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Human Activity Recognition from Accelerometer Data

Data Science Initiative, Brown University

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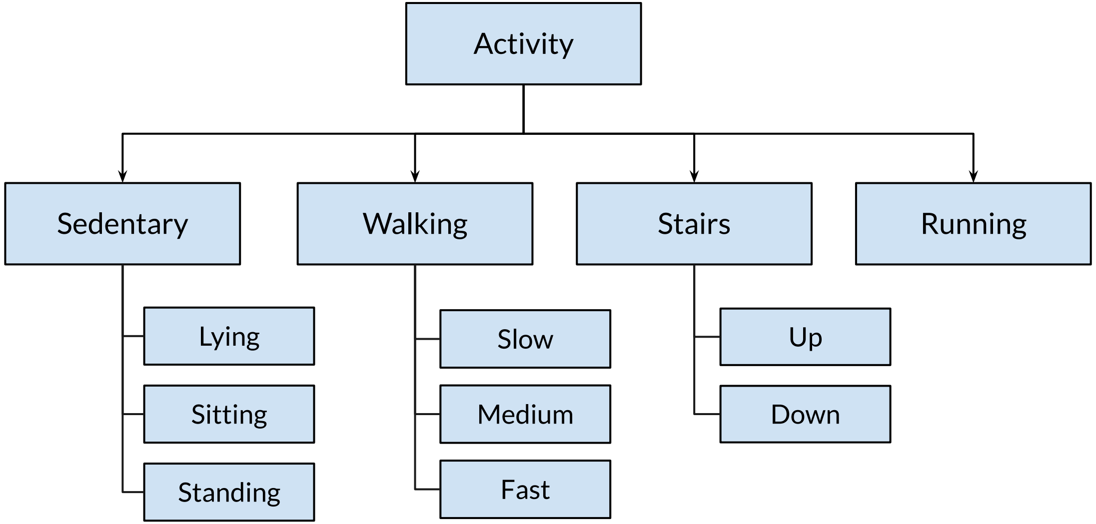
GitHub

