Human Activity Recognition (HAR)

Jose Ramon Hernandez Galan

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Introduction

This is a report showing the process and results for the creation of a model for human activity recognition (herafter HAR).

This is the capstone project of the Data Science course pursued by the author in HarvardX.

Dataset

The dataset used in this project is the **HAR Dataset for benchmarking** 1

The dataset includes measurements of **inertial sensors** attached to several person while doing normal activities during the day. It also includes data related to the person such as weight, height, etc.

A more detailed description of the dataset can be found **here**

The main goal of this project is to use machine learning techniques in order to predict the human activity. We will compare our results

We will also observe if all 4 sensors are really necessary or if we can use less sensors in order to predict the activity.

Analysis

In this section we will prepare the data to work with and explore some important characteristics of the dataset.

Data wrangling

The created har dataset has the following structure:

```
str(har)
```

```
## 'data.frame':    165633 obs. of  19 variables:
##  $ user              : Factor w/ 4 levels "debora","jose_carlos",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ gender            : Factor w/ 2 levels "Man","Woman": 2 2 2 2 2 2 2 2 2 2 ...
##  $ age               : int  46 46 46 46 46 46 46 46 46 46 ...
##  $ how_tall_in_meters: num  1.62 1.62 1.62 1.62 1.62 1.62 1.62 1.62 1.62 1.62 ...
##  $ weight            : int  75 75 75 75 75 75 75 75 75 75 ...
##  $ body_mass_index   : num  28.6 28.6 28.6 28.6 28.6 28.6 28.6 28.6 28.6 28.6 ...
##  $ x1                : int  -3 -3 -1 -2 -1 -2 1 -1 -1 0 ...
##  $ y1                : int  92 94 97 96 96 95 100 97 98 98 ...
##  $ z1                : int  -63 -64 -61 -57 -61 -62 -62 -63 -63 -61 ...
##  $ x2                : int  -23 -21 -12 -15 -13 -14 -10 -13 -14 -11 ...
##  $ y2                : int  18 18 20 21 20 19 22 20 19 22 ...
##  $ z2                : int  -19 -18 -15 -16 -15 -16 -12 -15 -17 -13 ...
```

```
##  $ x3                : int  5 -14 -13 -13 -13 -13 -13 -12 -13 -13 ...
##  $ y3                : int  104 104 104 104 104 104 104 104 104 104 ...
##  $ z3                : int  -92 -90 -90 -89 -89 -89 -90 -88 -90 -90 ...
##  $ x4                : int  -150 -149 -151 -153 -153 -153 -151 -151 -152 -151 ...
##  $ y4                : int  -103 -104 -104 -103 -104 -104 -104 -104 -103 -104 ...
##  $ z4                : int  49 47 45 43 44 43 44 43 45 45 ...
##  $ class             : Factor w/ 5 levels "sitting","sittingdown",..: 1 1 1 1 1 1 1 1 1 1 ...
```

Name	Type	Description
user	Factor	w/ 4 levels “debora”,“jose_carlos”,..: 1 1 1 1 1 1 1 1 1 1 ...
gender	Factor	w/ 2 levels “Man”,“Woman”: 2 2 2 2 2 2 2 2 2 2 ...
age	int	46 46 46 46 46 46 46 46 46 46 ...
how_tall_in_meters	num	1.62 1.62 1.62 1.62 1.62 1.62 1.62 1.62 1.62 1.62 ...
weight	int	75 75 75 75 75 75 75 75 75 75 ...
body_mass_index	num	28.6 28.6 28.6 28.6 28.6 28.6 28.6 28.6 28.6 28.6 ...
x1	int	-3 -3 -1 -2 -1 -2 1 -1 -1 0 ...
y1	int	92 94 97 96 96 95 100 97 98 98 ...
z1	int	-63 -64 -61 -57 -61 -62 -62 -63 -63 -61 ...
x2	int	-23 -21 -12 -15 -13 -14 -10 -13 -14 -11 ...
y2	int	18 18 20 21 20 19 22 20 19 22 ...
z2	int	-19 -18 -15 -16 -15 -16 -12 -15 -17 -13 ...
x3	int	5 -14 -13 -13 -13 -13 -13 -12 -13 -13 ...
y3	int	104 104 104 104 104 104 104 104 104 104 ...
z3	int	-92 -90 -90 -89 -89 -89 -90 -88 -90 -90 ...
x4	int	-150 -149 -151 -153 -153 -153 -151 -151 -152 -151 ...
y4	int	-103 -104 -104 -103 -104 -104 -104 -104 -103 -104 ...
z4	int	49 47 45 43 44 43 44 43 45 45 ...
class	Factor	w/ 5 levels “sitting”,“sittingdown”,..: 1 1 1 1 1 1 1 1 1 1 ...

Tranining set partitioning

Exploratory Data Analysis

Analysis approach

Model based on Classification Trees

Decission Tress

Random Forest

Rborist

Final Results

Conclusions

References

1. Ugulino, W.; Cardador, D.; Vega, K.; Velloso, E.; Milidiu, R.; Fuks, H. Wearable Computing: Accelerometers’ Data Classification of Body Postures and Movements. Proceedings of 21st Brazilian

Symposium on Artificial Intelligence. Advances in Artificial Intelligence - SBIA 2012. In: Lecture Notes in Computer Science. , pp. 52-61. Curitiba, PR: Springer Berlin / Heidelberg, 2012. ISBN 978-3-642-34458-9. DOI: 10.1007/978-3-642-34459-6_6