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Research



Microsoft Research Asia **Faculty Summit 2012**



Capturing Urban Context: Its Limitations and Possibilities

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Keio University

- Private comprehensive education institution
- 10 undergraduate faculties, 14 graduate schools and over 20 research centers
- 6 campuses across the greater Tokyo area
- University hospital, schools from elementary to high school levels



Mita Campus



Hiyoshi Campus



Yagami Campus



Shinanomachi
Campus



Shonan Fujisawa
Campus



Shiba-Kyoritsu
Campus



Microsoft Research Asia
Faculty Summit 2012



Hide Tokuda Lab., Keio University

- Smart Spaces
- Ubiquitous Service Platform (HW/SW)
- HCI
- Sensors and Dependable Ubiquitous Nodes
- MANET and Heterogeneous MANET

SS Lab., Smart Living, uPlatea



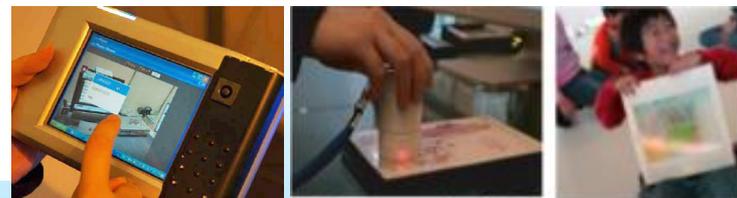
Service Platform: Smart Furniture, uTexture



MANET, Heterogeneous MANET
Ubiquitous Network Browser



Dependable Ubiquitous Nodes
Environmental Sensor Nodes



uPhoto, @Reader, uTexture, InfoPod
photo-based Interaction, Gesture-based Interaction
Multi-display Interaction

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Recovering from 3.11 Disaster

Thank you for Supporting and Praying for Japan



Recovering from 3.11 Disaster





Recovering from 3.11Disaster (by ABC News)

Sendai Airport

© Google, Digital Globe, GeoEye





Recovering from 3.11Disaster (by ABC News)

Sendai Airport

© Google, Digital Globe, GeoEye





Urban Context Capturing for Disaster Recovery

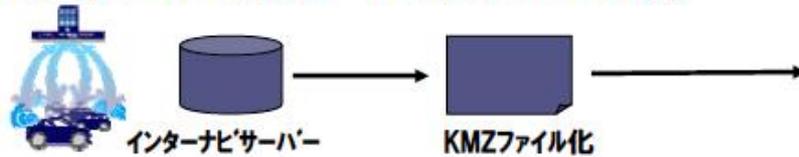
Honda & Google Collaboration Passage Route Map (by HONDA)

3.11東日本大震災「通行実績マップ」公開



3.11(金)14:46 地震発生 3.12(土) 10:30公開

3.14(月) Googleと提供開始



Google Crisis Response
in Google Crisis Project

東日本大震災(東北地方太平洋沖地震)



Google 自動車・通行実績情報マップ
(データ提供: 本田技研工業株式会社)

3.12(土)Hondaソーシャルメディアで情報発信



様々な機関で活用

防災情報マッシュアップサービス研究会
(座長: 東大加藤准教授 文科省)



(独)防災科学技術研究所
ALL311: 東日本大震災協働情報プラットフォーム



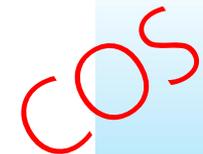
京都大学防災研究所
内閣府内緊急地図作成チーム(EMT)



首都大学東京渡邊研究室



Copyright © Honda Motor Co., Ltd.