https://github.com/raichandanisagar/human-activity-recognition

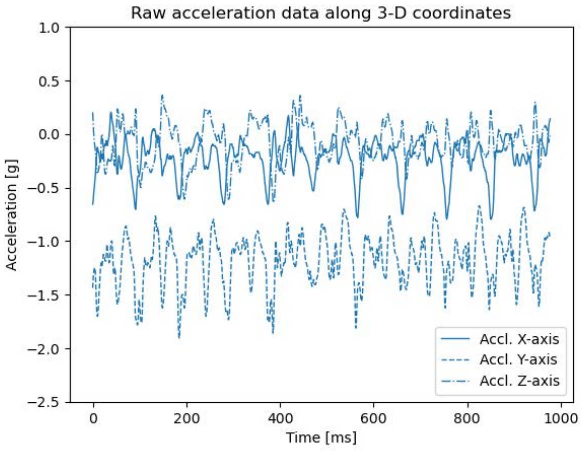
Project Goal

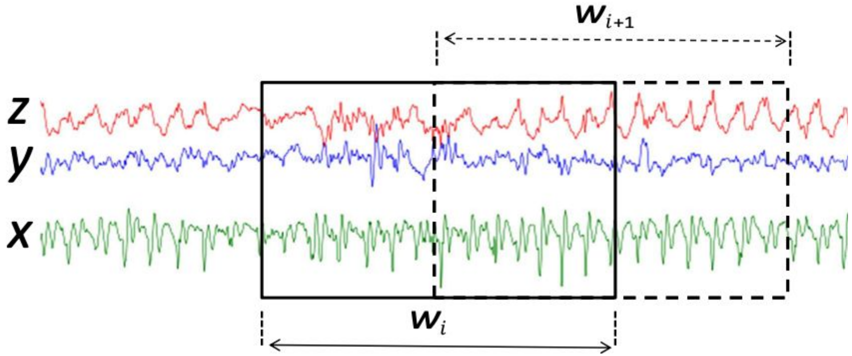
Objective

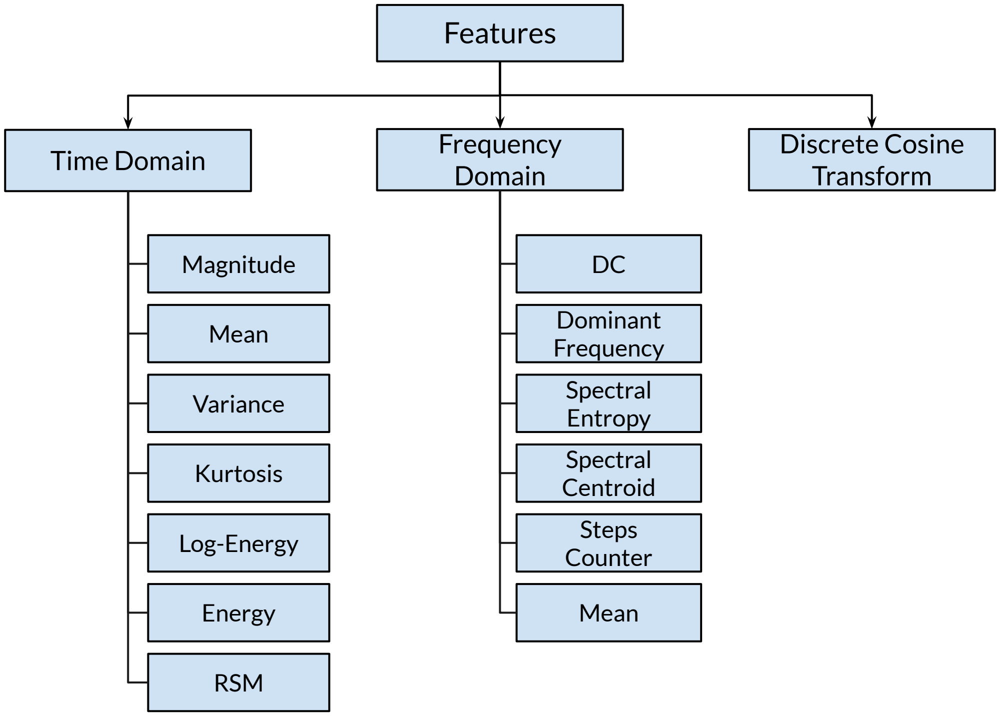
To create a subject independent classifier from time-series accelerometer data that identifies physical activity.



