

CS 6762
SP, ML, FC
Smart Watch Programming Assignment 1

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We detected Hand Washing activities using accelerometer data collected from a smart watch. We wanted to differentiate between hand washing and other activities using machine learning.

Data Collection

- Hand Washing Data: Collected accelerometer data for 20 hand washing instances.
- Non-Hand Washing Data: Collected 10 minutes of various other activities

Preprocessing and Feature Extraction

- Data Extraction: Used wada.jar to extract accelerometer data and convert it to CSV files.
- Segmentation: Divided the data into 1-second windows.
- Features Computed: For each window, calculated the mean and standard deviation for X, Y, and Z axes
- Labeling: Each window was labeled as either hand_wash or no_hand_wash.
- Feature File: Placed all features into features.csv.

Classification

Classifier: J48 Decision Tree (weka.classifiers.trees.J48) with default parameters.

Classifier Model (Decision Tree)

=== Run information ===

Scheme: weka.classifiers.trees.J48 -C 0.25 -M 2

Relation: wada

Instances: 933

Attributes: 7

Mean_X

Std_X

Mean_Y

Std_Y

Mean_Z

Std_Z

Activity

Test mode: 10-fold cross-validation

=== Classifier model (full training set) ===

The decision tree generated by the classifier:

J48 pruned tree

Std_X <= 0.130164

| Mean_X <= -1.19669

| | Mean_Y <= -5.441734: no_hand_wash (2.0)

| | Mean_Y > -5.441734: hand_wash (12.0)

| Mean_X > -1.19669: no_hand_wash (63.0/2.0)

