SEZAKI LAB.

[Urban Sensing and Mobility Analysis]

Center for Socio-Global Informatics

Center for Spatial Information Science

Socio-cultural Environmental Studies

Information & Communication Engineering

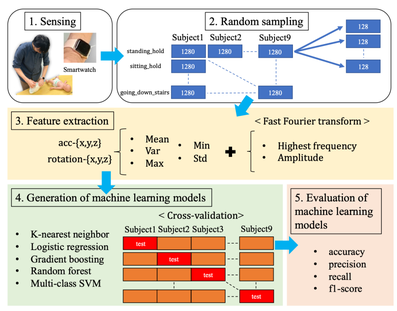
https://www.mcl.iis.u-tokyo.ac.jp

Detecting Childcare Activities Using Smartwatch

【Overview】
To solve the problem that males have less time for childcare while females are increasingly working in society, we analyzed sensor data from wearable devices to verify the possibility of detection regarding childcare activities.
【Result】
The most accurate machine learning model was able to detect with about 70% performance.

Examples of childcare activities

Doll used for the measurement



Overview of the analysis method

HeadSense: A Head Movement Detecting System for Micro-Mobility Riders

【Background】
Micro-Mobility (such as bicycles, scooters) is booming in major cities all over the world. However, they also take a great part in traffic accidents.
This research is focusing on the important rider behaviors, and then builds systems to collect and analyze related data, lay the groundwork for gaining further insight on the Micro-Mobility rider's safety.
【Method】
we use the helmet equipped with an inertial measurement unit (IMU) to detect the rider's head movement during traveling.

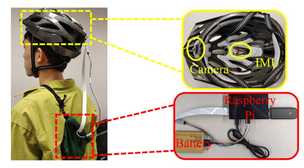


Figure 1. Participant wearing the helmet prototype and carrying the accessories.

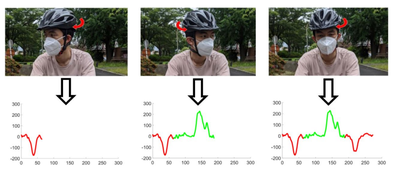


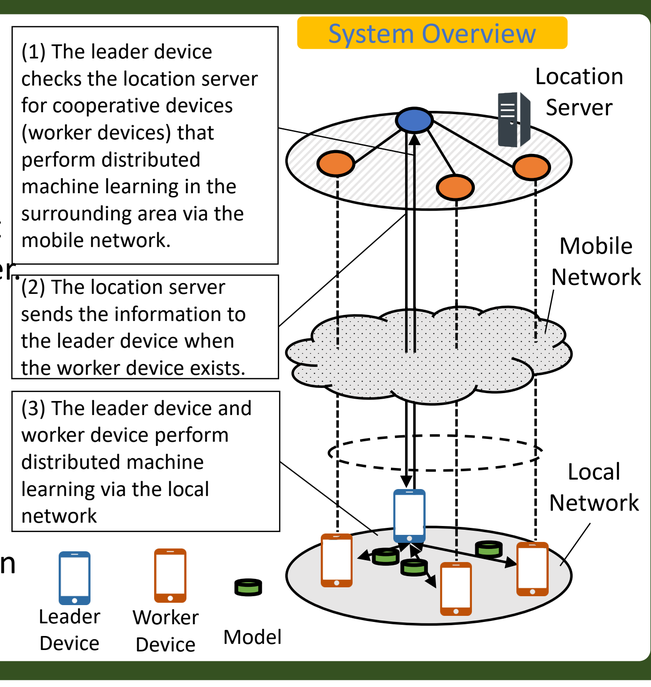
Figure 2. Rider made three head movement sequences and the corresponding data of gyroscope z axis.

Figure 3. Example of potential dangerous riding behaviors.

Green Distributed Machine Learning on Local Mobile Resources

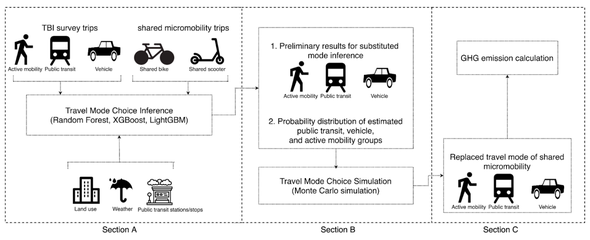
【Propose】
We devised a distributed machine learning system that is environmentally friendly by cooperating among devices that are physically close to each other.