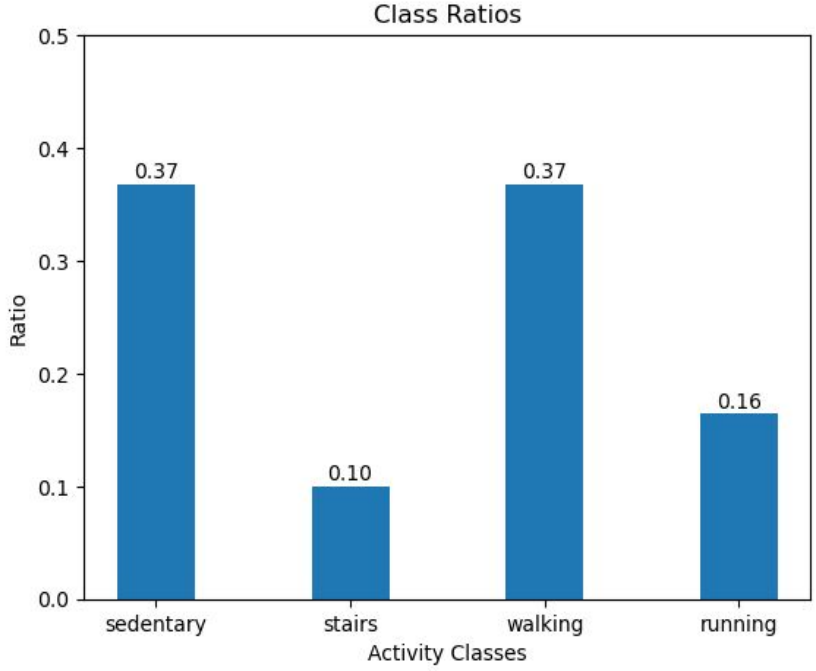
Windowing and Feature Engineering

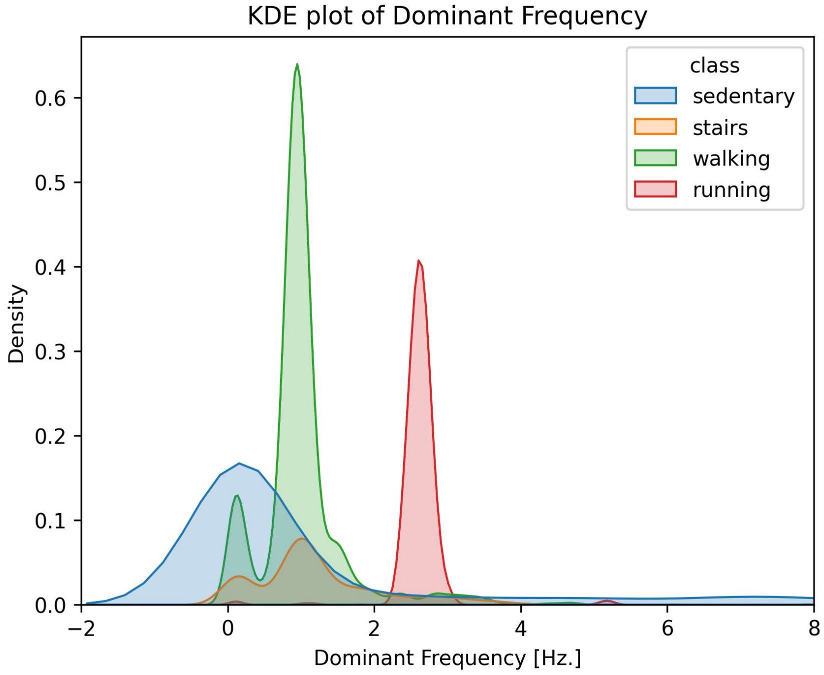






Key Observations from EDA