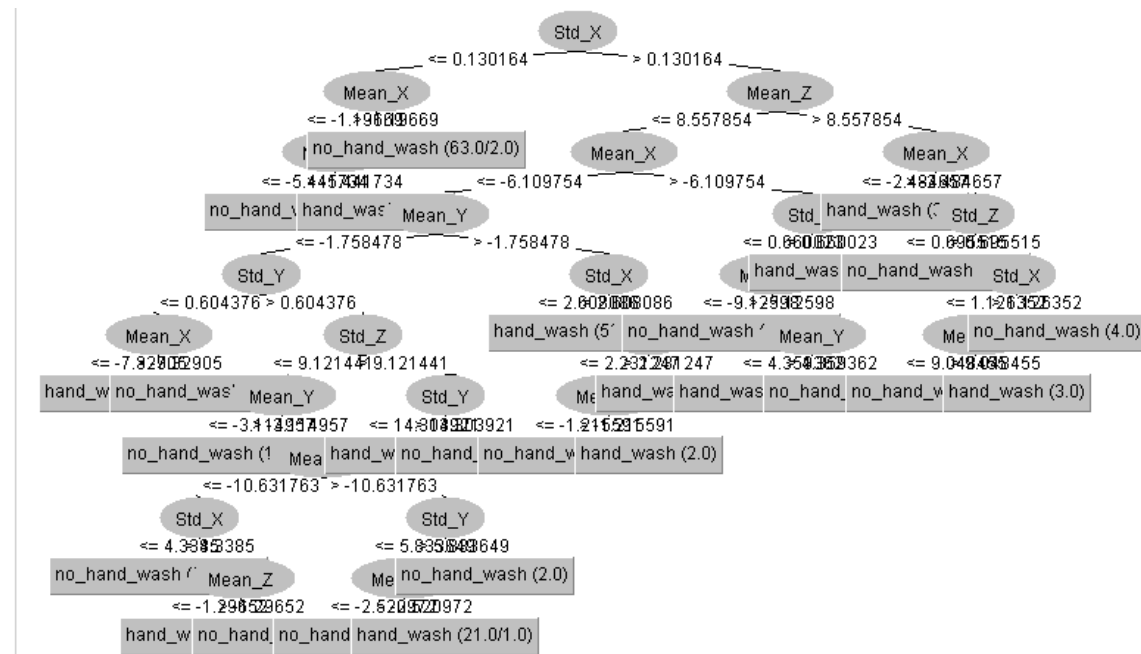
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Std_X > 0.130164
| Mean_Z <= 8.557854
| | Mean_X <= -6.109754
| | | Mean_Y <= -1.758478
| | | | Std_Y <= 0.604376
| | | | | Mean_X <= -7.32905: hand_wash (17.0)
| | | | | Mean_X > -7.32905: no_hand_wash (2.0)
| | | | Std_Y > 0.604376
| | | | | Std_Z <= 9.121441
| | | | | | Mean_Y <= -3.114957: no_hand_wash (115.0/29.0)
| | | | | | Mean_Y > -3.114957
| | | | | | | Mean_X <= -10.631763
| | | | | | | Std_X <= 4.3385: no_hand_wash (25.0/1.0)
| | | | | | | Std_X > 4.3385
| | | | | | | | Mean_Z <= -1.29652: hand_wash (14.0)
| | | | | | | | Mean_Z > -1.29652: no_hand_wash (2.0)
| | | | | | | | Mean_X > -10.631763
| | | | | | | | Std_Y <= 5.833649
| | | | | | | | Mean_Z <= -2.520972: no_hand_wash (2.0)
| | | | | | | | Mean_Z > -2.520972: hand_wash (21.0/1.0)
| | | | | | | | Std_Y > 5.833649: no_hand_wash (2.0)
| | | | | Std_Z > 9.121441
| | | | | | Std_Y <= 14.303921: hand_wash (16.0)
| | | | | | Std_Y > 14.303921: no_hand_wash (2.0)
| | | Mean_Y > -1.758478
| | | | Std_X <= 2.608086: hand_wash (50.0)
| | | | Std_X > 2.608086
| | | | | Std_Z <= 2.231247
| | | | | | Mean_Y <= -1.215591: no_hand_wash (5.0)
| | | | | | Mean_Y > -1.215591: hand_wash (2.0)
| | | | | | Std_Z > 2.231247: hand_wash (46.0/3.0)
| | Mean_X > -6.109754
| | | Std_Y <= 0.660023
| | | | Mean_Y <= -9.12598: no_hand_wash (14.0/1.0)
| | | | Mean_Y > -9.12598
| | | | | Mean_Y <= 4.359362: hand_wash (33.0/10.0)
| | | | | Mean_Y > 4.359362: no_hand_wash (4.0)
| | | Std_Y > 0.660023: hand_wash (450.0/63.0)
| Mean_Z > 8.557854
| | Mean_X <= -2.484657: hand_wash (3.0)
| | Mean_X > -2.484657
| | | Std_Z <= 0.695515: no_hand_wash (22.0)
| | | Std_Z > 0.695515
| | | | Std_X <= 1.126352
| | | | | Mean_Z <= 9.048455: no_hand_wash (2.0)
| | | | | Mean_Z > 9.048455: hand_wash (3.0)
| | | | Std_X > 1.126352: no_hand_wash (4.0)

```

Number of Leaves : 27
 Size of the tree : 53
 Time taken to build model: 0.1 seconds

Decision tree visualization



=== Stratified cross-validation ===

=== Summary ===

Classification Accuracy:

| | | |
|----------------------------------|-----------|-----------|
| Correctly Classified Instances | 749 | 80.2787 % |
| Incorrectly Classified Instances | 184 | 19.7213 % |
| Kappa statistic | 0.5437 | |
| Mean absolute error | 0.2384 | |
| Root mean squared error | 0.3994 | |
| Relative absolute error | 53.7126 % | |
| Root relative squared error | 84.7879 % | |
| Total Number of Instances | 933 | |

=== Detailed Accuracy By Class ===

| | TP Rate | FP Rate | Precision | Recall | F-Measure | MCC | ROC Area | PRC Area | Class |
|---------------|---------|---------|-----------|--------|-----------|-------|----------|----------|--------------|
| | 0.878 | 0.348 | 0.835 | 0.878 | 0.856 | 0.545 | 0.811 | 0.852 | hand_wash |
| | 0.652 | 0.122 | 0.727 | 0.652 | 0.687 | 0.545 | 0.811 | 0.688 | no_hand_wash |
| Weighted Avg. | 0.803 | 0.273 | 0.799 | 0.803 | 0.800 | 0.545 | 0.811 | 0.798 | |

Confusion Matrix:

=== Confusion Matrix ===

a b <-- classified as

547 76 | a = hand_wash

108 202 | b = no_hand_wash