

SEZAKI LAB.

[Urban Sensing and Mobility Analysis]

Center for Spatial Information Science

Socio-cultural Environmental Studies

Information & Communication Engineering

<http://www.mcl.iis.u-tokyo.ac.jp>

Capturing Human Mobility Using Bluetooth

Purpose

- Developing low-cost method to sense human mobility using Bluetooth

Technologies

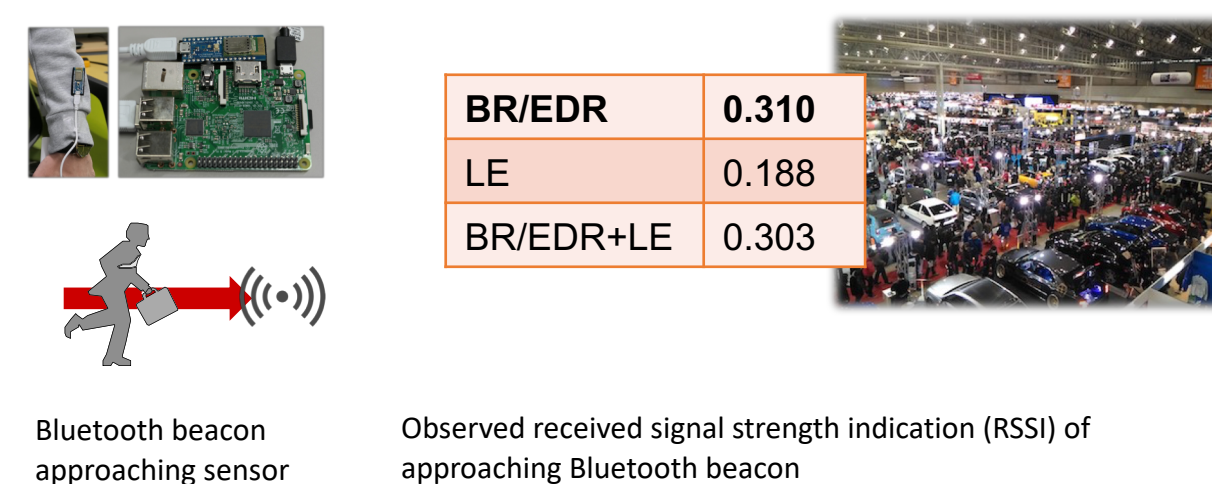
- Congestion sensing by detecting Bluetooth devices
- Direction detection by observing transition of signal strength of Bluetooth Low Energy beacon

Applications

- Managing and reducing congestion of indoor facilities
- Understanding human mobility in disaster to support evacuation



Relationship between number of counted people and number of detected Bluetooth device at Makuhari Messe