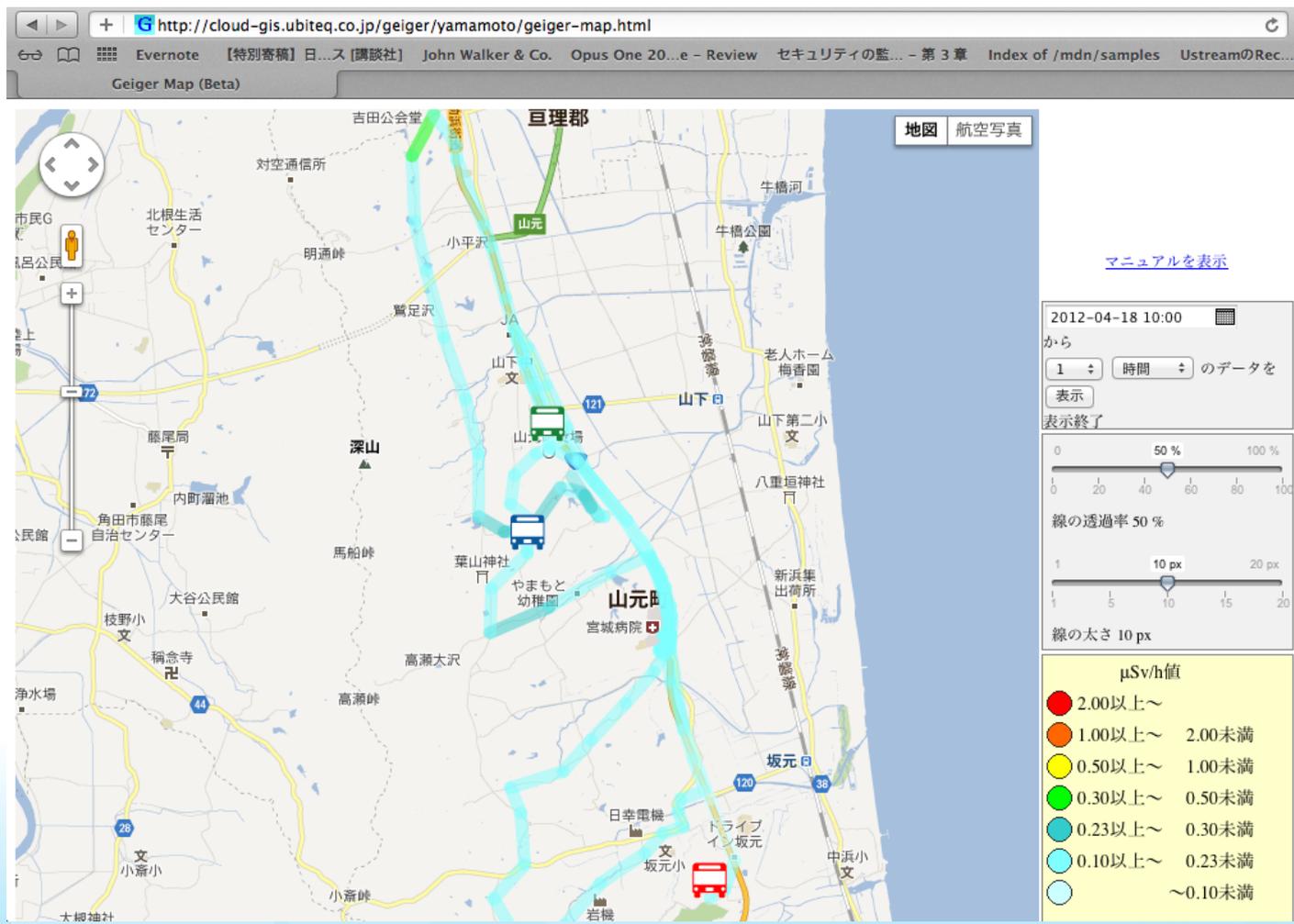


in Asia

Faculty Summit 2012



Yamamoto-town's (山元町) Geiger Counter Map by a community bus (by Ubiteq)





Outline

- A bit of History
 - March 11 Disaster and Urban Context
- Ubiquitous Services
 - What are Ubiquitous Services
- Capturing Urban Context
 - Limitations and Possibilities
- Place-triggered Geotagged Tweets Analysis
 - Case Study
- Summary