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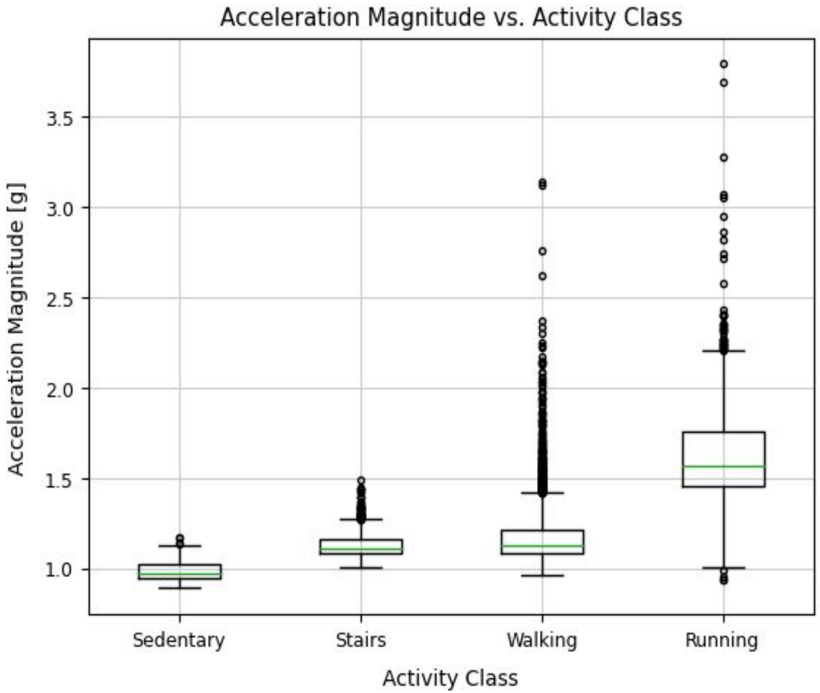
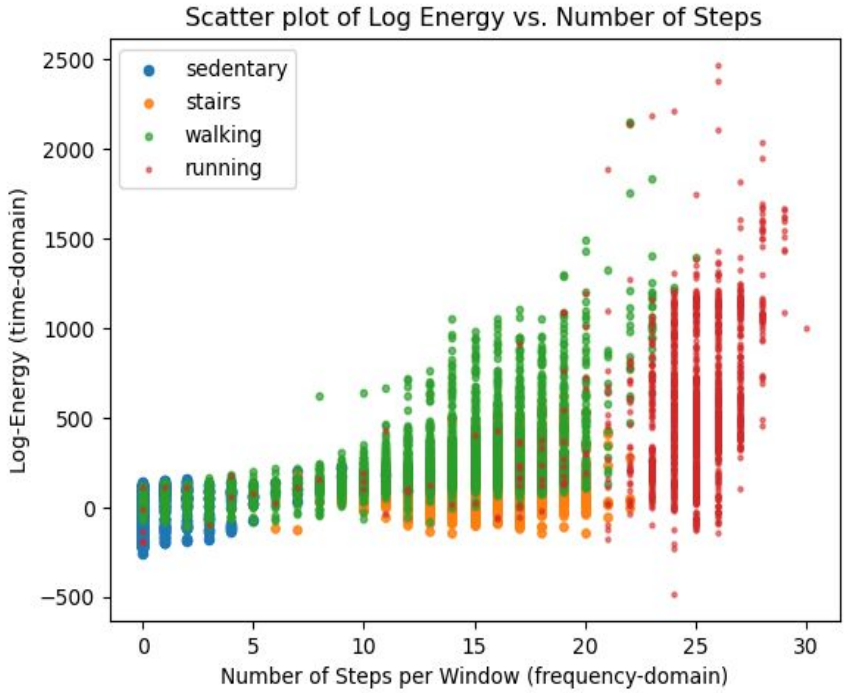
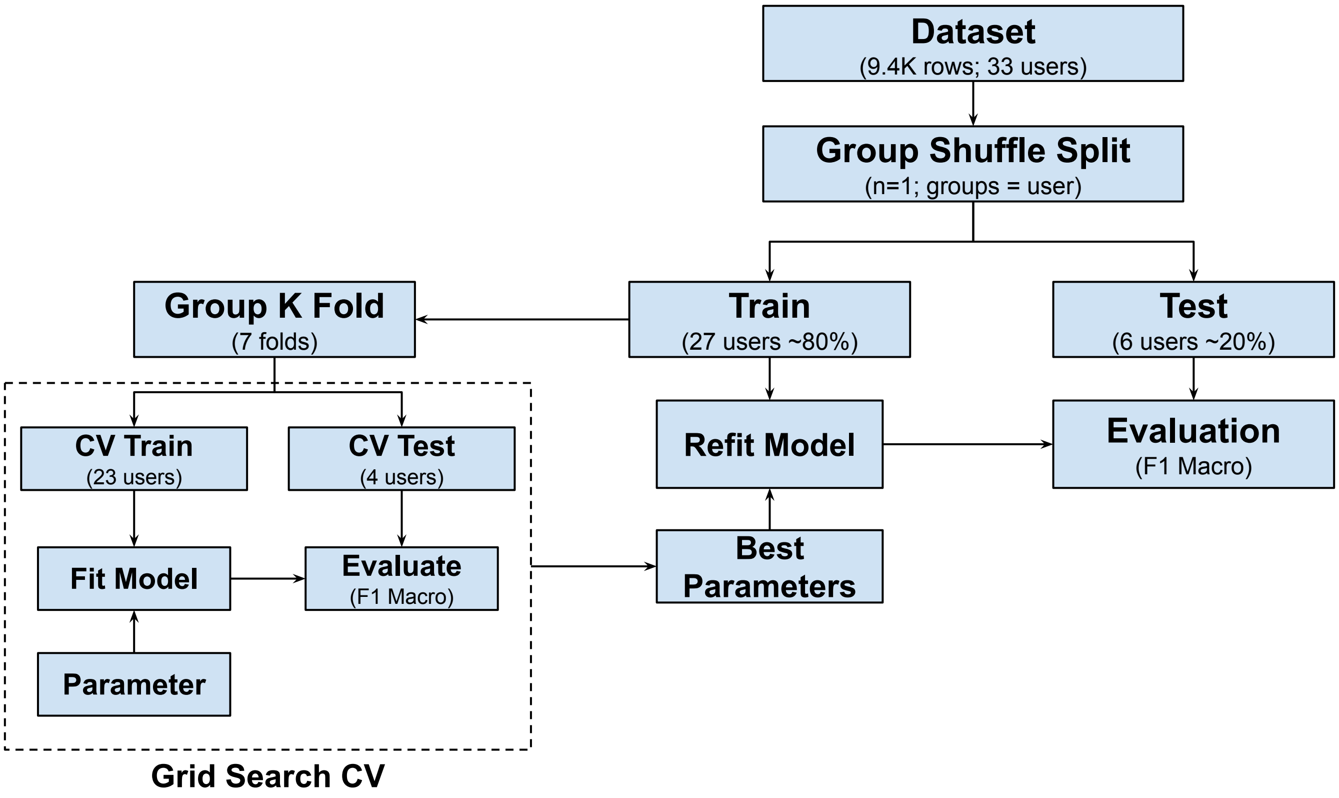




