Physical Activity Classified by Tri-Axial Accelerometer

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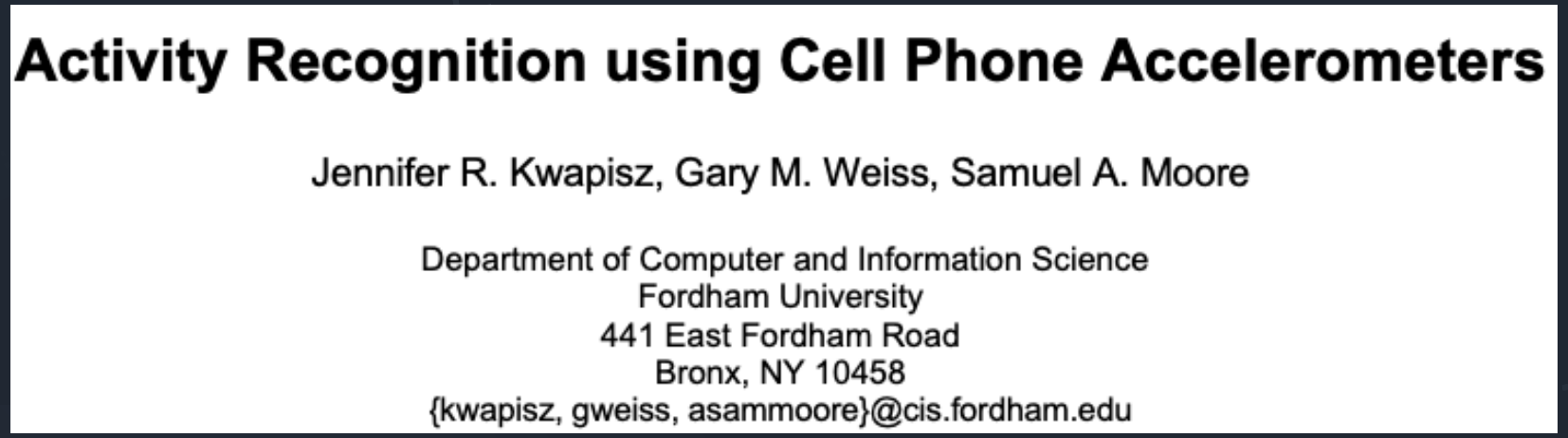
https://github.com/dbarnes16/DATA1030-Final.git

Introduction
Dataset

- Kaggle dataset: Activity-Detection-IMU-Sensor
- Wireless Sensor Data Mining (WISDM) Lab
  - Fordham University
- 29 volunteer subjects



Activity Recognition using Cell Phone Accelerometers

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Kwapisz, J. R., Weiss, G. M., & Moore, S. A. (2011). Activity recognition using cell phone accelerometers. *ACM SigKDD Explorations Newsletter*, *12*(2), 74-82.