What are **U**biquitous **S**ervices



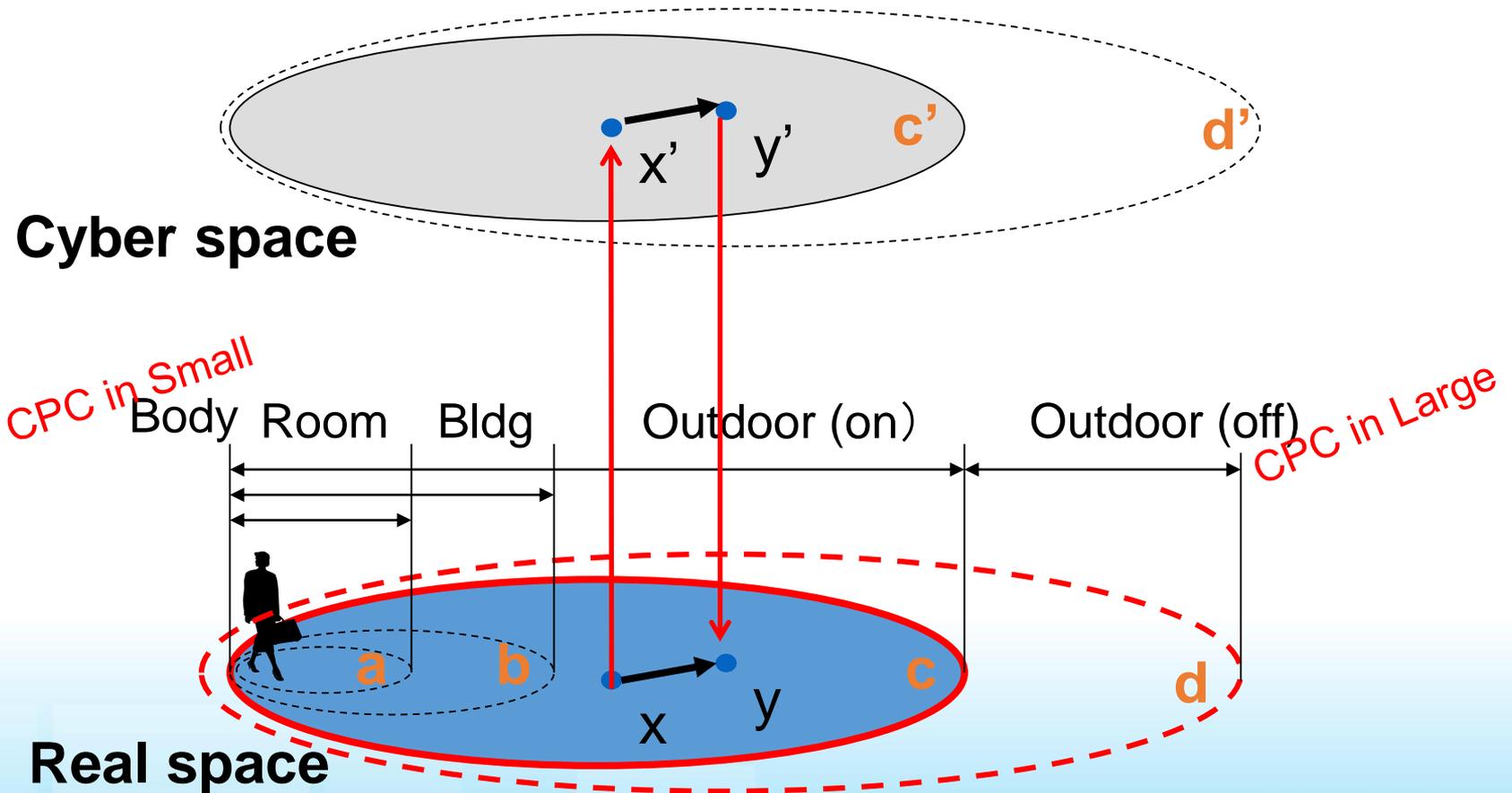


Ubiquitous Services

- Service type: **any3** vs. **only3**
 - At anytime, anywhere, for anyone
 - Only now, only here, only for me/us
- Ubiquitous Services
 - **C**ontext-aware Services
 - Context-aware **H**ealth Care
 - Context-aware **I**nformation Services
 - **P**resence Service for your friends (Real-Space SNS)
 - **P**ush-type information service
 - **M**obile e-Commerce with RFID tags
 - and more...