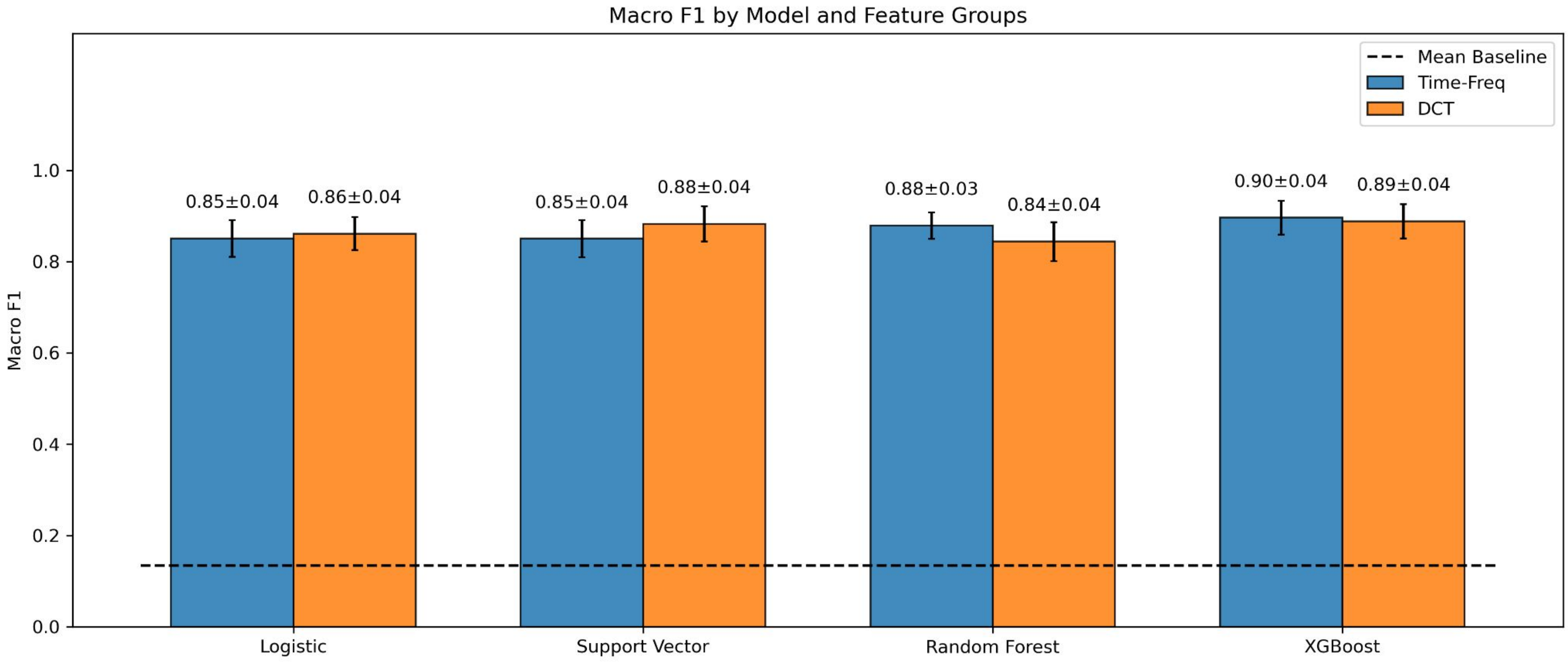
Cross Validation Pipeline



ML Models Trained & Evaluated

	Logistic Regression (L2)	Support Vector Classifier	Random Forest Classifier	XGBoost Classifier
Classification Strategy	One vs. Rest	One vs. One	Multiclass	Multiclass
Parameters Tuned	C- regularization inverse (log scale)	C- regularization inverse (log scale)	Max features (linear scale)	Learning rate (log scale)
		gamma- kernel coefficient (log scale)	Max depth (linear scale)	Max depth (linear scale)
Optimum Parameters (over 5 random iterations)	C = 100	C = 100; gamma = 0.01	Max features = 0.5; Max depth = 12	Learning rate = 0.5; Max depth = 8
Evaluation metric	F1 macro	F1 macro	F1 macro	F1 macro

