

# Locomotion-Transportation Recognition via LSTM and GPS Derived Feature Engineering from Cell Phone Data

Gulustan Dogan <sup>a</sup>, Jonathan Sturdivant <sup>a</sup>, Seyda Ari <sup>b</sup>, Evan Kurpiewski <sup>a</sup>  
University of North Carolina Wilmington, Wilmington, NC, USA <sup>a</sup>, Ege University, Izmir, Turkey <sup>b</sup>

## Introduction

- By analyzing sensor data acquired via smartphones or wearables, applications and services can be developed to contribute to overall quality of life.
- The SHL competition aims to classify transportation methods using this sensor data.
- The SHL team provided us with Training, Validation, and Testing data from four sources - GPS location, GPS satellites, Wi-Fi, and cellular connections

## Objectives

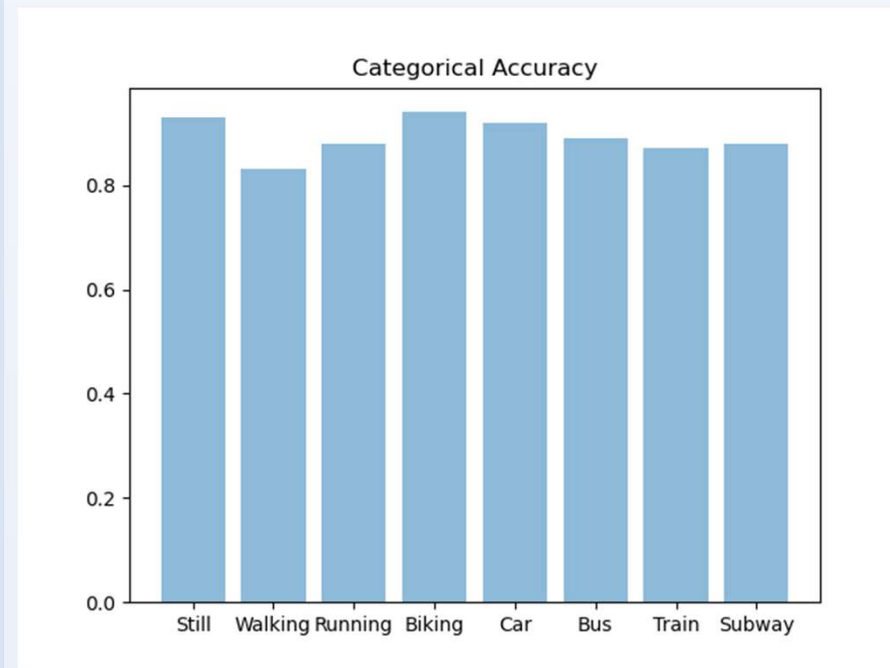
- Create a model to classify a user's transportation method in a user-independent manner.
- Classify into one of eight categories based off cellular radio data.

## Results

- Our model achieved an average categorical accuracy of .89 on the validation set Classifying biking most accurately (.94) and walking least accurately (.83). These results are comparable results to other GPS based classifiers.

## Future Work

- Combining radio signal data with IMU data.
- Classify into slow or fast before classifying transportation mode.



## Methods

- Standardized and combined data from each source into single file using epoch time
- Used Correlation analysis to decide the best features for the model
- Used the haversine formula to find distance traveled per second
- Used 74 features including 2 calculated features, which were speed and heading rate
- Created a Bidirectional LSTM focused on data from GPS coordinates and satellite locations

## Conclusions

- It is possible to classify a mode of transportation from cell phone radio frequency signals
- GPS location data provide the most initial value because we can calculate speed and direction from it.