



**CS 552 Term Project Proposal**  
**Data Science with Python**

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**2024**

**Project Title:** Detection and Classification of Cardiac Arrhythmia from 12-Lead ECG Using Deep Neural Network

**Objective:**

The electrocardiogram (ECG) reflects the electrical activity of the heart, and the interpretation of this recording can reveal numerous heart pathologies. An ECG is recorded using an electrocardiograph, whereas modern clinical devices usually contain automatic interpretation software that interprets the ECGs directly after recording. Although automatic ECG interpretation started in the 1950s, some limitations remain. Because of the errors they make, doctors have to read over the ECGs. This is time-consuming for the doctors and requires a high degree of expertise. There is a need for better ECG interpretation algorithms.

The recent years have shown a rapid improvement in machine learning. A sub-field of machine learning is called Deep Learning, where more complex architectures of neural networks are better able to scale with the amount of data in terms of performance. This type of machine learning has shown promising performance in many fields including medicine.

This project aims to utilize open-source Electrocardiography (ECG) datasets to detect and classify arrhythmias (heart rhythm disorders) using deep learning methods. The ultimate goal is to contribute to the improvement of automatic diagnosis methods in the healthcare sector and advance medical systems.

**Project Steps:**

**1. Exploration of Open-Source ECG Datasets**

- Investigate and select open-source ECG datasets
- Analyze the selected datasets' content, size, and quality.

**2. ECG Signal Pre-Processing**

- Obtaining a denoised ECG signal by applying various filters

**3. Feature Extraction from ECG Data**

- Obtaining the features that will form input to the DNN model from the ECG signal (Ventricular Rate, Atrial Rate, QRS Duration, QT Interval, etc.)

#### **4. Identification of Deep Neural Network Methods**

#### **5. Detection and classification using Deep Neural Network Methods**

##### **Data Information:**

- Zheng, Jianwei; Rakovski, Cyril; Danioko, Sidy; Zhang, Jianming; Yao, Hai; Hangyuan, Guo (2019). A 12-lead electrocardiogram database for arrhythmia research covering more than 10,000 patients. figshare. Collection. <https://figshare.com/collections/ChapmanECG/4560497/2>
- Rheng, J., Zhang, J., Danioko, S. et al. A 12-lead electrocardiogram database for arrhythmia research covering more than 10,000 patients. Sci Data 7, 48 (2020). <https://doi.org/10.1038/s41597-020-0386-x>