Activity Recognition

KTH WASP AS 1 Group 2

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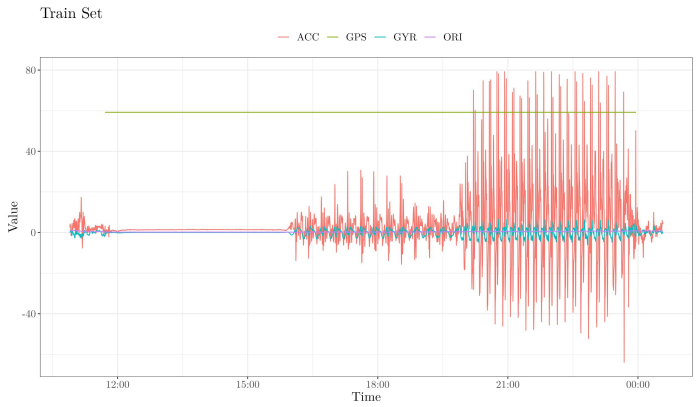
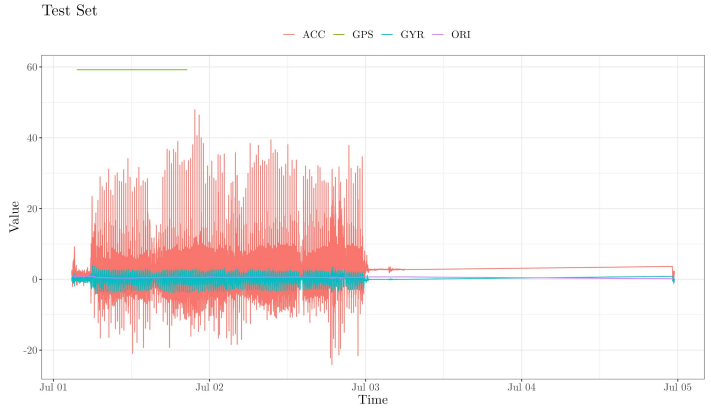
https://github.com/cesarsotovalero/wasp-act-recognition

Data Collection

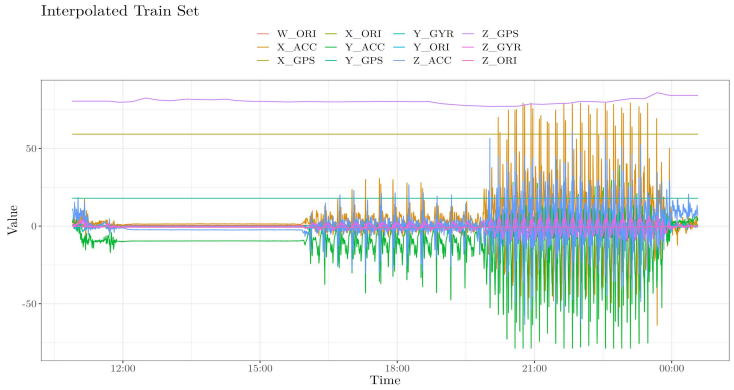
- Data was collected with the Sensor Fusion app
- Four variables were measured: ACC, GPS, GYR, and ORI
- Two rounds of measurement were made:
  - One round to collect the **Train Set**, and other round for the **Test Set**.

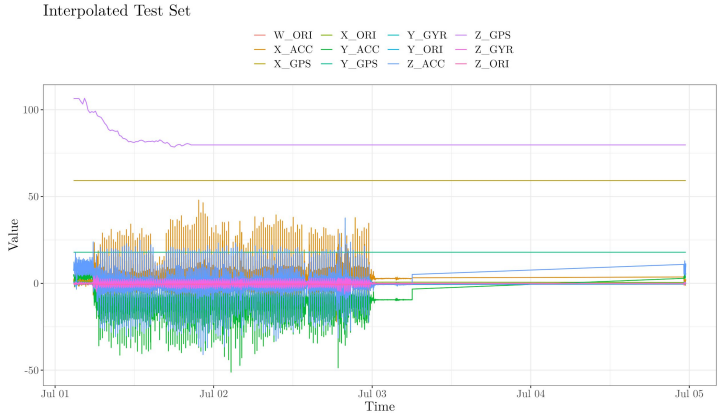




Data Preprocessing

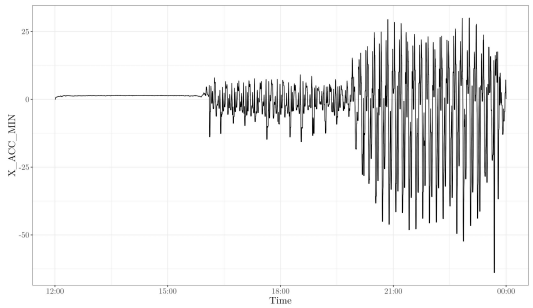
- We reshaped the dataset to obtain the measurements of each variable for each of the three dimensions: X, Y, Z
- Missing values were filled via quadratic interpolation