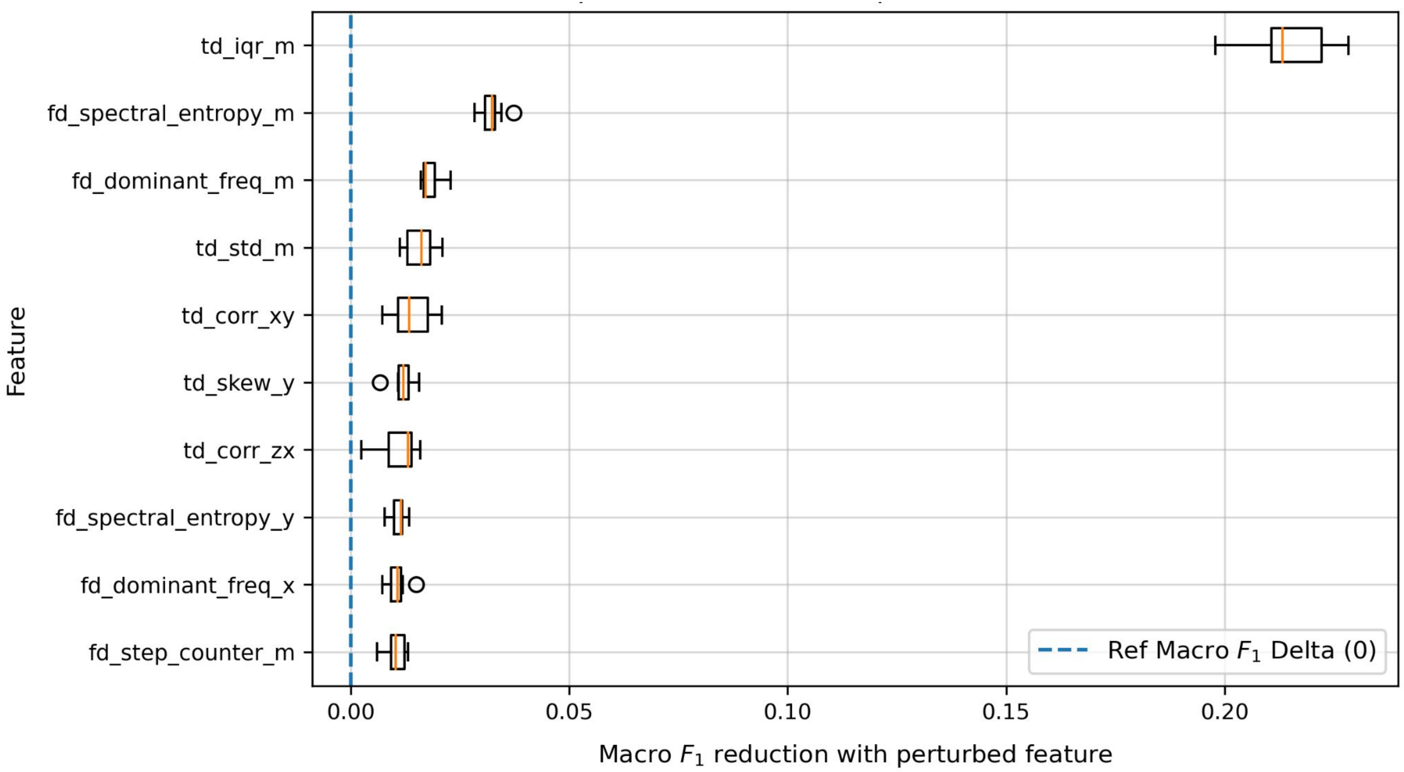
Evaluation Results



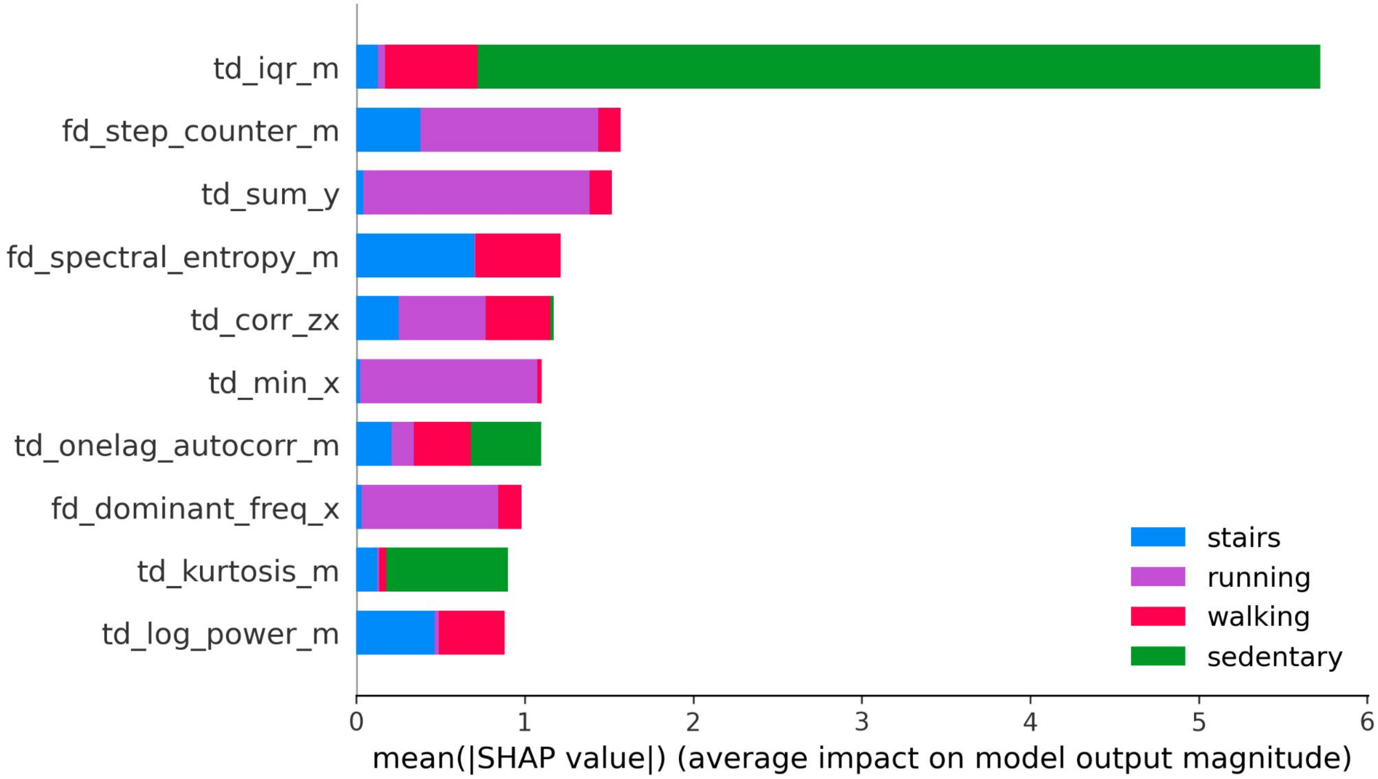
XGB Confusion Matrix

**XGBoost Classifier confusion matrix–
normalized by true labels (row-wise)**

Top 10 Features (Permutation Importance)



Global Feature Importance (Shap)



Outlook

- Tune window length (2, 5, 10 secs); this helps create a better balance between accuracy and latency

- Gauge impact of tuning β in F_β - the lower recall of minority classes made me question if weighing recall higher would be a more appropriate evaluation metric. Or alternatively using weighted F score with a custom function based on cost of misclassification.

- Estimate feature importance (permutation/global shap) after dropping correlated variables

- Train models for L2 classification of activity-type and intensity

Thank You!

Questions/Comments?