Classification of Ubiquitous Services





Cyber-Physical Coupling

Coupling = **S**ensing + **P**rocessing + **A**ctuation



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Urban Context Capturing

Limitations: Useful and Harmful



Context-awareness in Ubiquitous Services

- **P**ersonal Context
 - e.g. sleeping, eating, standing, running, walking, moving, stopping, ... etc.
- **G**roup Context
 - e.g. group meeting, discussion, sports, ad hoc chatting, lecture, ... etc.
- **U**rban Context
 - e.g. City-wide context
 - blackout area, rain, hot spots, traffic jam, train accident, social events, ... etc
- **N**ation-wide Context
 - e.g. population distribution, power distribution, ... etc



My Sports Pals (www.mysportspals.com)

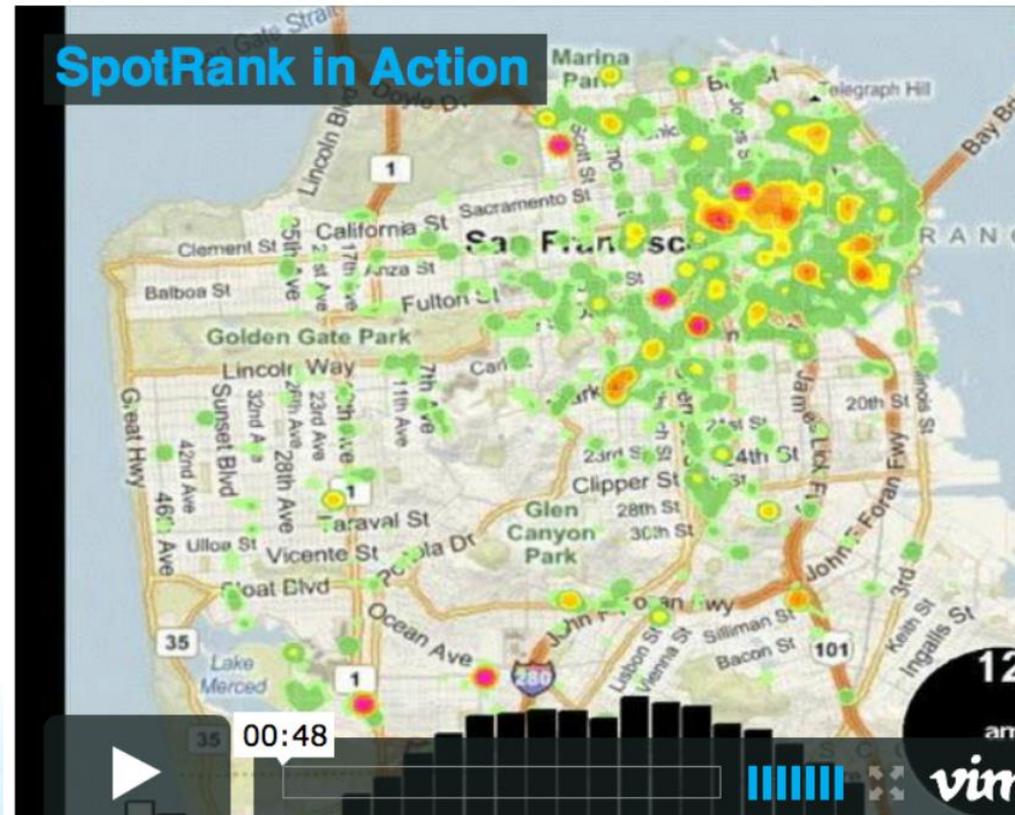
The screenshot displays the My Sports Pals website interface. At the top, the logo "my sport pals" is accompanied by a silhouette of a runner. The main heading reads "Where are your sport pals?" with the subtitle "Find the right place to make your own sport by your mobile". Below this, there are search input fields for "Barcelona" and "Spain", and a "Go!" button. The central part of the interface is a map of the Barcelona region, overlaid with several heatmaps in shades of blue, green, and yellow, indicating areas of high activity for different sports. The heatmaps are concentrated around major urban centers and specific areas like the coast and the mountains. The map includes labels for various towns and cities in both Japanese (e.g., タラサ, サバテイ, ルビー, バダロナ) and Spanish (e.g., Terrassa, Sabadell, Rubí, Badalona). Navigation controls like a compass and zoom buttons are visible on the left side of the map.



