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COMPARING TRADITIONAL MACHINE LEARNING ALGORITHMS AND DEEP LEARNING NETWORKS FOR ECG-BASED DISEASE CLASSIFICATION: A STUDY USING THE MIT-BIH ARRHYTHMIA DATASET

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Synopsis

This dissertation explores the application of artificial intelligence for electrocardiogram (ECG) processing and disease classification. The study focuses on comparing traditional machine learning algorithms and modern deep learning networks, specifically convolutional neural networks (CNNs), for their efficiency and accuracy in classifying diseases based on ECG signals.

The research uses the MIT-BIH Arrhythmia dataset and applies traditional filtering methods, including convolution filtering, band-pass filters, and Gustafson's edge correction methods, to preprocess the data. Mathematical features like mean, kurtosis, and skewness, as well as biological features like R-R interval, PR Interval, ST Interval, and Q-S Wave height, are extracted to implement traditional machine learning models. For the deep learning models, both CNNs and artificial neural networks (ANNs) with various inner structures and layers are used to make predictions. Cross Entropy loss is employed as the loss function, and Stochastic Gradient Descent is used as the optimisation function for the neural networks. For the machine learning models, a simple Jaccard Index is used as this is a classification problem.

The study compares the efficiency and accuracy of all these methods to develop a robust method for ECG-based disease classification. Most of the work is done using Python as the programming language. However, some work is being done using JavaScript and HTML to design illustrations.

To validate the model's effectiveness, the study tests it on a live subject and gets the results validated by practising physicians. The study aims to contribute to the development of a more accurate and efficient method for ECG-based disease classification, which can ultimately lead to improved patient care and diagnosis.