Report 5

Samuel Spillane

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Introduction

I ran my naive Bayes algorithm on the new larger dataset. This performed the worst yet, with less than 10% accuracy. I am assuming this is because the numbers for similar classes are not identical. A symptom of this is that, as more information is being added, it is becoming less accurate. This contradicts the central concept of Bayes' theorem, which is that as information is introduced more accurate probabilistic estimations can be made. I believe that a new method is called for; one that uses correlation to perform classification rather than raw class differences. I am going to import TensorFlow into R and make a basic DNN. I believe this will improve my results drastically with some tinkering.

While my code has not changed, I thought it would be wise to show my algorithm running with the new dataset.

```
#Load packages
library(ggplot2)
library(caret)
```

```
## Loading required package: lattice
```

```
library(rpart)
```

```
## Warning: package 'rpart' was built under R version 3.5.3
```

```
library(e1071)
library(psych)
```

```
## Warning: package 'psych' was built under R version 3.5.3
```

```
##
## Attaching package: 'psych'
```

```
## The following objects are masked from 'package:ggplot2':
##
##     %+%, alpha
```

```
#Read data
poses<- read.csv("data.csv")

#For understanding the structure of the data.
str(poses)
```

```
## 'data.frame':    51191 obs. of  18 variables:
##  $ Name  : Factor w/ 71 levels "breast_L","breast_R",..: 52 35 57 4 10 67 6 59 56 3 ...
##  $ HeadX : num  -2.98e-09 -2.02e-06 -1.17e-01 0.00 0.00 ...
##  $ HeadY : num  0.000668 -0.316516 -0.073046 0 0 ...
##  $ HeadZ : num  0.04703 -0.76012 -0.00943 0 0 ...
##  $ TailX : num  -1.34e-09 -2.42e-06 -1.51e-01 2.35e-02 -5.06e-03 ...
##  $ TailY : num  -0.2138 -0.3589 -0.4836 0.3885 0.0732 ...
##  $ TailZ : num  0.0134 -0.9053 -0.0379 -0.0238 0.1315 ...
##  $ TranX : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ TranY : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ TranZ : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ RotW  : num  1 1 1 1 1 1 1 1 1 1 ...
##  $ RotX  : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ RotY  : num  0 0 0 0 0 0 0 0 0 0 ...
##  $ RotZ  : num  0 0 0 0 0 0 0 0 0 0 ...
```

```
##  $ ScaleX: num  1 1 1 1 1 1 1 1 1 1 ...
##  $ ScaleY: num  1 1 1 1 1 1 1 1 1 1 ...
##  $ ScaleZ: num  1 1 1 1 1 1 1 1 1 1 ...
##  $ Pose  : Factor w/ 4 levels "run","sit","tpose",..: 3 3 3 3 3 3 3 3 3 3 ...
```

```
#For understanding the distributions of the data
describe(poses)
```

```
##        vars     n  mean    sd median trimmed   mad   min   max range  skew
## Name*     1 51191 36.00 20.49  36.00   36.00 26.69  1.00 71.00 70.00  0.00
## HeadX     2 51191  0.00  0.03   0.00    0.00  0.00 -0.12  0.12  0.23  0.00
## HeadY     3 51191 -0.05  0.11   0.00   -0.02  0.00 -0.41  0.08  0.49 -2.28
## HeadZ     4 51191 -0.01  0.09   0.00    0.00  0.00 -0.76  0.05  0.81 -8.07
## TailX     5 51191  0.00  0.04   0.00    0.00  0.00 -0.15  0.15  0.30  0.00
## TailY     6 51191  0.01  0.15   0.03    0.02  0.02 -0.48  0.39  0.87 -0.80
## TailZ     7 51191 -0.01  0.12   0.00    0.00  0.01 -0.91  0.17  1.08 -6.45
## TranX     8 51191  0.00  0.00   0.00    0.00  0.00  0.00  0.00  0.00   NaN
## TranY     9 51191  0.00  0.00   0.00    0.00  0.00  0.00  0.00  0.00   NaN
## TranZ    10 51191  0.00  0.00   0.00    0.00  0.00  0.00  