SkyHook's SpotRank

(<http://www.skyhookwireless.com>)

SpotRank In Action





NTT DoCoMo (Mobile Space Statistics(2010))

社会の発展に寄与するモバイル空間統計

参考出展

- モバイル空間統計は、人口分布、人口構成、移動人口などの推計値です。
- 携帯電話サービスをお客様に提供するために必要となる運用データを統計化することによって作成します。
- まちづくり、防災計画などの公共分野で活用されることにより社会の発展に寄与します。



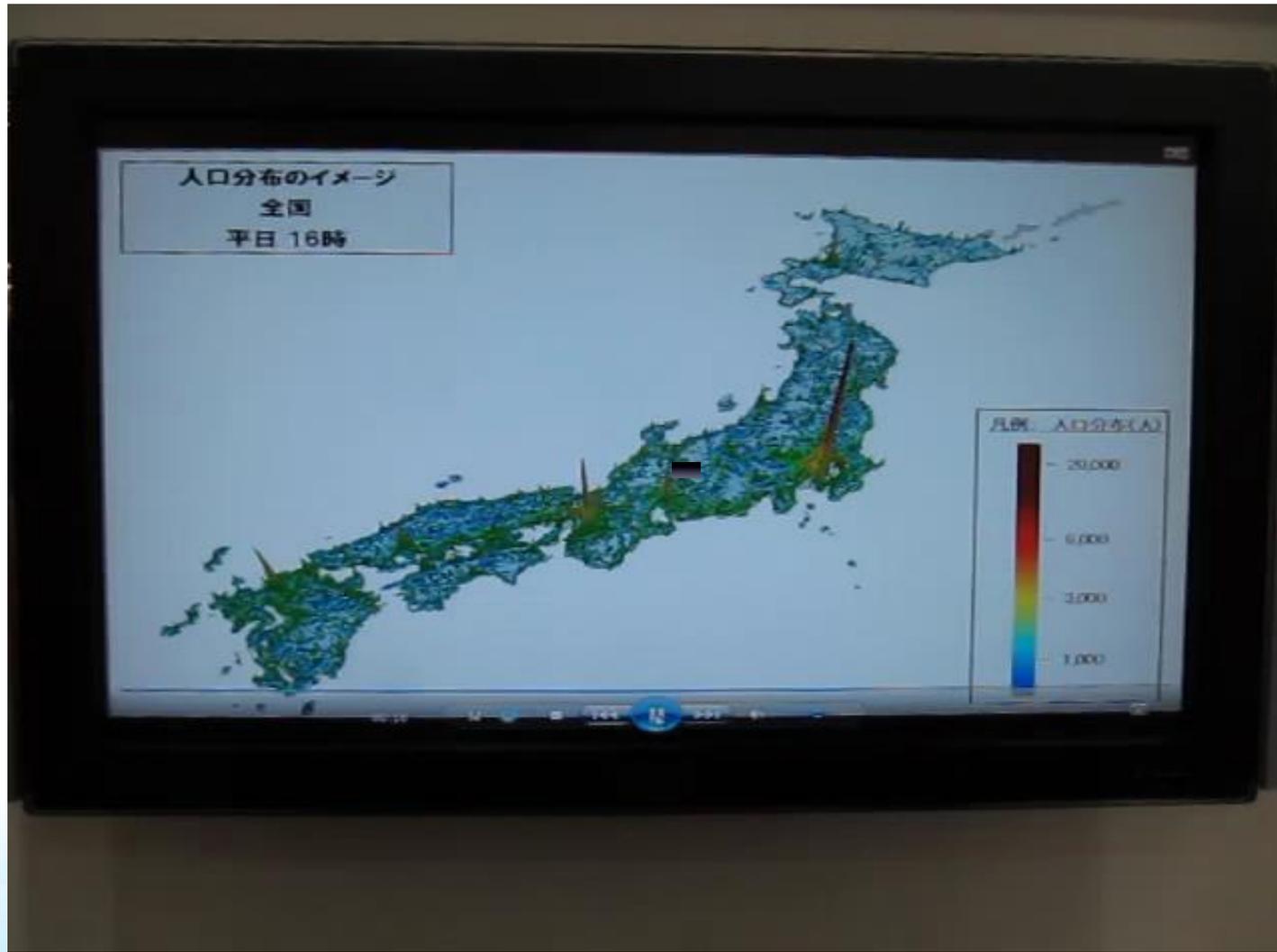
COP
COS

docomo

2012



Mobile Space Statistics (2010)





Limitations: Useful and Harmful

- Anonymity Set and Privacy Enhancement
 - Visualization Problem: Density vs. Actual Data
 - Sport Pals: No cycling path
 - Small Anonymity Set Problem
- Data Accuracy
 - Mobile Statistics/Skyhook
- Real-Time Sensing/Processing/Actuation
 - Mobile Statistics
- Target Users
 - City Planner vs. Individual



Urban Context Capturing Possibilities



Weather News: Hybrid Sensing Model

Defense forces for Guerrilla Thunderstorm

ゲリラ雷雨から国民を守る
ゲリラ雷雨防衛隊

⚡ ゲリラ雷雨防衛隊とは？
各エリアの代表として、ゲリラ雷雨を起こす雷雲を監視。ゲリラ雷雨情報の情報源を提供する専門部隊です。

⚡ 隊員のミッション

