An Efficient Designing of IIR Filter for ECG Signal Classification Using MATLAB

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INTRODUCTION

- ✓ The electrocardiogram (ECG) is a biological signal that is frequently employed and plays a significant role in cardiac analysis.
- ✓ In this article, a brand-new method for classifying and detecting QRS peaks in ECG data based on artificial intelligence is provided.
- ✓ The integration of the ECG signal data is proposed using a reduced order IIR filter design using the min-max method.
- ✓ Heart rate and ECG signals are used to evaluate a healthy heart. A cardiac arrhythmia is recognized if we record an ECG from a patient and there is any nonlinearity.
- ✓ The main focus of this study is on removing baseline uncertainty and power line interferences from the ECG signal.
- ✓ Outside electromagnetic field incursion, noise, power line interference (PLI), which comprises crucial cardiac foundations, frequency determination, and signal superiority.
- ✓ It is advised to solve the issue of contaminated noise removal because it improves accuracy and is crucial for the ECG data.

OBJECTIVES

Objectives of Research:

Designing an efficient IIR filter for ECG signals to identify heart problems was the main focus of the design, analysis, and implementation of the following subsystems are categorized as the work flow in order to create an effective model for ECG analysis.

- implementation of modules such arithmetic circuits for filters used in ECG signal classification as well as the construction of parallel prefix circuits.
- creating an algorithm that can identify the difficult QRS problem in real-time ECG classification, we may further investigate the effective filter utilized in ECG signal classification.

Pan- Tompkins Peak Detection Approach & IIR Filter Design

There are numerous strategies created to enhance the effectiveness peak detection and classification efficiency in two current filtering techniques—Pan-Tompkins and a 60 order IIR filter.

Optimum Reduced Order IIR Filter Design

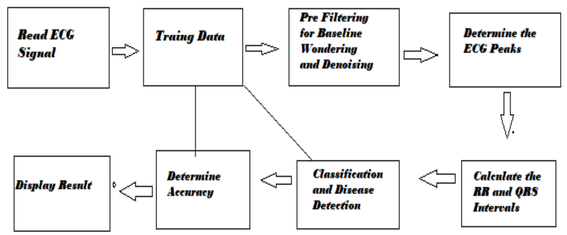

Figure 1: Image detection and classification methods

RESULTS & DISCUSSION

Using IIR Filter Design Algorithm to find Transfer function coefficients are optimized in a sequential manner, as demonstrated in the sequential Min-Max optimization technique.

Results of Optimized Filter ECG Design:

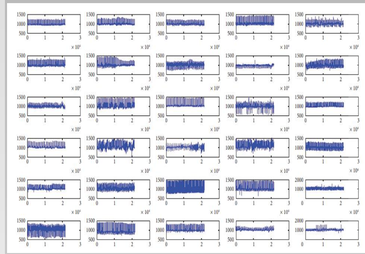

Figure 2: Enter data from the 5.556-second ECG arrhythmia database of 35 people recorded

Simulation Results of QRS Peak Detection in MATLAB

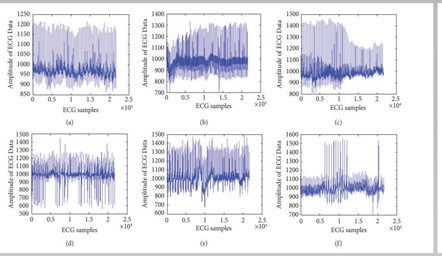

Figure 3: For perceptual result representation, six distinct ECG data with various feature difficulties

ECG Image Classification

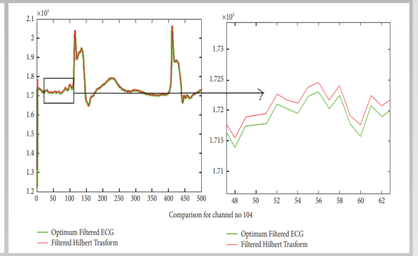

Figure 4 : Hilbert transform for channel number 105.

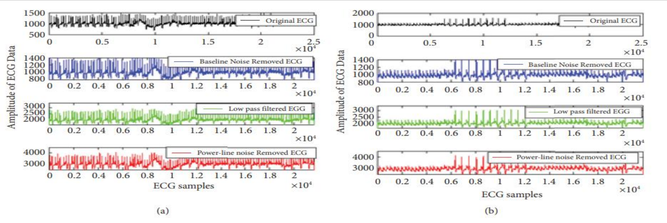

Figure 5: For the 3500 samples, ECG signal pre-processing is plotted for the (a) 101th ECG data and (b) 106th ECG data.

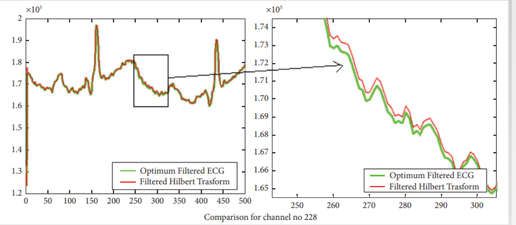

Figure 6:The channel number 228's R peak detection efficiency

Time Domain HRV Parameter Analysis

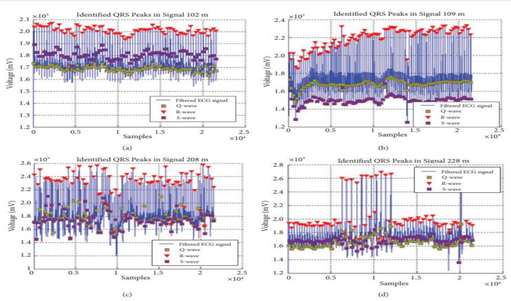

Figure 7: Results of the suggested optimum IIR filter technique for QRS peak identification for four ECG signals

Results of HRV analysis

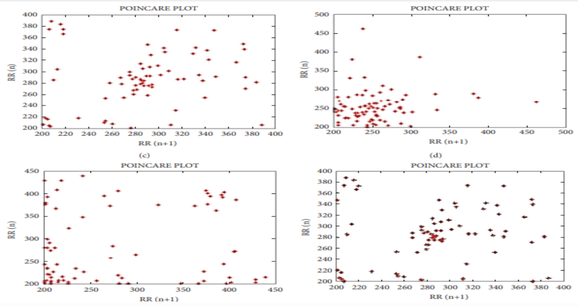

Figure 8: Results of HRV analysis

CONTACTS

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Comparative analysis for Statistics parameters

Below Table shows that comparative analysis for statistics parameters of existing method with proposed method.

Ref. No.	Accuracy	QRS peak detection	RR interval	HRV Analysis
Y. Kaya et al, Journal Biomedical Research,2017	85%	No	NO DETECTED	No
Y. Kaya and H. Pehlivan, International Conference. on IEEE ,2015	85.6%	No	NO DETECTED	No
M. S. Manikandan et al, Journal Biomedical Signal Processing and Control,2012	88%	No	NO DETECTED	YES
H. Kaur and R. Rajni,Wireless Personal Communications, 2017.	89%	No	NO DETECTED	No
V. Verma and S. S Rathore, International Journal of Advances in Engineering & Technology, 2015.	90%	YES	DETECTED	YES
A. K. Dohare et al, Computers & Electrical Engineering, vol. 40, no. 5, pp. 1717– 1730, 2014	91%	YES	DETECTED	NO
L. S. Sargar et al, J. Healthcare Eng. 2017	92.67%	YES	DETECTED	YES
Proposed work	**96.87%**	**YES**	**DETECTED**	**YES**

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