finding:	They used an algorithm to remove the noise from the ECG signal by fixing a threshold.
Limitation:	No machine learning model has been used as they just filtered the ECG data.
Future Work:	This method can be used for preprocessing our ECG data to remove the noise of the machine learning model for detecting anomalies. (don't have idea)
Questions	

06.Title: Authors AND venue (e.g., conference, journal, other).	**Regularized Encoder-Decoder Architecture for Anomaly Detection in ECG Time Signals** **Published**: 2019 Ashutosh Chandra; Rahul Kala https://ieeexplore.ieee.org/document/9066261
Main finding:	They used regularized encoder-decoder method and got 90% of F1 score using LSTM method for detecting anomalies.
Limitation:	
Future Work:	
Questions	

07.Title: (Authors AND venue (e.g., conference, journal, other).	**A Contrastive Learning Framework for ECG Anomaly Detection** Fangyu Li; Hui Chang; Min Jiang; Yihuan Su **Published in 2022** https://ieeexplore.ieee.org/document/9778634
Main finding:	A contrast learning ECG abnormality detection framework is designed by capturing the underlying patterns of ECG signals and design a data augmentation-based contrast learning module to alleviate the data imbalance and robustness problems of the model.

Limitation:	Can't read the whole paper.
Future Work:	
Questions	

08.Title: Authors AND venue (e.g., conference, journal, other).	**Anomaly Detection in ECG Signals: Identifying Abnormal Heart Patterns Using Deep Learning** Syed Huma Shah — Published On February 16, 2023 and Last Modified On March 10th, 2023 Link : https://www.analyticsvidhya.com/blog/2023/02/anomaly-detection-in-ecg-signals-identifying-abnormal-heart-patterns-using-deep-learning/
Main finding:	
Limitation:	
Future Work:	
Questions	

09.Title:	Sparse Coding with Anomaly Detection
Main finding:	
Limitation:	
Future Work:	
Questions	