Accelerometer data classification using Neural Networks

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Abstract

Human activity is a great source for building new kind of services that take the current status of the user into consideration. Equipping a service provided by a phone application with the context of the user results in richer and more engaging services. In this work we present a neural based classifier that is able to detect the status of the human body from readings of accelerometers placed on different parts of the body. We show how different configuration of the neural network and data preprocessing can change the accuracy of our prediction, we also show how we can predict the movement using one accelerometer reading to simulate the effect of having a mobile device in users pocket or a smart watch attached to the user's wrist. To the best of our knowledge this is the first study that considers a single source of data and achieves (676876%) accuracy.

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1 Introduction

With the increasing use of smart mobile devices new opportunities are present for richer and more engaging services that cater to every need of its users. Most of these smart devices are equipped with accelerometers that give an indication of of the relative position of the device and its user at any point in time. Using this data to identify the status of body movement provides an accurate record of the physical activity of the user which has applications related to the health care and interactive design for mobile devices' applications.

In this work we seek to build a neural network based classifier that is able to correctly identify a pattern of human body movement from a series of readings, we discuss different design choices and report their impact on prediction accuracy. The rest of this report goes as follows; section 3 describes the dataset we are using, section 2 provides a simple description of the inner workings of accelerometers for the inexperienced reader, section 4 describes the methodology we used, section 5 discusses a summary of the results we are getting and includes ideas for future work.

2 Accelerometer

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3 Data Set

Raw data we are using are based on the work by [1]. The data set report 8 hours of activity of 4 subject tests of varying age , weight, height and gender. Each subject provided two hours of activity of postures varying between (Standing, sitting down, sitting , standing up and walking). The data provided is a continuous stream of reading from sensors placed of four parts of the body, waist, arm, leg and foot. Figure 1 shows the places of these accelerators [1].

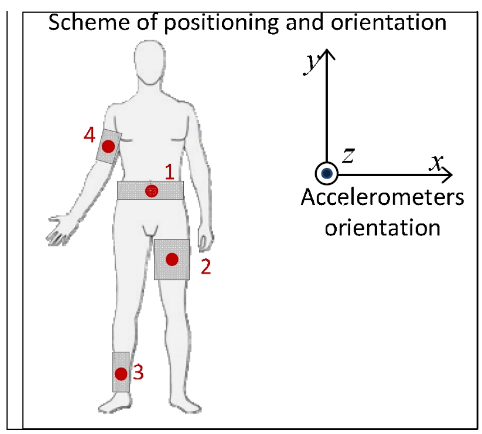

Figure 1: Accelerometer Placement

4 Methodology

Previous work in detecting the body posture [1] used decision tree algorithms , namely C4.5, with intensive data preprocessing and feature extraction before actually using the data for classification; work include finding the roll and pitch angles for the body and also the variance in roll and pitch . In this work we opted for doing as possible of data preprocessing and to let the neural network the feature extraction. We try to train our network with the following variants:

1. Using unprocessed rows and feeding them to the network, section 4.1 discusses that.
2. Using deltas of two consecutive rows or more than two rows, section 4.2 discusses that.
3. A person specific learner where we only do the training for one person for increased accuracy.
4. Use only one accelerometer to detect body posture. This gives a more realistic use case where the user only has one source of data; a smart phone. Section 4.3 discusses that.
5. Using recurrent neural network to classify raw data. Section 4.4 discusses this work.
6. Hello

4.1 Classification using raw rows

4.2 Consecutive Rows

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4.3 Single source of data

4.4 Recurrent neural network

In this section we try to use recurrent Neural networks instead of feed forward networks to build a learner for the continuous data. Wu use Continuous time recurrent Neural networks.

5 Conclusion

6 Future Step for this work

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1. Sameer
2. is
3. the
4. Best

References

[1] Wallace Ugulino, Débora Cardador, Katia Vega, Eduardo Velloso, Ruy Milidiú, and Hugo Fuks. Wearable computing: accelerometers data classification of body postures and movements. In *Advances in Artificial Intelligence-SBIA 2012*, pages 52–61. Springer, 2012.