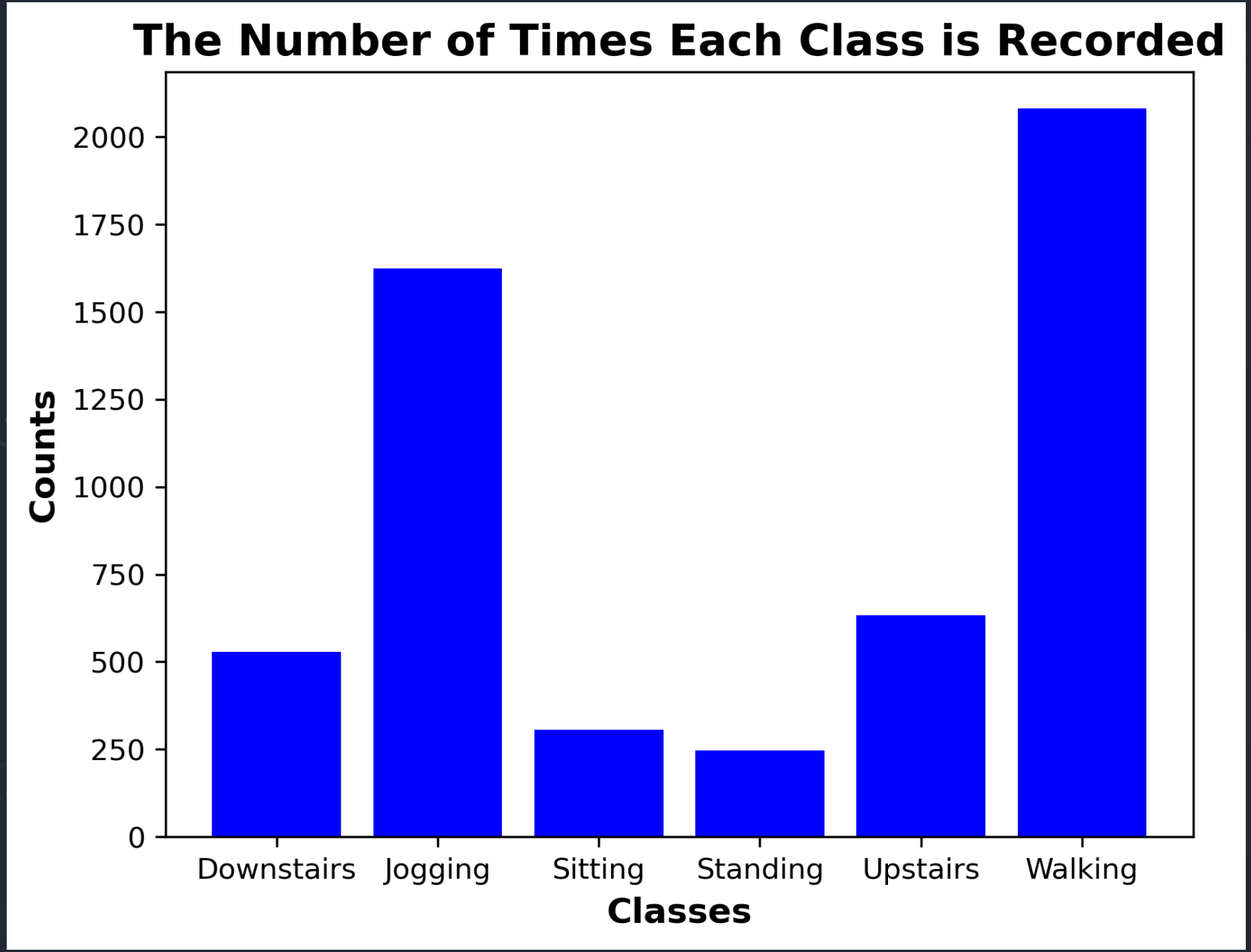
Recap

Goal

- **Classify** the user's motion by the phone-based accelerometers

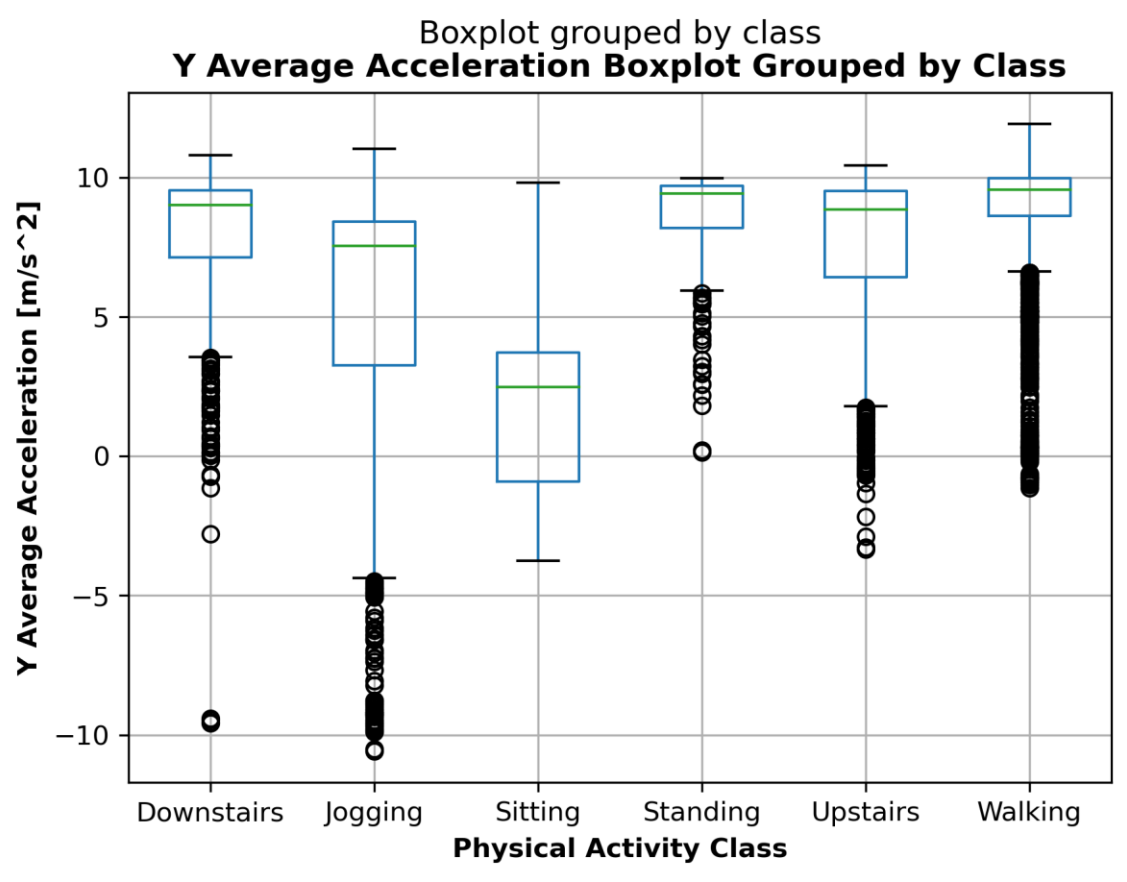
Exploratory Data Analysis

