Wearables and Remote Monitoring Case Studies

Developing algorithms derived from wearables data

Case Study

The Challenge

We wanted to explore the use of machine learning to develop new digital biomarkers from raw accelerometer data. In addition to summary outcomes, some accelerometers provide access to raw acceleration measurements captured on each of the three axes. This raw data may contain patterns which can identify and quantify specific motor movements, which may be valuable in the study of movement disorders.

The Solution

As a hypothetical example to evaluate methodological approaches, we used an Actigraph GT3X Link wrist-worn accelerometer to determine the sensitivity and specificity of machine learning techniques to identify periods of toothbrushing – an activity selected because of the fine motor movements involved – in a study of healthy volunteers. Partitioning our data into model training and testing datasets, we used the R statistical programming language to test a number of machine learning algorithms to attempt to detect periods of motor movement corresponding to toothbrushing activity.

The Outcome

We demonstrated that it is possible to use machine learning techniques to train a classification model from summarised raw accelerometer data to identify periods of specific movement patterns. The quantity of data required to build a robust algorithm will depend on the variance in the pattern between individual events and from subject to subject.

The best performing model in our study was a support vector machine model and delivered sensitivity and specificity values of 0.9991 and 0.8889 respectively when applied to the test dataset. This approach has potential application in objectively measuring motor movement events in neuromuscular disorders, but also in the development of unique personal digital fingerprints.

ICON's Value Add

ICON analytics scientists were able to provide scientific expertise to interpret complex data derived from wearable devices. We were able to develop and validate new endpoints derived from wearables data, in particular in the detection of specific motor movement events. This approach may be valuable in trials across a number of therapeutic areas.

For more information, contact:
enquiries@iconplc.com