Detecting Activity Types with Machine Learning Helps Improve the Reliability of Blood Pressure Monitoring

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Thesis work done by Alison B. Tshala, a student of Aalto University, in the field of Biomedical Engineering with the title "Improving Wearable Non-Invasive Blood Pressure Measurement Using Activity Classification" was completed for GE Healthcare. The work aimed to improve the reliability of wearable blood pressure monitoring devices. Blood pressure monitoring has become increasingly important in diagnosing heart related health conditions. The need for continuous blood pressure measurements has been noticed especially in patients recovering from surgery and those admitted to the hospital for blood pressure related issues, as well as outpatients requiring daily continuous monitoring.

However, the problem with wearable monitoring is the ability of the device to tolerate movement during use. Any motion can cause faulty readings which can mislead the person who is using the device. In some cases, the device will not even provide blood pressure readings if the person is moving. Without the device being able to track movement, accounting for activity types in measurements becomes challenging.

Several wearable devices have accelerometers embedded in them. Accelerometers are small sensors which can track movement in three dimensions, in the x-, y- and z-axis. Movement produces characteristic signals in these three axes depending on the type of activity. Different positions and postures can also be identified with the signals produced by the accelerometer. This information was used so that a person’s activity state can be estimated.

Machine Learning was used to estimate the types of activity completed by a person. It was used to solve the task of classifying activities with the provided accelerometer signals. Given the activity type during monitoring, the solution developed during the thesis enabled the device to choose when to start or delay taking a blood pressure measurement. Concrete applications of the solution include helping to smartly automate blood pressure measurements.

Results from the work are promising for automating wearable blood pressure monitoring in a smart way taking into consideration user’s movement. Future applications involve integrating the solution to wearable devices and testing them with more activity types. By using the solution, there is potential to reduce workload for healthcare staff in clinical environments and produce more reliable information for users.

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Two-sentence summary for social media.

Motion tracking with accelerometers can be used to detect activity types using machine learning. The reliability of wearable blood pressure monitoring has been shown to improve with the use of accelerometers by starting measurements during the most suitable activity type.