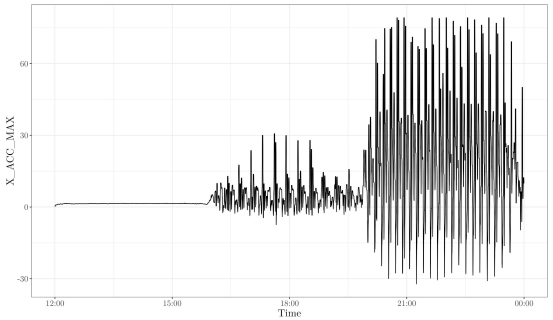


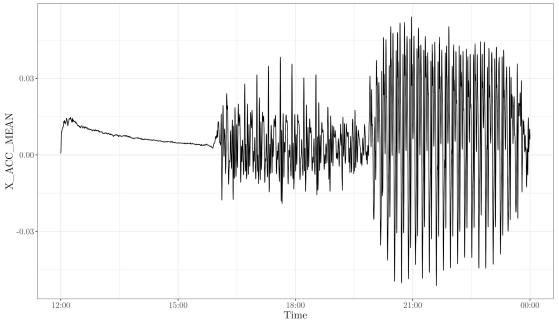


Data Preprocessing

- We created three additional features for each variable
  - <variable>_MIN
  - <variable>_MAX
  - <variable>_MEAN