Diffusive-DNA-Based Molecular Communication

Conventional Communication

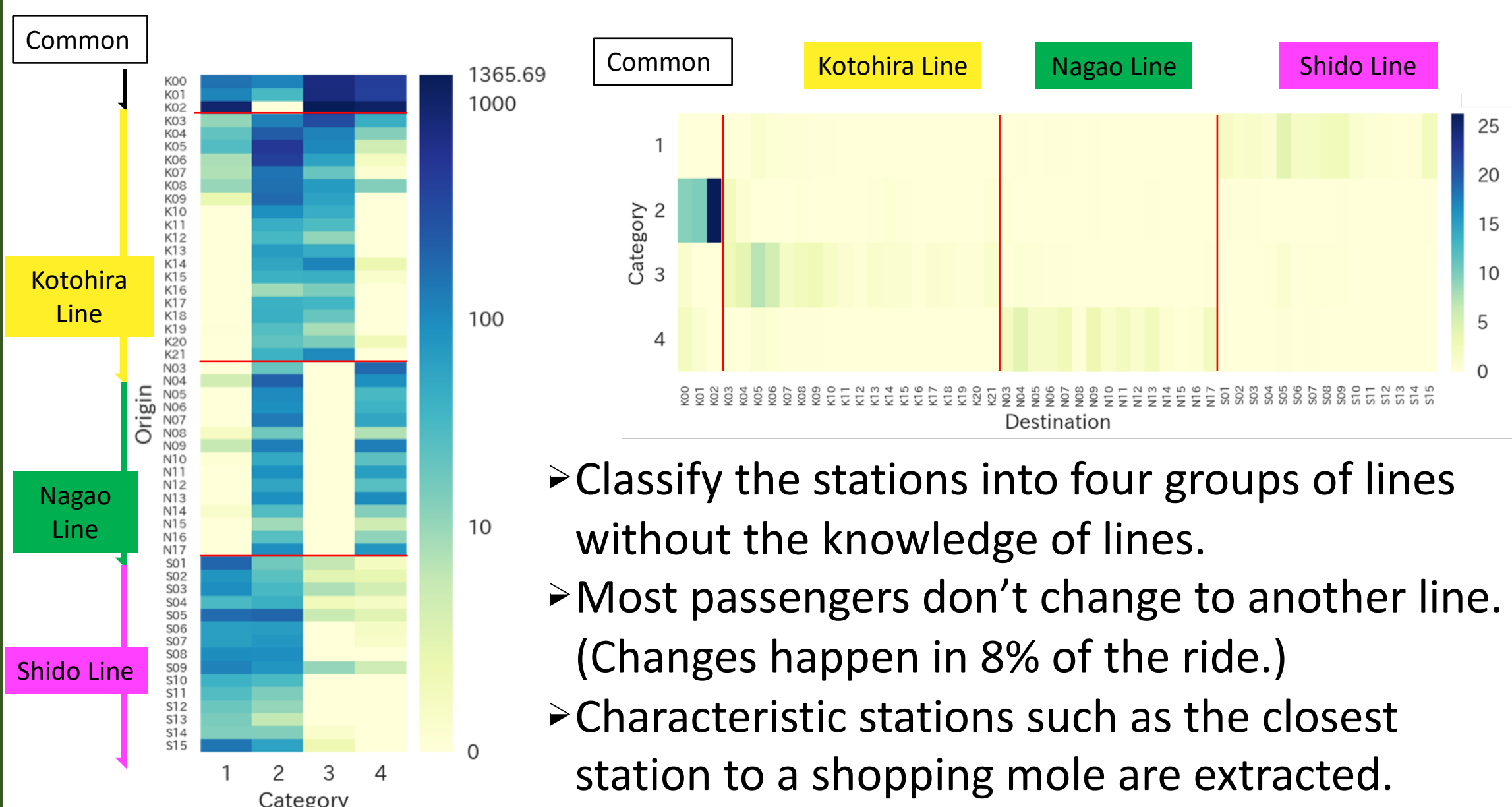
Diffusive-DNA-based Molecular Communication

DNA Diffusivity $D_l = 490 \mu\text{m}^2 / \text{s} \cdot [l(\text{bp})]^{-0.72}$

Hit probability $f_{\text{hit}}(t) = \frac{r}{d_c} \frac{1}{\sqrt{4\pi D_l t}} \frac{d_c - r}{t} \exp\left[-\frac{(d_c - r)^2}{4D_l t}\right]$

