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Fig1. Digital Personal Trainer App.

DIGITAL PERSONAL TRAINER

REAL-TIME PHYSICAL EXERCISES RECOGNITION ON WEARABLE DEVICES

Context and Overview

The number of created applications and solutions based on wearable devices has increased in the recent years, making users increasingly closer to this technology, integrating it in their lifestyle.

It is from the assumption that the future of mobile technology passes through these devices that this project was developed, with the objective of exploiting the features of a smartwatch to detect and recognize physical exercises.

Possible applications of such a solution are directed to the fitness and health sectors and can be used for physical therapy or personal training.

Gesture Recognition

The created approach makes use of a pattern recognition algorithm called Dynamic Time Warping (DTW) to carry out comparison calculation between the trained and tested data. Through this comparison the output result indicates how far the two time-series are, and with this process it's possible to only detect the exercise when the DTW's output is below a certain threshold distance.

With the right sensor data, DTW for calculation, and a good multi-threading approach, it was possible to create a proof of concept that can recognize multiple gestures.

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The Solution

Fig2. shows the overall operation of the DPT solution. The transition between the training and testing algorithms are automatic, if the user succeeds in the training process.

Project Keywords

- Pattern Recognition
- Dynamic Time Warping
- Android Wear
- Sensor Fusion
- Data Analysis

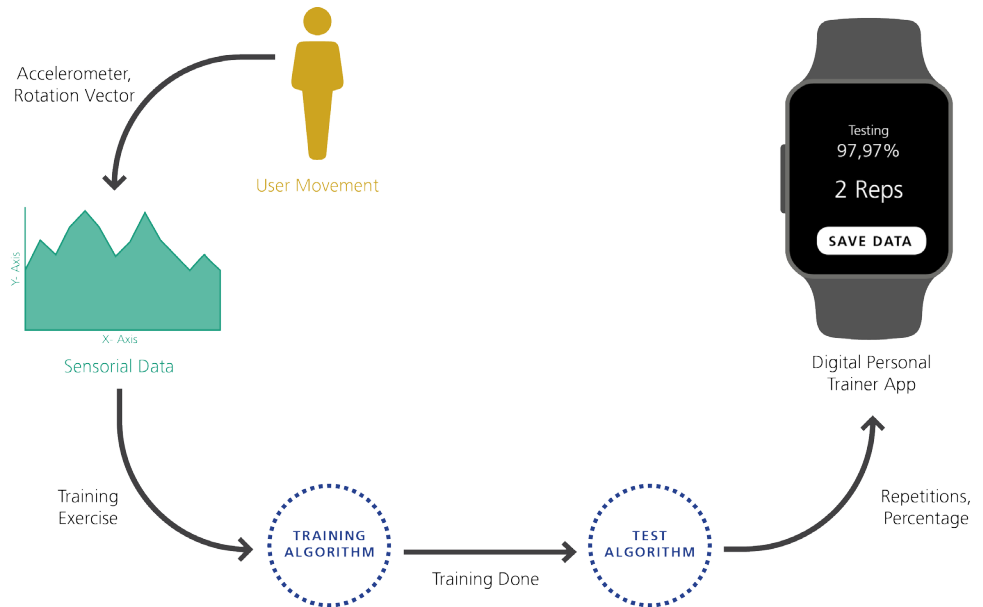


Fig2. Digital Personal Trainer App Operating Structure.

Tests and Results

Several tests were made to the app and the results were satisfactory, although there were some difficulties experienced by the users that are related with the effectiveness of the training algorithm.

It is illustrated in Fig3. an example of data collected from sensors during a test, where the upper curve represents the trained exercise, while the curve below shows the tested exercises. Through the features of an algorithm such as Dynamic Time Warping it is possible to compare values between the two time-series of Fig3., and calculate how far away the trained data are from the tested data.

During testing, the presence of certain limitations of the application that eventually influence the process itself were notorious, although the results were satisfactory. It was also possible to observe some algorithm sensitivity to strange movements throughout the test.

Conclusion

The development of this solution allowed to obtain a great knowledge in different fields of technology and showed that it is possible to create algorithms with a simple approach to solve recent problems.

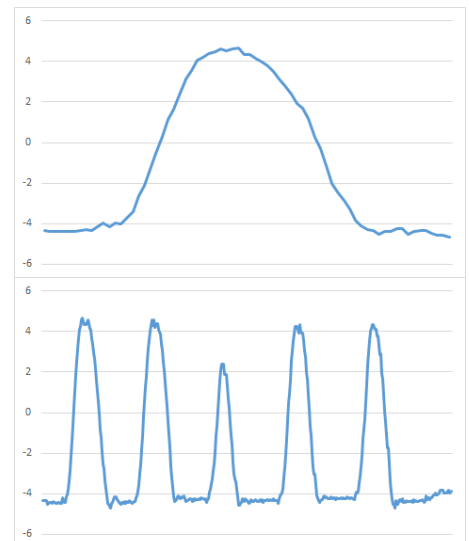


Fig3. Time-Series Comparing for Gesture Recognition.