【Result】
It is found that the proposed method can reduce the execution time of ML and the power consumption of the router in comparison with that in conventional methods.

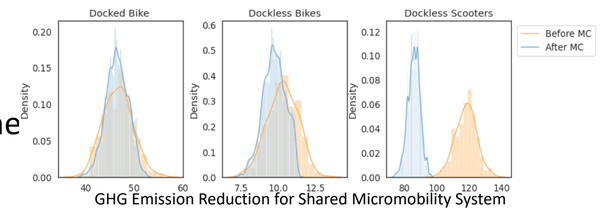


Estimation of Greenhouse Gas Emission Reduction from Shared Micromobility System

【Background】
Shared micromobility system is widely recognized as a critical component of transportation decarbonization. However, quantitatively assessing its environmental impact using real-world trip data is unresolved and challenging.
【Method】
Proposed a system combining machine learning algorithms and the Monte Carlo (MC) simulation to address this issue.



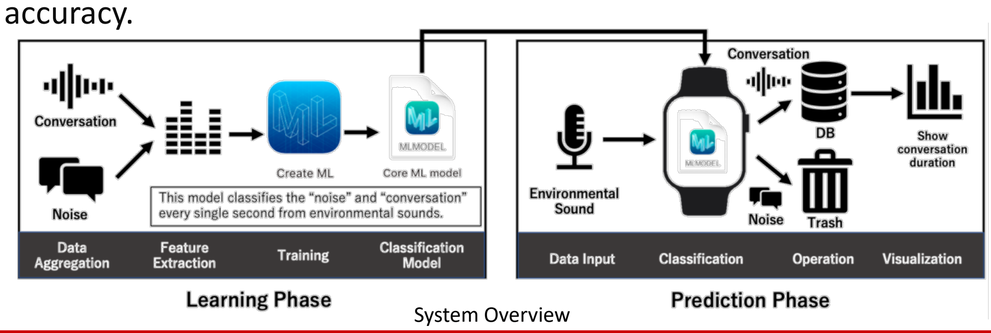
System Overview



GHG Emission Reduction for Shared Micromobility System

Toward Measuring Conversation Duration Using a Smart Watch

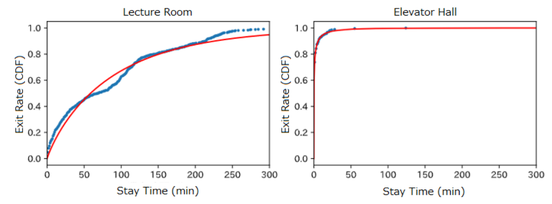
【Background】
As more and more people are feeling stagnant due to lack of social contact, it is necessary to continuously measure the frequency of conversations in daily life in order to control secondary health problems.
【Result】
Machine learning was performed using a wristwatch-type wearable device, which was able to discriminate between speech and noise with approximately 85% accuracy.



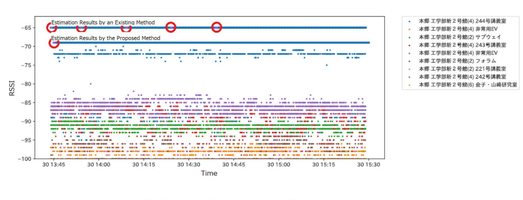
System Overview

A Robust BLE Indoor Localization Method Using Survival Analysis

【Background】
MOCHA, a BLE-based user location tracking and sharing platform, is used at our university. In this system, misjudgment of the place of stay sometimes occurs due to instability in the received signal strength (RSS) or signals leaking from adjacent rooms.
【Method】
The proposed method fit the distribution of past user stay times to Weibull distribution, and apply survival analysis to estimate the user status (whether the user is about to leave or not).



Fitting of Stay Time Distribution to Weibull Distribuiton



RSSI and Estimation Results