ステップ1 雲の監視を依頼
ゲリラ雷雨発生の可能性があるときに、ウェザーニュースからゲリラ雷雨防衛隊に雲の監視を依頼

ステップ2 雲を監視&レポート
隊員は雲を監視し、レポートを送る

ステップ3 レポートを分析
ウェザーニュースにて、雲のレポートを分析

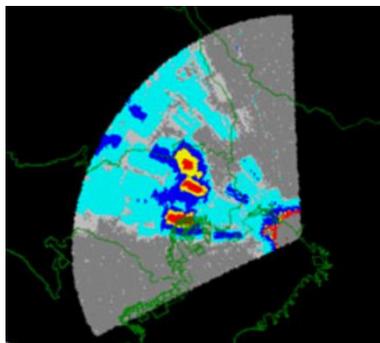
ステップ4 ゲリラ雷雨メールを配信
ゲリラ雷雨の発生前にゲリラ雷雨メール登録者にお知らせリアルタイムのゲリラ雷雨予報にも活用

あなたの“五感”がみんなを救う
防衛隊員はケータイで写真を撮影、方位磁針を使いながら、雷雲の状態をレポートすることはもとより、人の“五感”による感覚の情報もレポートします。
この“五感”が従来の観測では捉えることができないゲリラ雷雨を事前に発見することにつながります。

ゲリラ雷雨防衛隊へ入隊



Weather News: Better Prediction



・ 昨年の「ゲリラ雷雨メール」実績

各都府県	ゲリラ雷雨 発生数	ゲリラ雷雨 捕捉率	ゲリラ雷雨メール 事前送信時間
東京都	172回	76.7%	平均38分前
大阪府	128回	62.5%	平均8分前
愛知県	172回	63.9%	平均19分前



Electricity Consumption: Improving Citizen's awareness



projects

LINKが取り組んでいるプロジェクトです。

SFC Power Awareness Campus Project

SFCの消費電力をモニタリングし、可視化することで、電力予測、節電通知、意識向上など、SFC全体の電力awarenessの向上に貢献しています。



Airy Notes

ユビキタス技術で環境を感じよう！

電車を降りた瞬間むっとした熱風を感じてうんざりするような日でも、新鮮な空気を吸えればひんやりとしたさわやかな空気の流れを感じることができる。これは、都市の豊かな緑と水のはたらきによるものです。近年の調査では、緑地が周辺地域に冷涼な空気を送り込み、都市気候の緩和に貢献する都市のクールアイランドであることも明らかになっています。