0.00  0.00   NaN
## RotW     11 51191  0.97  0.11   1.00    1.00  0.00  0.48  1.00  0.52 -3.65
## RotX     12 51191 -0.02  0.17   0.00    0.00  0.00 -0.82  0.64  1.46 -1.18
## RotY     13 51191 -0.02  0.13   0.00    0.00  0.00 -0.71  0.72  1.43 -2.39
## RotZ     14 51191  0.00  0.07   0.00    0.00  0.00 -0.47  0.32  0.79 -1.29
## ScaleX   15 51191  1.00  0.00   1.00    1.00  0.00  1.00  1.00  0.00   NaN
## ScaleY   16 51191  1.00  0.00   1.00    1.00  0.00  1.00  1.00  0.00   NaN
## ScaleZ   17 51191  1.00  0.00   1.00    1.00  0.00  1.00  1.00  0.00   NaN
## Pose*    18 51191  2.33  1.25   2.00    2.29  1.48  1.00  4.00  3.00  0.38
##        kurtosis   se
## Name*     -1.20 0.09
## HeadX     13.45 0.00
## HeadY      3.87 0.00
## HeadZ     64.18 0.00
## TailX      6.44 0.00
## TailY      3.08 0.00
## TailZ     48.57 0.00
## TranX       NaN 0.00
## TranY       NaN 0.00
## TranZ       NaN 0.00
## RotW      12.31 0.00
## RotX       9.77 0.00
## RotY      18.22 0.00
## RotZ      16.41 0.00
## ScaleX      NaN 0.00
## ScaleY      NaN 0.00
## ScaleZ      NaN 0.00
## Pose*     -1.50 0.01
```

```
#Set seed so that data can be easily reproduced
set.seed(762)

#Split data and format it for model, may subset data based on bone name later depending on results
splitIndex = createDataPartition(y = poses$Pose,p = 0.75,list = FALSE)
train = poses[splitIndex,]
test = poses[-splitIndex,]
```

```r
#Train naive-bayes
model = naiveBayes(Pose~., data=train)
print(model)
```

```
##
## Naive Bayes Classifier for Discrete Predictors
##
## Call:
## naiveBayes.default(x = X, y = Y, laplace = laplace)
##
## A-priori probabilities:
## Y
##        run        sit      tpose       walk
## 0.33286451 0.33286451 0.00140647 0.33286451
##
## Conditional probabilities:
##        Name
## Y         breast_L   breast_R     calf_L     calf_R calf_twist_L
##   run   0.01455399 0.01392801 0.01510172 0.01384977   0.01384977
##   sit   0.01361502 0.01275430 0.01416275 0.01486698   0.01408451
##   tpose 0.00000000 0.01851852 0.01851852 0.01851852   0.00000000
##   walk  0.01447574 0.01384977 0.01439750 0.01424100   0.01400626
##        Name
## Y       calf_twist_R clavicle_L clavicle_R     foot_L     foot_R
##   run     0.01361502 0.01486698 0.01384977 0.01424100 0.01408451
##   sit     0.01345853 0.01416275 0.01424100 0.01369327 0.01471049
##   tpose   0.01851852 0.01851852 0.01851852 0.01851852 0.01851852
##   walk    0.01439750 0.01463224 0.01439750 0.01345853 0.01439750
##        Name
## Y           hand_L     hand_R       head  index00_L  index00_R  index01_L
##   run   0.01384977 0.01392801 0.01384977 0.01338028 0.01361502 0.01353678
##   sit   0.01400626 0.01439750 0.01416275 0.01384977 0.01377152 0.01463224
##   tpose 0.01851852 0.01851852 0.01851852 0.01851852 0.01851852 0.01851852
##   walk  0.01455399 0.01408451 0.01306729 0.01400626 0.01424100 0.01369327
##        Name
## Y        index01_R  index02_L  index02_R  index03_L  index03_R lowerarm_L
##   run   0.01330203 0.01392801 0.01338028 0.01424100 0.01369327 0.01447574
##   sit   0.01408451 0.01463224 0.01455399 0.01345853 0.01353678 0.01369327
##   tpose 0.00000000 0.01851852 0.01851852 0.01851852 0.01851852 0.00000000
##   walk  0.01439750 0.01353678 0.01392801 0.01455399 0.01455399 0.01345853
##        Name
## Y       lowerarm_R lowerarm_twist_L lowerarm_twist_R middle00_L middle00_R
##   run   0.01369327       0.01392801       0.01353678 0.01439750 0.01306729
##   sit   0.01306729       