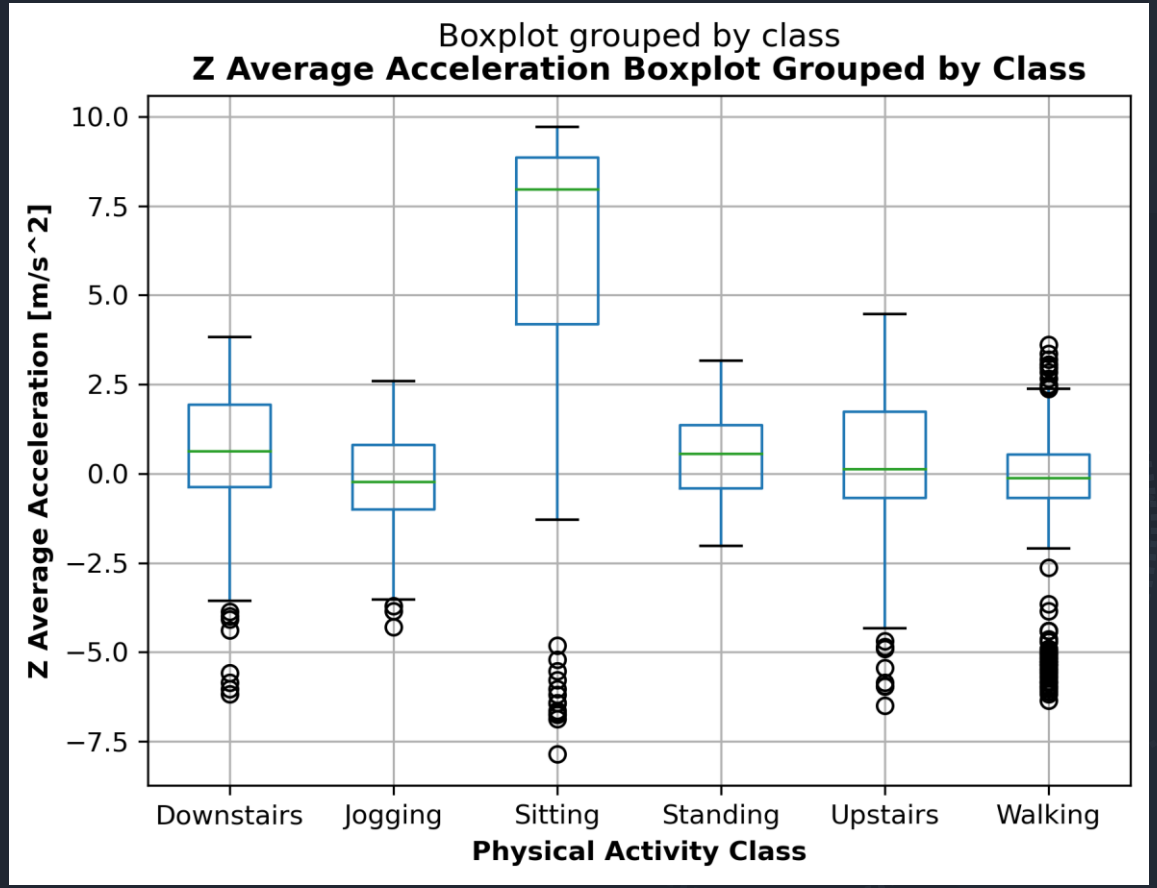
Data Imbalance



Exploratory Data Analysis

Y and Z Average Acceleration





Cross-Validation

Splitting
&
Preprocessing

Is the data IID?

