Comparison of Digital Filters in Denoising Electrocardiogram Signals using MATLAB

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INTRODUCTION

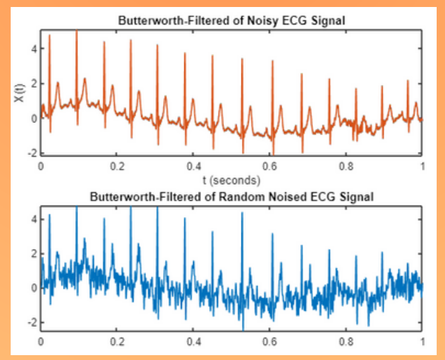
An electrocardiogram (ECG) is a medical instrument that tracks the electrical activity of the heart. It monitors the SA node of the heart's spontaneous depolarization (SD) wave. Segments, waves, and intervals are used to group the deflection waves, which are caused by the SD flow through the carefully positioned nodes on the body. However, the nodes are susceptible to interference from various factors, and corresponding frequency ranges where the noises/interference can be found exist.

Baseline wander (BW) and powerline interference (PLI) are two types of ECG noise that occur when the impedance between the electrodes and the patient's skin, breathing, or movement is incorrect. EMG noise occurs when muscle electrical activity outside of the heart is detected.

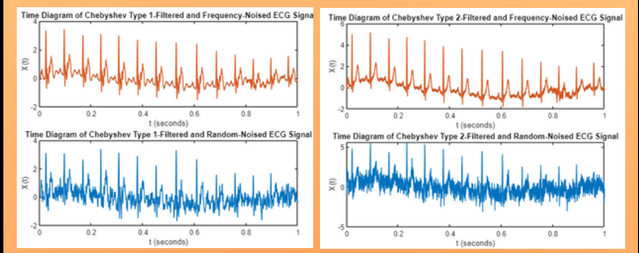
METHODOLOGY

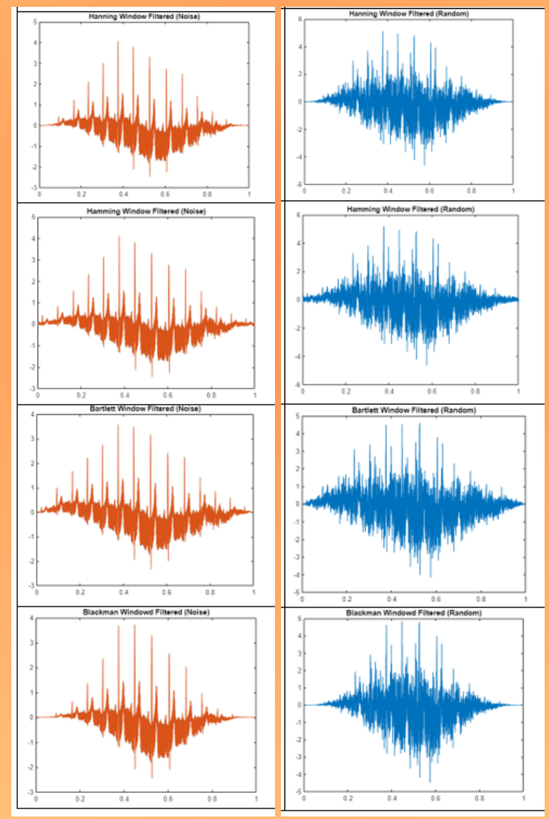
- ECG Signal from a database
- Generation of two different Noise
- Combining the Two different Noise to the Original ECG Signal
- Signal Filter Processing Stage
  - Lowpass Butterworth Filter
  - Lowpass Chebyshev Type 1 Filter
  - Lowpass Chebyshev Type 2 Filter
  - Hanning Window Method
  - Hamming Window Method
  - Bartlett Window Method
  - Blackman Window Method

RESULTS



RESULTS





CONCLUSION

To conclude, out of all the filtering process between the butterworth, chebyshev types 1 and 2, the chebyshev type 2 produces the cleanest results. As it was able to filter out the two kind of noise that was combined with the original ECG signal. As for the window method, the blackman window method filtered the most noise out of all the window method that was implemented.

REFERENCES

- Potter, L. (2022) Understanding an ECG: ECG interpretation, Geeky Medics. Available at: https://geekymedics.com/understanding-an-ecg/. (Accessed: April 13, 2023).
- Price, D. (no date) How to read an electrocardiogram (ECG). part One: Basic principles of the ECG. the normal ECG, Welcome to South Sudan Medical Journal. Available at: http://www.southsudanmedicaljournal.com/archive/may-2010/how-to-read-an-electrocardiogram-ecg.-part-one-basic-principles-of-the-ecg.-the-normal-ecg.html (Accessed: April 13, 2023).