0.01400626       0.01416275 0.01447574 0.01471049
##   tpose 0.00000000       0.01851852       0.01851852 0.01851852 0.00000000
##   walk  0.01400626       0.01377152       0.01314554 0.01400626 0.01353678
##        Name
## Y       middle01_L middle01_R middle02_L middle02_R middle03_L middle03_R
##   run   0.01330203 0.01541471 0.01314554 0.01463224 0.01384977 0.01478873
##   sit   0.01455399 0.01439750 0.01322379 0.01431925 0.01377152 0.01377152
##   tpose 0.01851852 0.01851852 0.01851852 0.00000000 0.01851852 0.01851852
##   walk  0.01353678 0.01377152 0.01377152 0.01424100 0.01447574 0.01424100
##        Name
## Y             neck     pelvis  pinky00_L  pinky00_R  pinky01_L  pinky01_R
```

```
##   run   0.01400626 0.01471049 0.01517997 0.01384977 0.01322379 0.01471049
##   sit   0.01439750 0.01424100 0.01439750 0.01416275 0.01424100 0.01416275
##   tpose 0.01851852 0.00000000 0.01851852 0.01851852 0.01851852 0.01851852
##   walk  0.01463224 0.01377152 0.01471049 0.01447574 0.01416275 0.01384977
##         Name
## Y        pinky02_L  pinky02_R  pinky03_L  pinky03_R   ring00_L   ring00_R
##   run   0.01400626 0.01502347 0.01377152 0.01369327 0.01447574 0.01361502
##   sit   0.01392801 0.01369327 0.01533646 0.01494523 0.01455399 0.01486698
##   tpose 0.01851852 0.00000000 0.01851852 0.01851852 0.01851852 0.01851852
##   walk  0.01361502 0.01431925 0.01431925 0.01424100 0.01392801 0.01471049
##         Name
## Y          ring01_L   ring01_R   ring02_L   ring02_R   ring03_L   ring03_R
##   run   0.01330203 0.01494523 0.01486698 0.01455399 0.01424100 0.01439750
##   sit   0.01447574 0.01408451 0.01298905 0.01377152 0.01416275 0.01345853
##   tpose 0.01851852 0.01851852 0.00000000 0.01851852 0.01851852 0.00000000
##   walk  0.01424100 0.01439750 0.01377152 0.01416275 0.01431925 0.01471049
##         Name
## Y              root    spine01    spine02    spine03    thigh_L    thigh_R
##   run   0.01361502 0.01541471 0.01306729 0.01345853 0.01377152 0.01416275
##   sit   0.01525822 0.01478873 0.01377152 0.01384977 0.01392801 0.01416275
##   tpose 0.01851852 0.01851852 0.01851852 0.01851852 0.01851852 0.00000000
##   walk  0.01392801 0.01322379 0.01353678 0.01267606 0.01424100 0.01377152
##         Name
## Y       thigh_twist_L thigh_twist_R  thumb01_L  thumb01_R  thumb02_L
##   run      0.01416275    0.01431925 0.01502347 0.01431925 0.01424100
##   sit      0.01400626    0.01416275 0.01377152 0.01298905 0.01424100
##   tpose    0.00000000    0.01851852 0.01851852 0.00000000 0.01851852
##   walk     0.01424100    0.01455399 0.01447574 0.01408451 0.01431925
##         Name
## Y        thumb02_R  thumb03_L  thumb03_R     toes_L     toes_R upperarm_L
##   run   0.01439750 0.01400626 0.01377152 0.01384977 0.01471049 0.01283255
##   sit   0.01416275 0.01369327 0.01416275 0.01283255 0.01369327 0.01345853
##   tpose 0.00000000 0.01851852 0.01851852 0.01851852 0.00000000 0.00000000
##   walk  0.01478873 0.01439750 0.01494523 0.01377152 0.01416275 0.01447574
##         Name
## Y       upperarm_R upperarm_twist_L upperarm_twist_R
##   run   0.01533646       0.01392801       0.01416275
##   sit   0.01478873       0.01455399       0.01486698
##   tpose 0.01851852       0.01851852       0.01851852
##   walk  0.01345853       0.01408451       0.01369327
##
##         HeadX
## Y               [,1]       [,2]
##   run   5.791823e-05 0.02504214
##   sit   2.743453e-05 0.02480224
##   tpose 3.151381e-04 0.02139516
##   walk  1.087529e-04 0.02505712
##
##         HeadY
## Y              [,1]      [,2]
##   run   -0.04558550 0.1128854
##   sit   -0.04568990 0.1130472
##   tpose -0.03598047 0.1018562
##   walk  -0.04550344 0.1131359
```