No. It is group-structured

What will the model predict?

Physical activity class on unseen **users**

Group Kfold & Standard Scaler

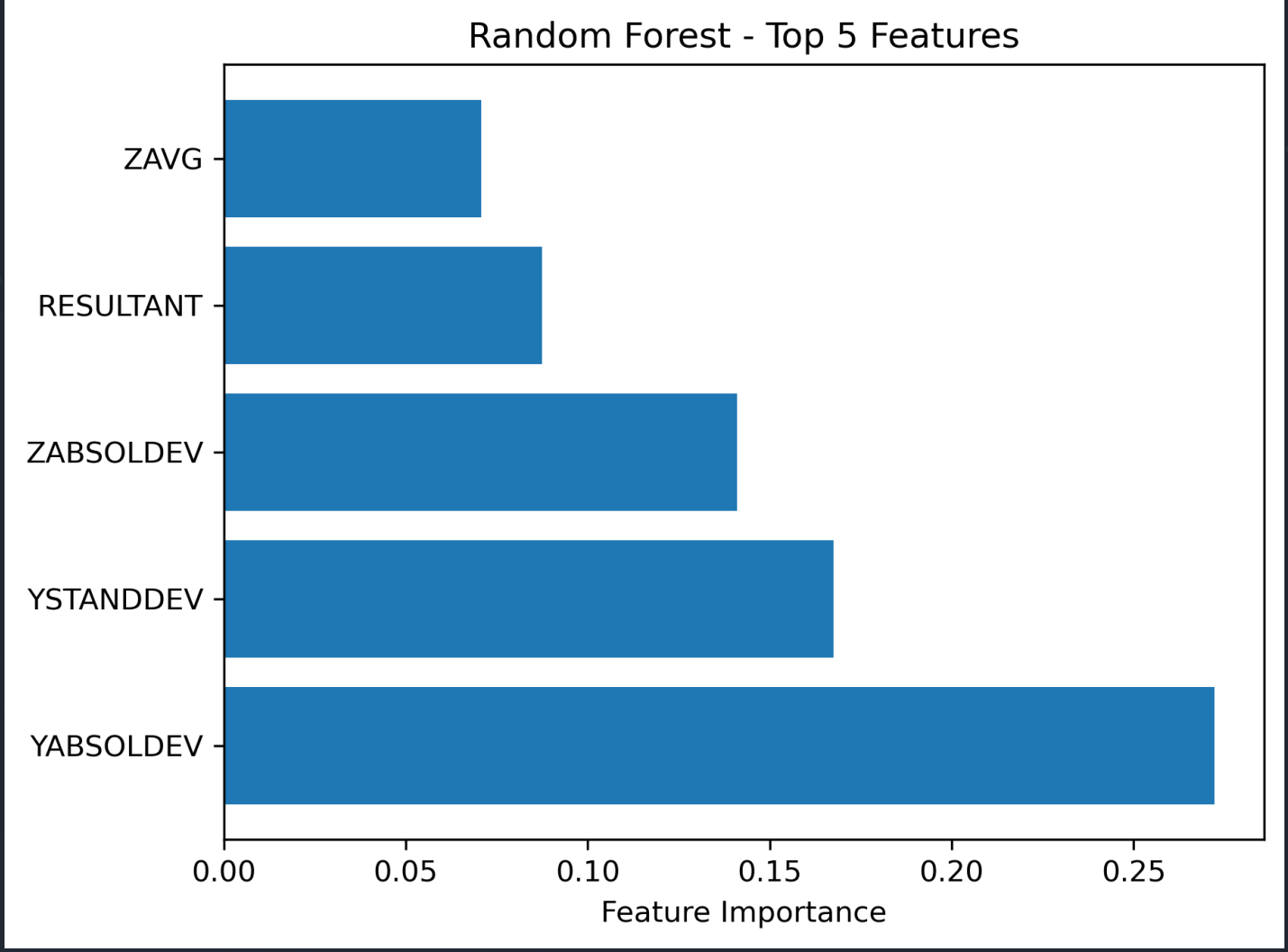
Cross-Validation

Machine Learning Algorithms & Parameters

XGBoost	• N_Estimators: [50,100,500] • Max_Depth: [1,3,10,30]
