

Detecting cardiac irregularities using heart rate data from fitness trackers

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External stakeholder(s): Crickles Project (<https://crickles.casa/>)

Scientific background

Recent preliminary research done in collaboration with Warwick Medical School has suggested that it may be possible to use heart rate data captured from fitness trackers by keen amateur cyclists during exercise to detect the presence of heart rhythm problems. Some of the heart rhythm problems experienced by amateur athletes are asymptomatic. This work could therefore result in an early warning system for problems that could become more serious over time. An interesting aspect of this work is that it is both true jumps in heart rate as well as apparent glitches in device measurements of heart rate that seem to be informative. The glitches show up in the heart rate time series data as sequences of structural breaks that are not thought to be physiologically realistic. The term "gappiness" has been coined to describe this phenomenon of jumps and glitches.

Research challenge

The purpose of this project is to do more refined time series analyses of gappiness in heart rate data to maximise the amount of information that can be extracted about the possible relationship with cardiac arrhythmia. Heart rate time series and health survey data will be provided by the Crick-

les Project. Some possible areas to explore are:

1. Analysis of possible changes in irregularity measures over time for each athlete.
2. Devise and validate more refined methods for the detection of gappiness in the data.
3. Come up with model-based approaches to try to separate time series anomalies that result from artefacts in the measurement device from anomalies due to jumpiness in the heart rate. This is hard since the two are believed to be inter-related and there is no "ground truth" data available.

Pre-requisites

There are no strict technical requirements other than the level of statistical and programming knowledge that any MathSys student should already have. However an interest in time series analysis and practical data science is recommended. It would also help if you have a personal interest in the area of application!

Additional considerations

This research is still at quite an exploratory stage but if things go well, there are likely to be opportunities for follow-on PhD level research.