CSIS

SEZAKI LAB.

[Urban Sensing and Mobility]

Center for Spatial Information Science

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Information and Communication Engineering

Information & Communication Engineering
Socio-cultural Environmental Studies

Setagaya Sensing Project

Overview

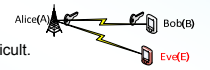
- Trajectory sensing using Android application.
- Area : Setagaya-ku, Tokyo (gross area 60 [km²]).
- Participants : 40 people.
- Period : 4 days (about 170 hours).

The new research method of city environment (residential environment)

Secrecy-Enhanced Transmission Schemes in Cooperative Sensor Networks

Conventional secrecy transmission scheme:

cryptography

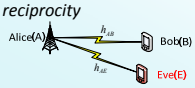


- Key management is difficult.
- It is unsuited and complex to be implemented in large scale or dynamic sensor networks.

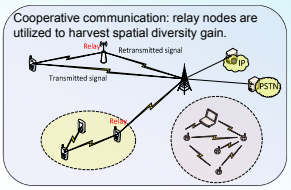
Alternative: *wireless physical layer security*

Main idea: exploit wireless channel fading to secure data transmission.

-Channel fading h_{AB} and h_{AE} are *independent* and *reciprocity*



Secrecy capacity:
$C_S = [C_{AB} - C_{AE}]^+$
$C_{ij} = \log\left(1 + SNR|h_{ij}|^2\right)$
is the channel capacity of *i-j* link



Secrecy-enhanced transmission schemes:

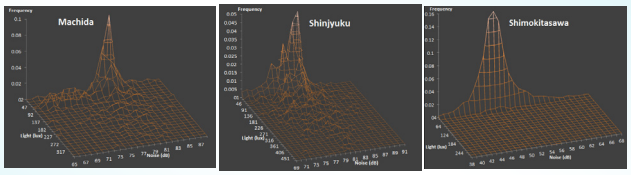
- Controlled jamming
- Relay selection
- Adaptive cooperation
- Secure user scheduling

Estimation of How Busy a City Is

Introduction

Assumption: ambient light and noise at night is the energy emitted by a city through human activities

Ambient noise-light joint distribution



Relative measure of how busy (RB)

$$RB = \frac{1}{2}(D_{KL}(P||Q) + D_{KL}(Q||P)), D_{KL}(P||Q) = \sum_i \sum_j \ln\left(\frac{P_{ij}}{Q_{ij}}\right) P_{ij}$$

where P_{ij}, Q_{ij} is noise − light joint distribution in two areas.

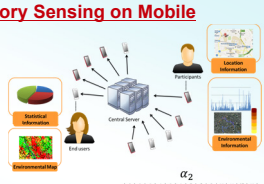
	Area A	Area B	Area C
Area A	0.000	17.825	16.200
Area B	17.825	0.000	16.917
Area C	16.200	16.917	0.000

Area A: Machida
Area B: Shimokitazawa
Area C: Shinjuku

Perturbation for Privacy-Preserving Participatory Sensing on Mobile

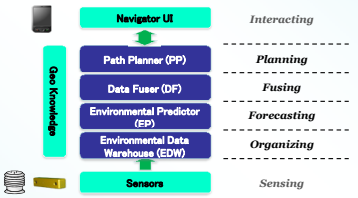
Proposed Method For Real-World Data Sets

- **Trade-offs between privacy and utility**
- **Multidimensional data sets with large number categories**
  - **Extend Negative Surveys to Selective Negative Surveys**
  - **Assumed each dimension having fine granularity**
- **Having the capable of change subject to the feature of data**
  - **Using variables $\beta i1$, $\beta i2$ ⋯βiN to restrict perturbed value in each dimension $\alpha i1$, $\alpha i2$,⋯ ,αiN for improving the utility of static data**

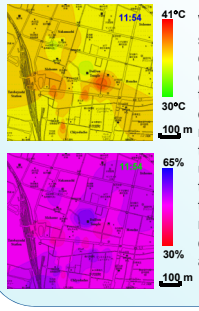


Carrier Pigeon-like Sensing System

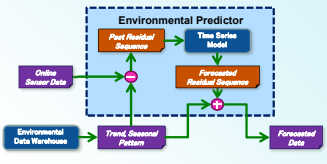
Pedestrian Navigation for Thermal Comfort



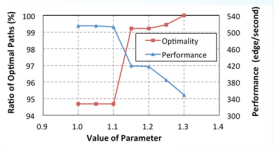
We proposed a general framework as the guidance in the construction of pedestrian navigation systems.



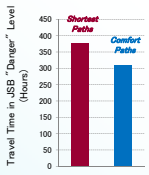
We used wireless sensor network, which contained 40 micro-climate sensor nodes, to collected information of air temperature and relative humidity in the target area. We also used data warehouse technologies to store the sensor data and reconstruct thermal conditions in the target area.



Time series method was applied to build the environmental predictor in data forecasting.

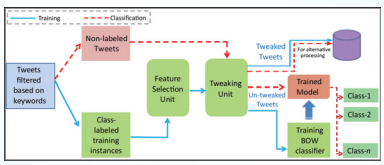


We developed robust search algorithms for path planning.



In the evaluation, WBGT index was used. Simulation results showed that travel time in "danger" level has been reduced by 17% for those improved paths.

Filtering Tweets Relevant to Urban Events using BOW Classifiers



We proposed a framework to build classifiers that would be able to filter tweets relevant to any specific topic or social phenomena.

Proposed model is stable even when:

-there are very few training instances, or

- hashtags are used as class labels for constructing trailing set. This approach is cheaper than manual labeling, but leads to impure training set. We propose an automated 'tweaking process' to identify and remove these 'confounding outliers' from training set.

Our Contributions:

-Algorithm for selecting corpus specific 'stop words'

$$S_u = \{\arg\max_{i \in U - U'} \|tf_i\|_1 : \gamma_i > 0.15 \text{ and } |S_u| = 40\}$$

$$\gamma_i = \frac{\|df_i\|_1 - max(df_t)}{\|df_i\|_1}$$

-Algorithm for selecting bigram features with structural importance

-Algorithm for automatically tweaking 'confounding outliers' from impure training set.

Word cloud for selected training instances for class #ows

Word cloud for training instances 'Tweaked' for class #ows

Result

Hashtags	Topic	Class
#job, #jobs	Job related news and advertisement	Job
#knick, #knicks	Baseball team New York Knicks	Knick
#nowplaying	Currently popular music tracks	Nowplaying
#occupywallstreet, #occupywallst, #ows	Occupy wall street movement	Ows
#realestate	Recent activities in real estate sector	Realestate