Logistic Regression L2	• C: [0.001,0.1,1,10,100] • Max_Iter: [1000,5000]
Random Forest	• Max_Depth: [1, 3, 10] • Max_Features: [0.5,0.75,1.0]
SVC	• C: [0.1, 0, 1] • Gamma: [0.001, 0.1, 1, 1000]

Results

Global Feature Importance

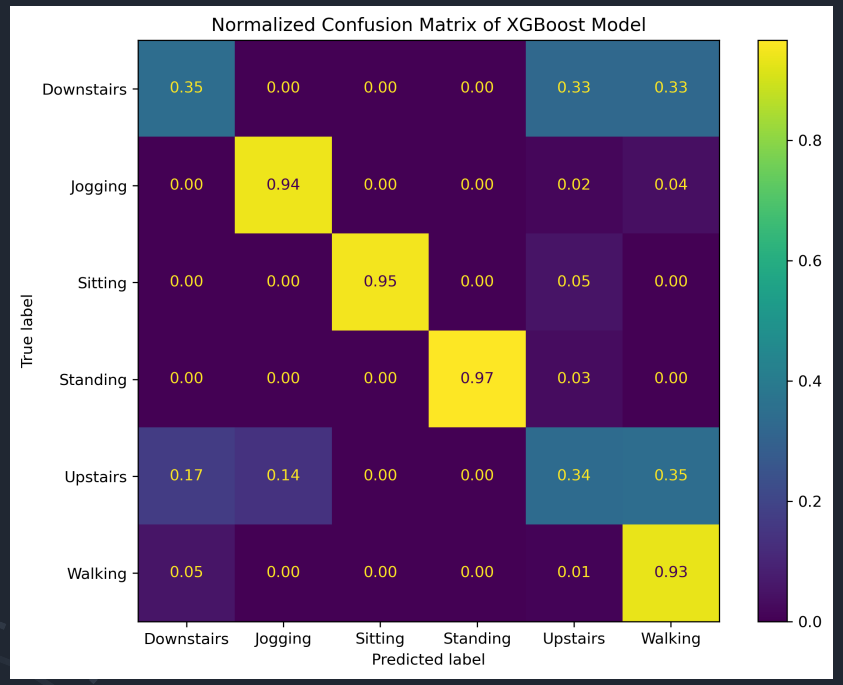


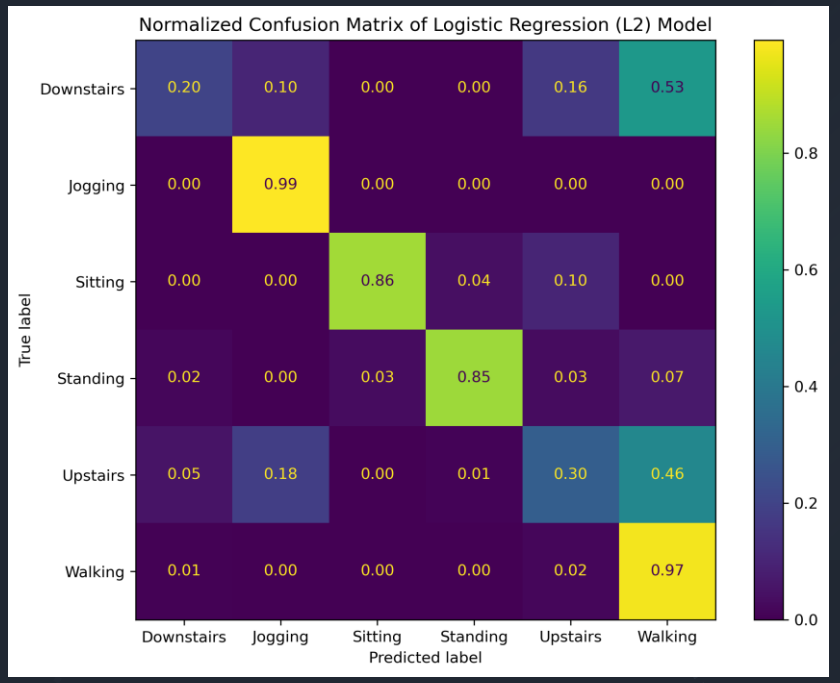
XGBoost &
Logistic Regression (L2)