Understanding Urban Mobility Using Smart Card Data

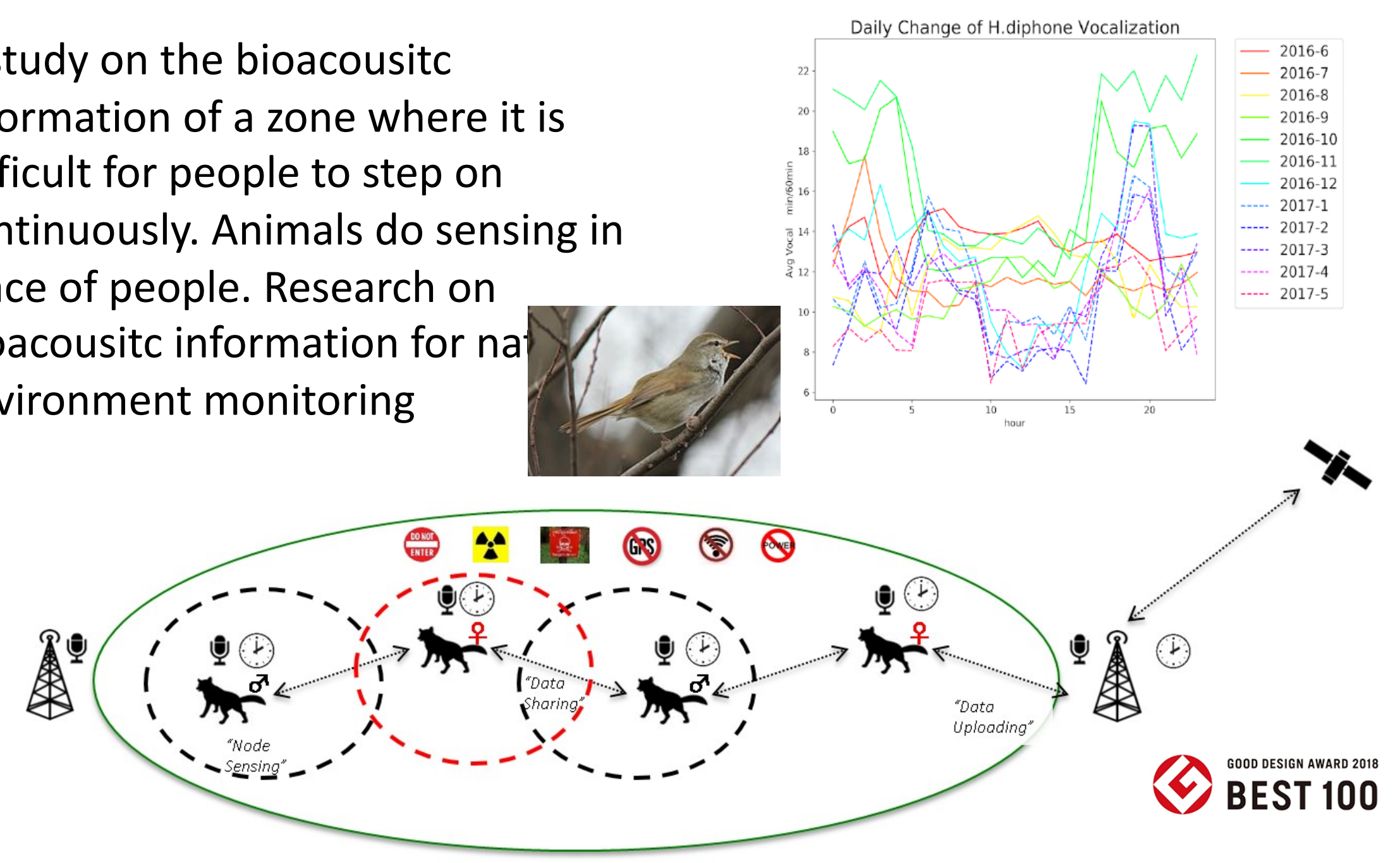
Grasp the patterns of passengers' movement in Kotoden by using Non-negative Matrix and Tensor Factorizations (NMF, NTF).



- Classify the stations into four groups of lines without the knowledge of lines.
- Most passengers don't change to another line. (Changes happen in 8% of the ride.)
- Characteristic stations such as the closest station to a shopping mole are extracted.

Nature Environment Monitor Research Using animal wearable sensors

A study on the bioacoustic information of a zone where it is difficult for people to step on continuously. Animals do sensing in place of people. Research on bioacoustic information for nature environment monitoring



