Project Idea:

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- Title: ECG Classification based Time Frequency Analysis and Deep Learning.

- Objective: This project aims to classify human electrocardiogram (ECG) signals into three categories: cardiac arrhythmia (ARR), congestive heart failure (CHF), and normal sinus rhythm (NSR). The classification process will utilize time-frequency representations of ECG signals, which will be further classified using deep convolutional neural networks (CNNs).

2. Relevance to Sustainable Development Goals (SDGs):

- Goal 3: Good Health and Well-being: By improving the accuracy and efficiency of diagnosing heart conditions, this project directly supports the goal of reducing premature mortality from non-communicable diseases through prevention, treatment, and monitoring of cardiovascular diseases.

3. Literature Examples:

- The study "ECG Classification Using Wavelet Transform and Deep Learning" showcases the effectiveness of combining wavelet transforms with deep learning models for ECG signal classification, highlighting the importance of time-frequency analysis in signal processing [1].

- The research on "Transfer Learning for Medical Image Classification Using Pretrained CNNs" emphasizes the use of transfer learning with pretrained models like GoogLeNet to enhance the performance of medical image classification tasks, demonstrating the adaptability of CNN architectures to various domains [2].

4. Describe Your Data:

- Source: The data consists of 162 ECG recordings from the PhysioNet databases, specifically the MIT-BIH Arrhythmia Database, MIT-BIH Normal Sinus Rhythm Database, and the BIDMC Congestive Heart Failure Database [3].

- Format: The data is stored in MATLAB format (`.mat`), with each ECG signal sampled at 128 Hz. Preprocessing involves converting the signals into time frequency images, which are then saved as RGB images for input into the CNNs [3].

- Size:The dataset includes 96 ARR, 30 CHF, and 36 NSR recordings.

5. Approach:

- Deep Learning: The project will employ deep learning techniques, specifically adapting CNNs to classify the time-frequency images derived from the ECG signals. This approach is chosen due to the complexity of the classification task and the nature of the data, where transfer learning can effectively leverage the features learned from large-scale image datasets.

References:

1. Mohonta, S. C., Motin, M. A., & Kumar, D. K. (2022). Electrocardiogram based arrhythmia classification using wavelet transform with deep learning model. *Sensing and Bio-Sensing Research*, *37*, 100502.‏
2. Sabeenian, R. S., & Janani, K. S. (2023). Transfer learning-based electrocardiogram classification using wavelet scattered features. *Biomedical and Biotechnology Research Journal (BBRJ)*, *7*(1), 52-59
3. Goldberger A. L., L. A. N. Amaral, L. Glass, J. M. Hausdorff, P. Ch. Ivanov, R. G. Mark, J. E. Mietus, G. B. Moody, C.-K. Peng, and H. E. Stanley. "PhysioBank, PhysioToolkit,and PhysioNet: Components of a New Research Resource for Complex Physiologic Signals." Circulation. Vol. 101, Number 23: e215–e220. [Circulation Electronic Pages; http://circ.ahajournals.org/content/101/23/e215.full]; 2000 (June 13). doi: 10.1161/01.CIR.101.23.e215.

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