Providing an Optimal Algorithm for Extracting P,Q,R,S,T Points from the ECG signal

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Introduction

The ECG records the heart's electrical activity, revealing vital information about its function through distinct waveforms (P, Q, R, S, and T). Changes in these waves, such as in the QRS complex, can indicate conditions like hypertension or myoca.

Objectives

1. Preprocessing
• Bandpass filtering to remove baseline wander and noise
• Signal normalization

2.. ORS Detection
• Pan-Tompkins algorithm for initial R-peak localization
• Wavelet transform for noise reduction and feature enhancement
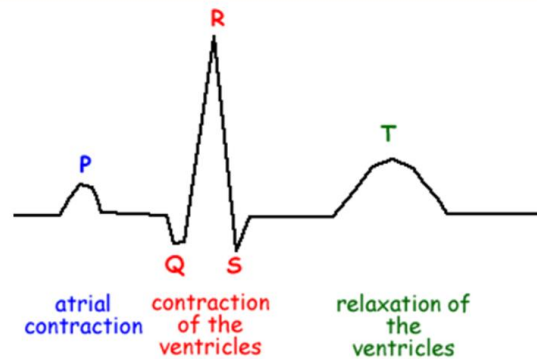
3. Fiducial Point Identification
• Pand T.points, Detected as slope and ampiitude analysis before an after
• O,and s points. Located as local min-ma around R-peak using derivative thresholding
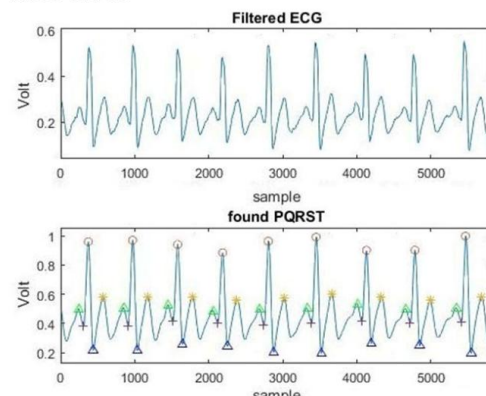
4. Optimization
Fine-tuning window sizes using grid s earch
Applying adaptive thresholds for different signal qualities

Results

Conclusion

This project aimed to accurately detect the challenging T and P points in ECG signals using a simple, fast algorithm with basic filters and thresholding. The proposed method achieved high accuracy, and future improvements may involve adaptive filters and neural networks for enhanced performance.

References

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2. Z. Wu and C. Guo, "Deep learning and electrocardiography: systematic review of current techniques in cardiovascular disease diagnosis and management," BioMedical Engineering OnLine, vol. 24, Art. no. 23, Feb. 2025. (BioMed Central)

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