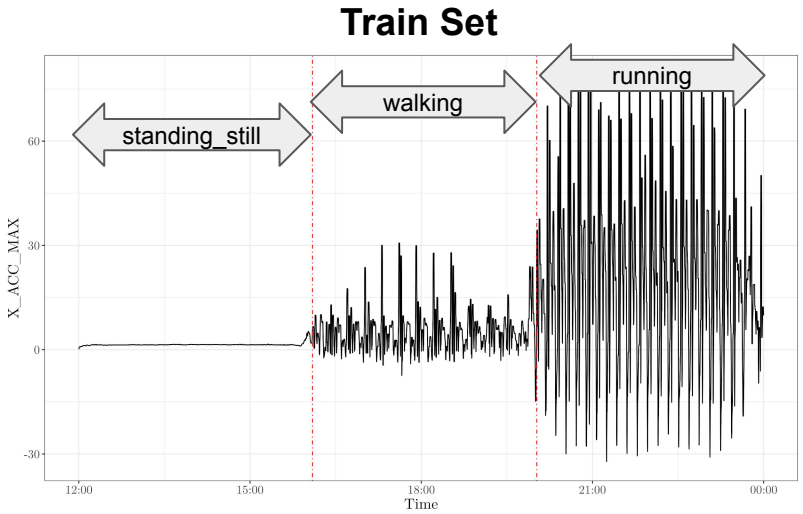


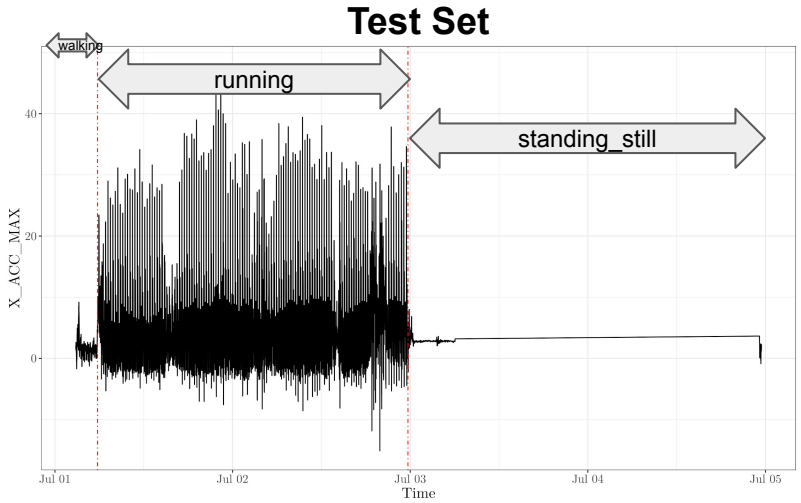




Data Labelling

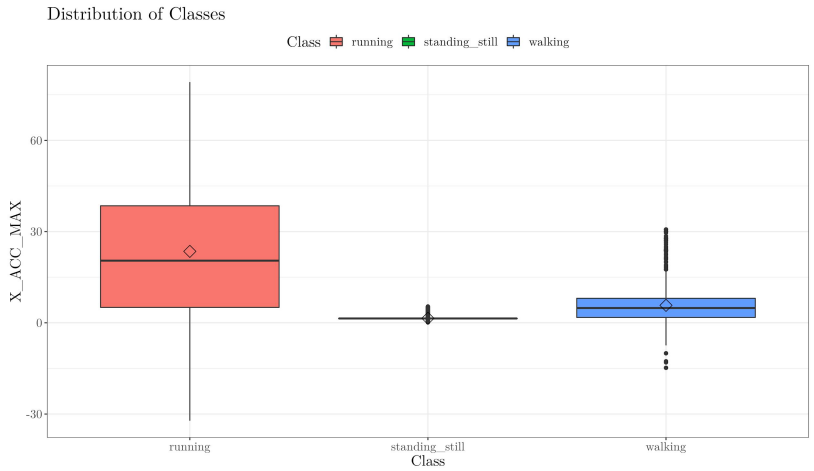
- We manually labelled the train and test datasets

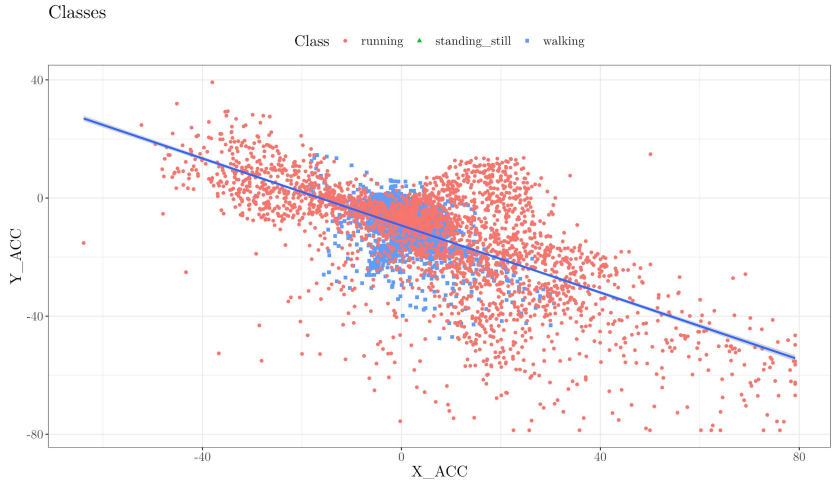




Data Labelling

- We plot the projection of the classes to get insights about the distribution of the data and the best classifier to use





Classification

- We use the XGBoost classifier as our machine learning model for the activity recognition decision task

```
667  # Define the main parameters
668  Class ← as.factor(data$Class)
669  num_class ← length(levels(Class))
670  params ← list(
671    booster = "gbtree",
672    eta = 0.001,
673    max_depth = 5,
674    gamma = 3,
675    subsample = 0.75,
676    colsample_bytree = 1,
677    objective = "multi:softprob",
678    eval_metric = "mlogloss",
679    num_class = num_class
680  )
```

```
682  # Train the model: train the XGBoost classifer
683  xgb.fit ← xgb.train(
684    params = params,
685    data = xgb.train,
686    nrounds = 1000,
687    nthreads = 1,
688    early_stopping_rounds = 10,
689    watchlist = list(val1 = xgb.train, val2 = xgb.test),
690    verbose = 0
691  )
```

Classification

- We obtained a high accuracy of 99.91% on the Test Set

```
696 # Predict the test set
697 xgb.pred = predict(xgb.fit, test.data, reshape = T)
698 xgb.pred = as.data.frame(xgb.pred)
699 colnames(xgb.pred) = levels(Class)
700
701 # Use the predicted label with the highest probability
702 xgb.pred$prediction = apply(xgb.pred,1,function(x) colnames(xgb.pred)[which.max(x)])
703 xgb.pred$label = levels(Class)[test.label+1]
704
705 # Calculate the final accuracy
706 result = sum(xgb.pred$prediction==xgb.pred$label)/nrow(xgb.pred)
707 print(paste("Final Accuracy =",sprintf("%1.2f%%", 100*result)))
708 ```

[1] "Final Accuracy = 99.91%"
```

Deliveries

- Code: https://github.com/cesarsotovalero/wasp-act-recognition/tree/master/Notebooks
- Data: https://github.com/cesarsotovalero/wasp-act-recognition/tree/master/Data
- Figures: https://github.com/cesarsotovalero/wasp-act-recognition/tree/master/Figures
- README: https://github.com/cesarsotovalero/wasp-act-recognition/blob/master/README.md