**GYRO Processing**

**15.Jan.2021**

Repeating the ECG processing on the Gyro signals for Shay (Raw GYRO X, Y, Z from ‘ERROR’ channel on Grafana, dated: 12/01/2021 @16h37:59 through to 16h38:04 @ 100sps).

Here is the raw ECG, alongside the raw GYROX, Y, Z:

Chart, box and whisker chart

Description automatically generated

Graphical user interface, application

Description automatically generated

After band pass filtering, these signals look as follows (ECG first, GyroX second):

Chart

Description automatically generated

Chart, line chart

Description automatically generated

There is clearly a lot of action going on here…. Which is much more sensitive to threshold setting.

We differentiate the signal to identify the large signal changes, i.e. to accentuate the R peak.

Chart, histogram

Description automatically generated

Chart, line chart

Description automatically generated

Now, we square it up, to accentuate the larger peaks further from the smaller ones, and rectify the signal

Chart

Description automatically generated

Chart, histogram

Description automatically generated

What’s a bit concerning here is the variation in GYROX peak sizes…which makes it more unreliable than the ECG peaks.

In terms of determining the “BEAT” threshold (i.e. the level above which we consider it to be a beat), I try out a couple approaches using a moving average window, as you can see in the sequence of images below:

Chart

Description automatically generated

Chart

Description automatically generated

The above comparison shows that the algorithm detects all R peaks using the ECG, but only 4 of the 6 from the GYROX Signal.

The Green line shows the threshold for considering the pulse to be an R peak. This level is too high for the peak between 400ms and 500ms to be detected as a peak. But what’s concerning is the peak is down about the black dotted line – i.e. the noise power. That means these peaks are indistinguishable from noise.

The peak at around 100ms (first peak in the sample set) should be detected, so we can treak the algorithm to achieve that.

Note the black dashed line indicates the noise in the signal – which is VERY low, especially compared to the dashed red line, which is the signal level.

Chart, line chart, box and whisker chart

Description automatically generatedGraphical user interface, chart, application

Description automatically generated

Using this approach, I detected peaks in the ECG interspaced at the following time intervals in the 5s segment: ﻿0.91683s, 1.00000s, 0.88084s, 0.92014s, 0.98062

Thus, the average beat time in this segment is 0.93968s, equivalent to a heart rate of 63.9beats per minute.

Using this approach, I detected peaks in the GYROX interspaced with the following time: ﻿1.00000s, 0.64920, 0.81374, 0.61510

Thus, the average beat time in this segment is 0.93968s, equivalent to a heart rate of 78beats per minute, which is not a good result.

GYRO Y and Z CHANNELS ARE MUCH WORSE – AND DO NOT HELP RESOLVE THE HR, MAKE IT MUCH WORSE!