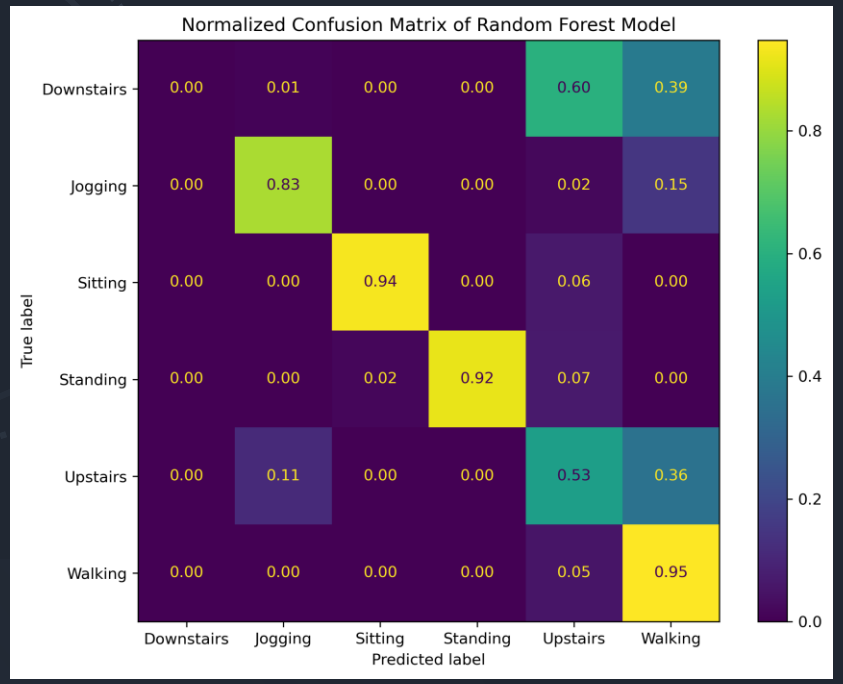
Results

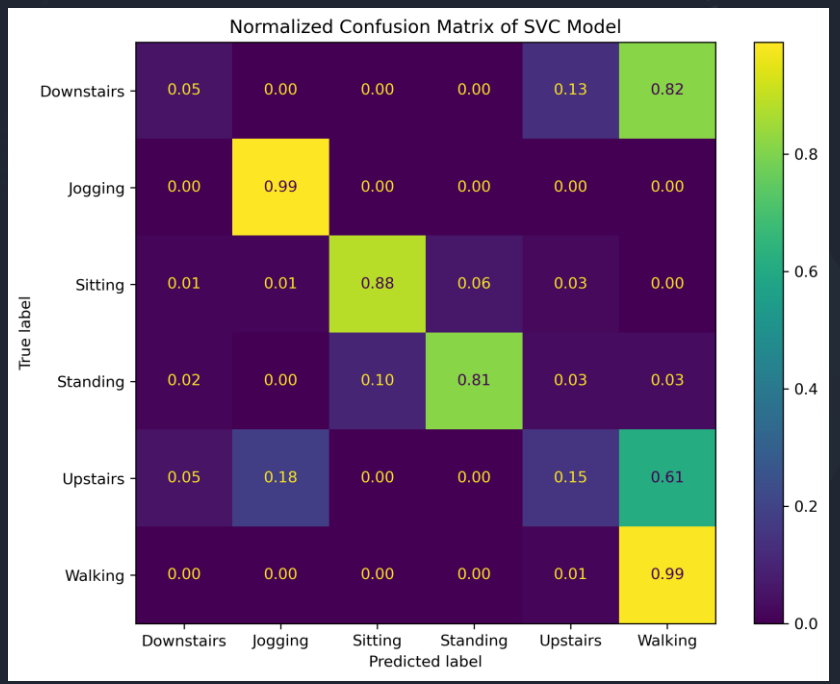
Normalized Confusion Matrices

Random Forest & SVC



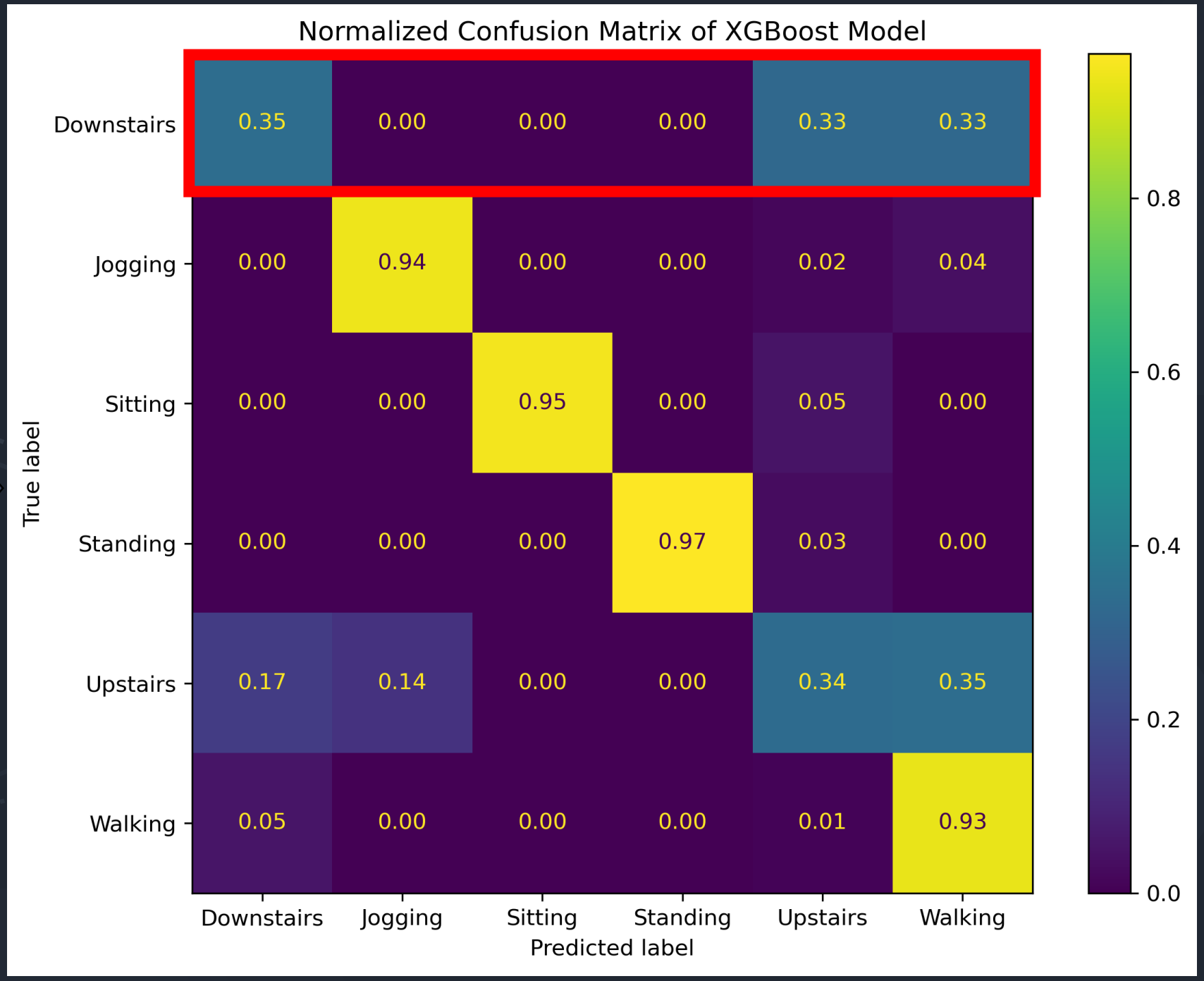






Results

XGBoost Normalized Confusion Matrices



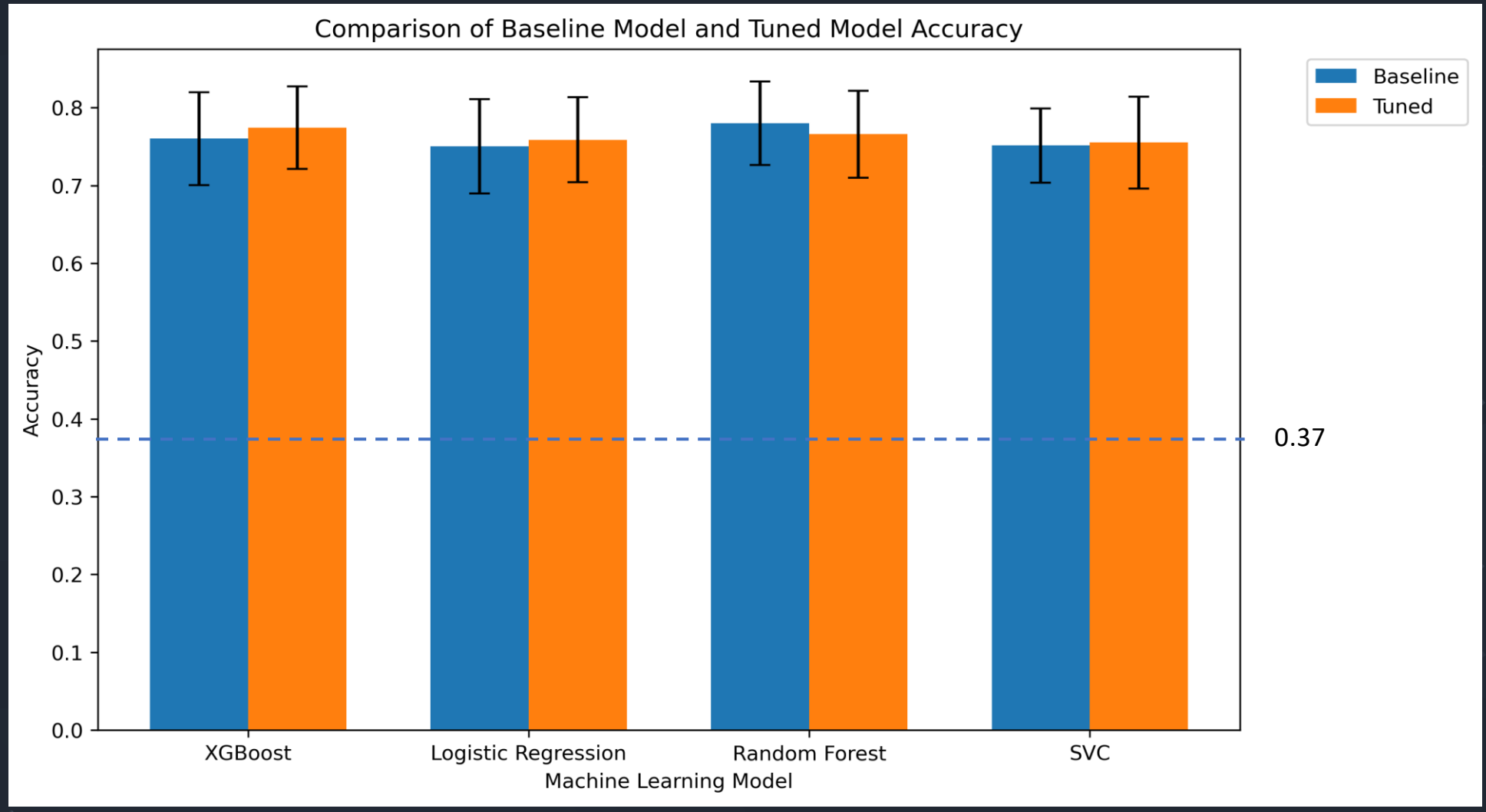
Results

Average Test Scores

	XGBoost Mean +/-StDev	Logistic Regression L2 Mean +/-StDev	Random Forest Mean +/-StDev	SVC Mean +/-StDev
Accuracy	**0.774 +/-0.053**	0.759 +/-0.054	0.762 +/-0.054	0.752 +/-0.057
Precision	0.755 +/-0.050	0.725 +/-0.067	**0.770 +/-0.046**	0.712 +/-0.062
Recall	**0.774 +/-0.053**	0.759 +/-0.054	0.762 +/-0.054	0.752 +/-0.057
F1 Beta Score	**0.751 +/-0.53**	0.718 +/-0.060	0.749 +/-0.052	0.703 +/-0.057

Results

Average Baseline Scores Comparison



Outlook

- Tune more hyperparameters
- Explore other machine-learning models
- Increase the dataset sample size and create a balanced set
- Incorporate muscle activity data

Questions?

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