# Insights from Data Analytics Into Our Personal Sensor Data

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## ABSTRACT

Personal sensors are now ubiquitous and they can be wearable, they can be carried or they can be *in situ* and fixed into our homes or workplaces. The major factors influencing the growth in personal sensing include that they are smaller, smarter, cheaper, require less energy and they integrate with consumer devices. The major benefits of personal sensing are in the healthcare sector with secondary uses in sports and performance and in long-term monitoring of vulnerable populations, like the aged.

So what do we usually do with the data generated from personal sensing ? We count steps taken, measure distance walked, add up energy expenditure, assess sleep quality and thatâĂŹs about it. We can also longitudinally track our behaviour and detect changes, but we tend to do this only for cases like following a weight loss or a smoking cessation program or improving our food intake. Then, outside such motivational scenarios, we get bored and stop using them.

Sometimes personal sensors use aspects of human behaviour by engaging us in competitions with others, or setting goals for ourselves. Strava is an example sensor for running and cycling that encourages its users to form part of a (virtual) community and to engage with others through social media. Beyond that we do not use our personal sensing data for any real value, for example to monitor our health or to form part of our annual medical check-up, for example.

It is a fact that human lifestyles have in-built periodicities of various frequencies . . . daily, weekly, monthly, seasonal, and annual. The 24h periodicity is the most important, and dominant and disruptions to our 24h periodicity do cause us harm. For example, jet lag disruption includes us fatigue, malaise and poor concentration, all caused by deviation from our circadian rhythm. Using wearable sensors to collect data we can detect these periodicities. Not only can we detect but we can also measure the strength or intensity of the 24h periodicity over a time period.

Using wrist-worn accelerometer data gathered from subjects over a 3-month period we measured the strength of their 24h periodicity and found correlation between shifts in periodicity intensity and some cardio-metabolic biomarkers which are health-related quality of life indices including LDL cholesterol, triglycerides, hc-CRP (C-Reactive Proteins, indicators of inflammation)

This is a surprising result showing cardio-metabolic health feedback based on data-driven analytics of accelerometer data. This example highlights that we have much more to do to really maximise value from personal sensing data.


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## CCS CONCEPTS

• **Information systems** → *Mobile information processing systems*; *Multimedia information systems*; • **Applied computing** → *Consumer health*;

## KEYWORDS

Wearable sensors, Health, Periodicity, Signal Processing

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## BIOGRAPHY

Alan Smeaton is Professor of Computing at Dublin City University where he has previously been Head of School and Executive Dean of Faculty. He is a Founding Director of the Insight Centre for Data Analytics at DCU and a member of the Board of the Irish Research Council with a Ministerial appointment from 2012 to 2018. He is also a member of the COST Scientific Committee which oversees the disbursement of COST's budget of €300m during the lifetime of Horizon 2020.

His research focuses on the development of theories and techniques to support all aspects of information discovery and human memory. He is recognised for his work on multimedia retrieval and on automatic video analysis. He is founding coordinator of TRECVid, the international benchmarking evaluation campaign on content operations on digital video, run by the National Institute of Standards and Technology in the US annually since 2001.

Alan is an elected member of the Royal Irish Academy and in 2016 he was awarded the Academy's Gold Medal for Engineering Sciences, an award given once every 3 years. In 2017 he was elevated to Fellow of the Institute of Electrical and Electronic Engineers (IEEE) and in July 2017 Alan was elected Chair of ACM SIGMM.

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