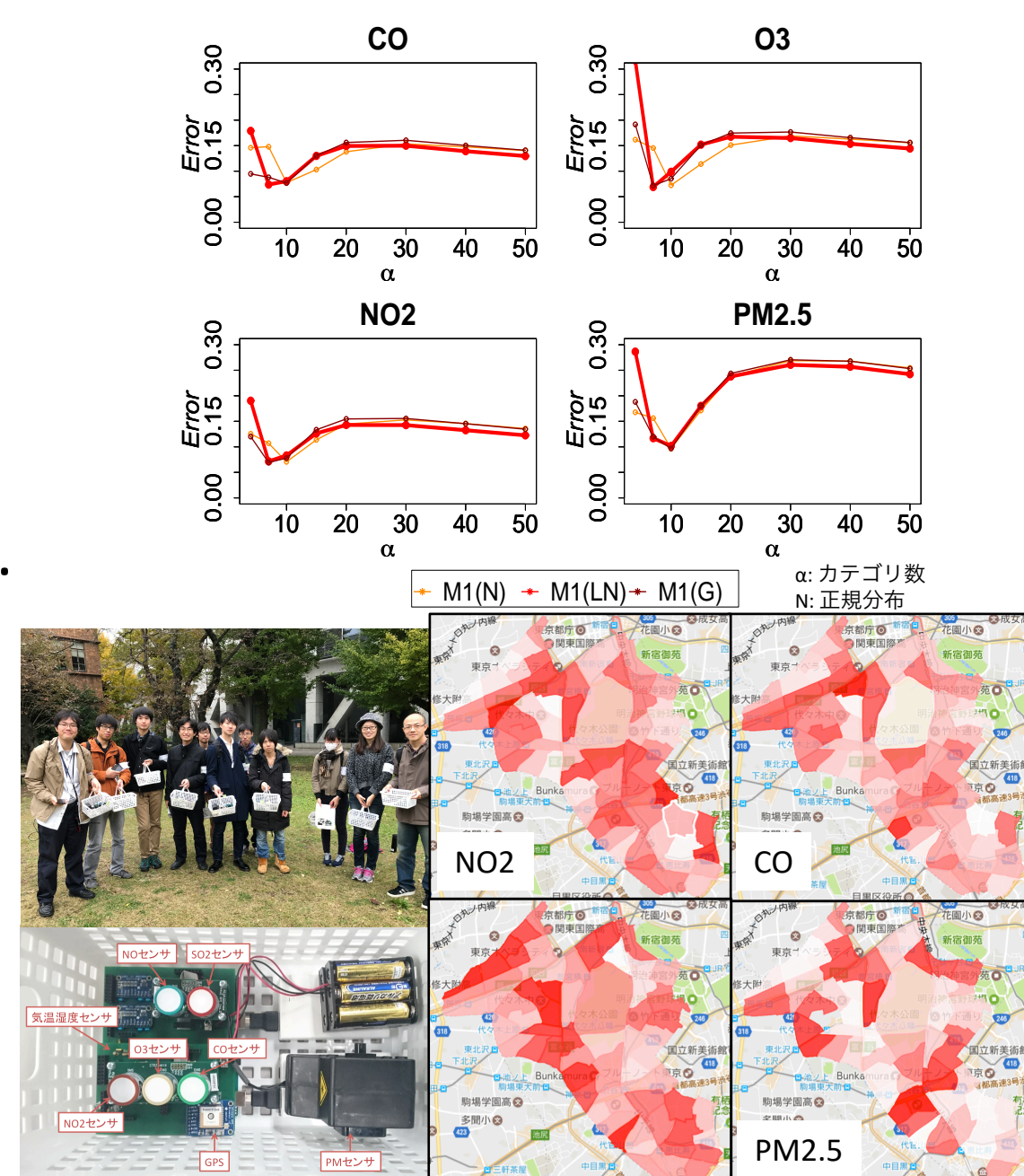
Estimating Reconstruction Accuracy of Data Perturbation in Mobile Sensing

Data Perturbation

- A technique to protect privacy by randomizing observed sensor values by each user before sending to a server. The server restore only statistical information from a collection of randomized sensor data.

Proposal and Experiment

- Estimate reconstruction accuracy assuming spatiotemporal correlation of the original data.
- Did an field experiment of mobile environmental sensing in Shibuya, and evaluated the proposal.



Placement of Sensor Nodes in Mobile Sensing

We propose methods to observe high-quality geospatial information by collecting sensing data from a part of numerous IoT devices that exist in many places and are moving. One method is to indicate the way to move IoT devices if you continue to select the same IoT devices. Another method is to improve the way to select IoT devices if you reselect a set of IoT devices for each measurement. Both methods uses the kriging variance (reliability of the interpolated geospatial data).

