Activity Monitor

Yoan Bidart

2/26/2018

Introduction

This project has been made on Health Hackathon in Nice, France (november 2017). Our goal was to create a prototype of an activity monitor for elderly people in retirement home to quantify their activity and detect differences. Our material was a 3D camera with a first layer that gives us the 3 dimension spacial coordinates of different joints in the body.

Data engineering and creation of the prediction model

Getting the data

As we created a prototype our measurements were during 1 min, but for a real life use our timeframe would be 24h to measure sleeping and active time, all day long. We created samples with average activity, high-activity, low-activity, and no-activity.

```
library(jsonlite)
library(caret)
library(dplyr)
```

First we cleaned the Json input, put the measures in a dataframe and compute the standard deviation of the points to quantify our activity.

```
#function to clean the output and compute standard deviation for each sample
clean <- function(x, ...) {
        obs <- NULL
        for (i in 1:length(input$Skeletons)) {
                x <- unlist(input$Skeletons[[i]])
                obs <- rbind(obs, x)
        }
        obs <- obs[,80:ncol(obs)]
        apply(X=obs, MARGIN=2, FUN=sd)
}
#read the files and label them
file <- c("01.json", "02.json", "03.json", "04.json", "05.json", "06.json",
          "07.json", "08.json", "09.json", "10.json")

#slow status
path <- "data/slowCase/"
nfiles <- 10
temp <- data.frame()
for (i in 1:nfiles) {
        inpath <- paste(path, file[i], sep="")
        input <- fromJSON(inpath)
        inputC <- clean(input)
        temp <- rbind.data.frame(temp, inputC)
        names(temp) <- names(inputC)
}
```

```
slowTrain <- temp
slowTrain$status <- rep("slow", 10)

#stop status
path <- "data/motionLessCase/"
nfiles <- 6
temp <- data.frame()
for (i in 1:nfiles) {
        inpath <- paste(path, file[i], sep="")
        input <- fromJSON(inpath)
        inputC <- clean(input)
        temp <- rbind.data.frame(temp, inputC)
        names(temp) <- names(inputC)
}
stopTrain <- temp
stopTrain$status <- rep("stop", 6)

#fast status
path <- "data/fastCase/"
nfiles <- 10
temp <- data.frame()
for (i in 1:nfiles) {
        inpath <- paste(path, file[i], sep="")
        input <- fromJSON(inpath)
        inputC <- clean(input)
        temp <- rbind.data.frame(temp, inputC)
        names(temp) <- names(inputC)
}
fastTrain <- temp
fastTrain$status <- rep("fast", 10)

#average status
path <- "data/normalCase/"
nfiles <- 10
temp <- data.frame()
for (i in 1:nfiles) {
        inpath <- paste(path, file[i], sep="")
        input <- fromJSON(inpath)
        inputC <- clean(input)
        temp <- rbind.data.frame(temp, inputC)
        names(temp) <- names(inputC)
}
normalTrain <- temp
normalTrain$status <- rep("average", 10)

#bind the dataframes together
allTrain <- rbind(stopTrain, slowTrain, normalTrain, fastTrain)
```

Feature engineering

We got rid of the near zero variance features.

```
zeroVar <- nearZeroVar(allTrain)
allTrain <- select(allTrain, -zeroVar)
```

Fitting model

As we had few observations, we created a random forest model. For choosing the best model, I think it could be interesting to pick up real life data and then build a better model.

```
fit1 <- train(status~., data=allTrain, method="rf")
```

Real time prediction

We integrated the following R script in the backend, for this project our backend dev used Node.js.

```
#clean input
input2 <- unlist(input)
input2 <- fromJSON(input2)
obs <- NULL
for (i in 1:length(input2$Skeletons)) {
        x <- unlist(input2$Skeletons[[i]])
        obs <- rbind(obs, x)
}
obs <- obs[,80:ncol(obs)]
#compute standard deviation
data <- apply(X=obs, MARGIN=2, FUN=sd)
#remove zero variation features
data <- select(data, -zeroVar)
#predict
predict(fit, data)
```

Thinking forward

This project can be very useful for elderly people. I think the best way to make it work is to train the model with the data from one people for a few days, and then alert the nurses and doctors if we detect a change in the behaviour. This could be linked with depression or being sick (less movement), and becoming hyperactive could be a sign of dementia or other mental disease.