“Airy Notes”プロジェクトでは、新宿御苑100周年記念イベント「玉川上水の復活に向けて」の一環として、ユビキタス技術による都市環境モニタリングの実証実験をおこなっています。センサー機能を持つ超小型コンピュータによるユビキタス（いつでもどこでも）な環境情報の取得と可視化により、緑地の環境を視覚的に身体的に感じてもらうことをわらわらとしたものです。



uPart



紙シェルター

uPart (165個)

温度、湿度、振動センサを備え、観測データを定期的に無線通信で発信する。最大約 3cm 四方程度の超小型コンピュータです。

雨水缸でつくられたセンサの日よけ。表面に貼られた QR コードを使い、観測地点からその uPart の観測値にアクセスすることができます。

計測・発信と受信の機材



xbridge (11箇所)

uPart から送信された観測データを受信し、データベースサーバに送ります。

ドイツ・カールスルーエ大学で開発された超小型コンピュータと受信の機材を用いています。

環境情報の可視化と共有

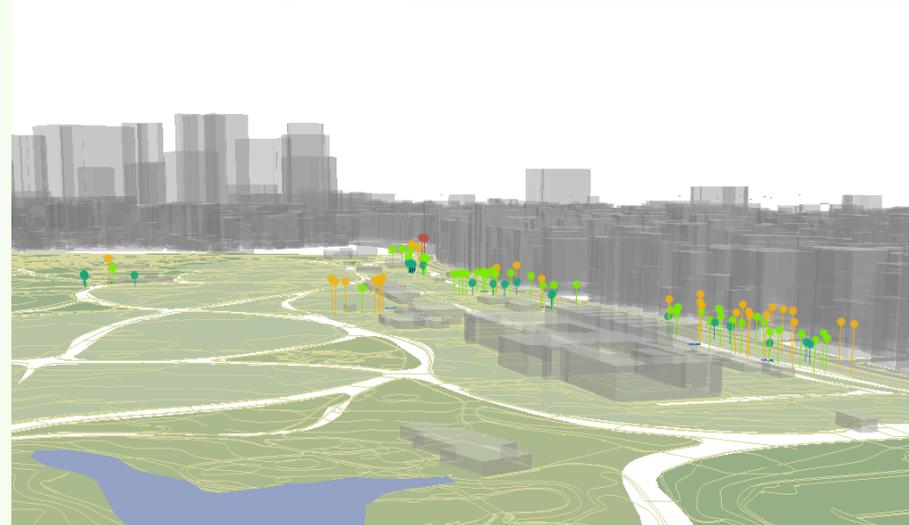
今、自分のいる場所の気候は他の地区とは？ 昨日のこの時間は？ もし、ここに水が流れていたら？ もし、この緑がなくなってしまうたら？ ちいさな子供の想っている環境は？... 設置した多数のセンサの観測値が、インターネットを通じて即時にデータベースまで送り届けられる。“Airy Notes”は、さまざまな条件下の気象情報を可視化し、比較、共有するためのシステムとしての展開することを構想しています。

Airy Note 体験エリア (写真提供)

