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Normalizing for Noise Removal from Electrocardiogram Signals

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Introduction

- Electrocardiography (ECG) measures the electrical impulse of the heart over time using electrodes that attached to the body
- ECG data can determine arrhythmias in the heart
- The ability to analyze the ECG by observing the signal is difficult due to human motion
- Designing a computational program using a synthetic ECG to test Normalized Least Mean Square (NLMS) filter serves as a basis to remove noise from the signal

Methods

- To test the efficiency of NLMS, we used a synthetic ECG that is similar to a normal human ECG

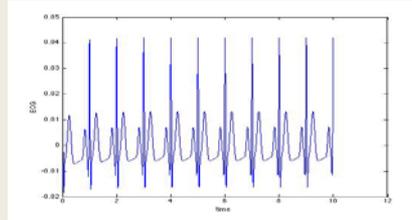


Figure 1- Synthetic ECG

Using a synthetic ECG comes with some great advantages that allows us to:

- Use this as a standard for exploring the effect of various parameters in the signal
- Change the levels of the accelerometer noise
- Use different sampling frequencies

NLMS

- Use NLMS to estimate the effect of user motion on measured ECG
- Use estimated effect to estimate noise for ECG

Results

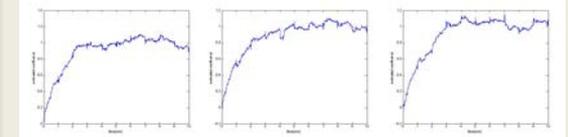


Figure 2- Estimated Coefficients of x, y, z

- NLMS is producing the estimated coefficients of user acceleration
- NLMS is converging to 1, which is the correct value, with little noise and remains at 1 with some noise in the signal

Conclusion

- The NLMS filter results indicate that the filter is working properly
- We will expand on this research by adding computational intelligence in combination with NLMS