```
##
##        HeadZ
## Y               [,1]       [,2]
##   run   -0.008030090 0.09249485
##   sit   -0.007686243 0.09104746
##   tpose  0.003436650 0.01069133
##   walk  -0.007279753 0.08958561
##
##        TailX
## Y                [,1]       [,2]
##   run   -5.364987e-05 0.04303257
##   sit   -7.603013e-05 0.04266869
##   tpose -1.694354e-03 0.04077834
##   walk   2.505953e-04 0.04308308
##
##        TailY
## Y             [,1]      [,2]
##   run   0.01292838 0.1482993
##   sit   0.01275585 0.1483114
##   tpose 0.02323160 0.1305610
##   walk  0.01256877 0.1476535
##
##        TailZ
## Y               [,1]       [,2]
##   run   -0.006066988 0.11801524
##   sit   -0.006262400 0.11609102
##   tpose  0.005185222 0.04098023
##   walk  -0.005335937 0.11468497
##
##        TranX
## Y       [,1] [,2]
##   run      0    0
##   sit      0    0
##   tpose    0    0
##   walk     0    0
##
##        TranY
## Y       [,1] [,2]
##   run      0    0
##   sit      0    0
##   tpose    0    0
##   walk     0    0
##
##        TranZ
## Y       [,1] [,2]
##   run      0    0
##   sit      0    0
##   tpose    0    0
##   walk     0    0
##
##        RotW
## Y            [,1]       [,2]
##   run   0.9141525 0.17361657
##   sit   0.9868247 0.04865496
```

```
##   tpose 1.0000000 0.00000000
##   walk  0.9963635 0.01784547
##
##        RotX
## Y                [,1]      [,2]
##   run   -0.0783975999 0.2548639
##   sit    0.0288080321 0.1345602
##   tpose  0.0000000000 0.0000000
##   walk   0.0004733706 0.0444327
##
##        RotY
## Y                [,1]       [,2]
##   run   -0.0578994935 0.22169881
##   sit   -0.0001876068 0.04047751
##   tpose  0.0000000000 0.00000000
##   walk   0.0041489843 0.02889318
##
##        RotZ
## Y                [,1]       [,2]
##   run   -0.0117610659 0.10223437
##   sit    0.0003303912 0.05689327
##   tpose  0.0000000000 0.00000000
##   walk  -0.0001555123 0.05251775
##
##        ScaleX
## Y       [,1] [,2]
##   run      1    0
##   sit      1    0
##   tpose    1    0
##   walk     1    0
##
##        ScaleY
## Y       [,1] [,2]
##   run      1    0
##   sit      1    0
##   tpose    1    0
##   walk     1    0
##
##        ScaleZ
## Y       [,1] [,2]
##   run      1    0
##   sit      1    0
##   tpose    1    0
##   walk     1    0
```

```
trainPred=predict(model, newdata = train, type = "class")
trainTable=table(train$Pose, trainPred)
testPred=predict(model, newdata=test, type="class")
testTable=table(test$Pose, testPred)

#Get accuracy
trainAcc=(trainTable[1,1]+trainTable[2,2]+trainTable[3,3])/sum(trainTable)
testAcc=(testTable[1,1]+testTable[2,2]+testTable[3,3])/sum(testTable)
#Contingency Table
```

```r
print(trainTable)
```

```
##        trainPred
##           run   sit tpose  walk
##   run    3583   534  8111   552
##   sit    1062     0 10828   890
##   tpose     0     0    53     1
##   walk    357   358 11161   904
```

```r
print(testTable)
```

```
##        testPred
##          run  sit tpose walk
##   run   1217  186  2689  168
##   sit    378    0  3572  310
##   tpose    0    0    15    2
##   walk   123  122  3719  296
```

```r
#Print Accuracy
print(round(cbind(trainAccuracy=trainAcc, testAccuracy=testAcc),3))
```

```
##      trainAccuracy testAccuracy
## [1,]         0.095        0.096
```