この実証実験を体験することができるのは、以下のエリアです。また、ぜひお越しください。

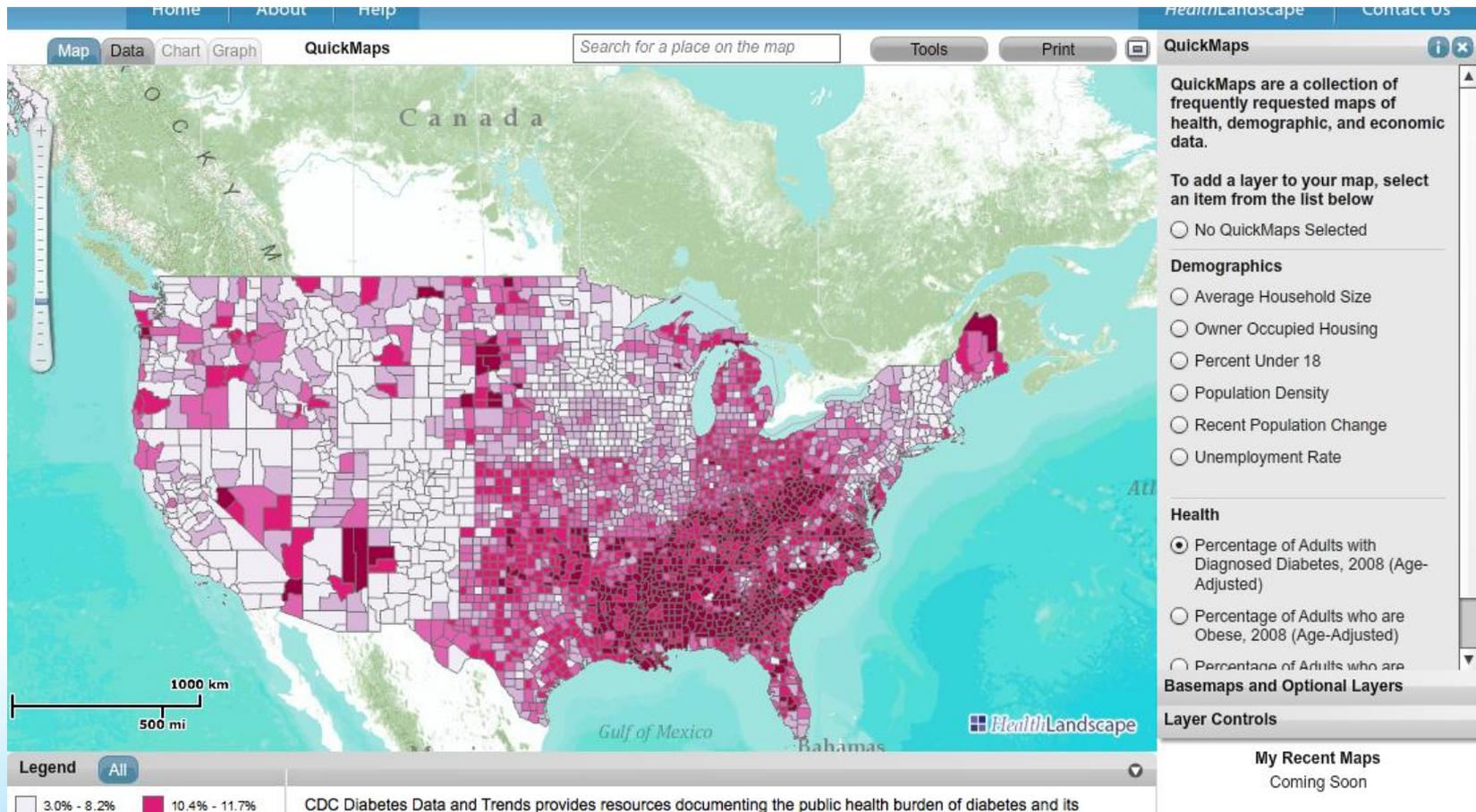
観測地点とネットワーク構成

センサ (uPart) の観測値は、インターネットを通じて即時に収集され、いつでも最新の情報を見ることが出来るようになっています。





HealthLandscape (www.healthlandscape.org)





Possibilities: Big Potentials

- **Improved Data Accuracy and Prediction**
 - Use of Physical Sensors with Human Sensors
 - Hybrid Sensing Model with Crowdsourcing
- **Human as a Sensor**
 - Crowdsourcing with Gamification
- **Tweet as a Sensor**
 - Geo-tagged Tweets
- **Real-Time Dynamic Event Analysis**
 - Prescheduled event vs. Dynamic Event
- **Open data as a Sensor**



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- **Place-triggered Geotagged Tweets Analysis**
 - Case Study
- Summary



Detection, Classification and Visualization of Place-triggered Geotagged Tweets

- Shinya Hiruta ⁽¹⁾
 - Takuro Yonezawa ⁽¹⁾
 - Marko Jurmu ^(1,2)
 - Hideyuki Tokuda ⁽¹⁾
- ¹Keio University, ² University of Oulu



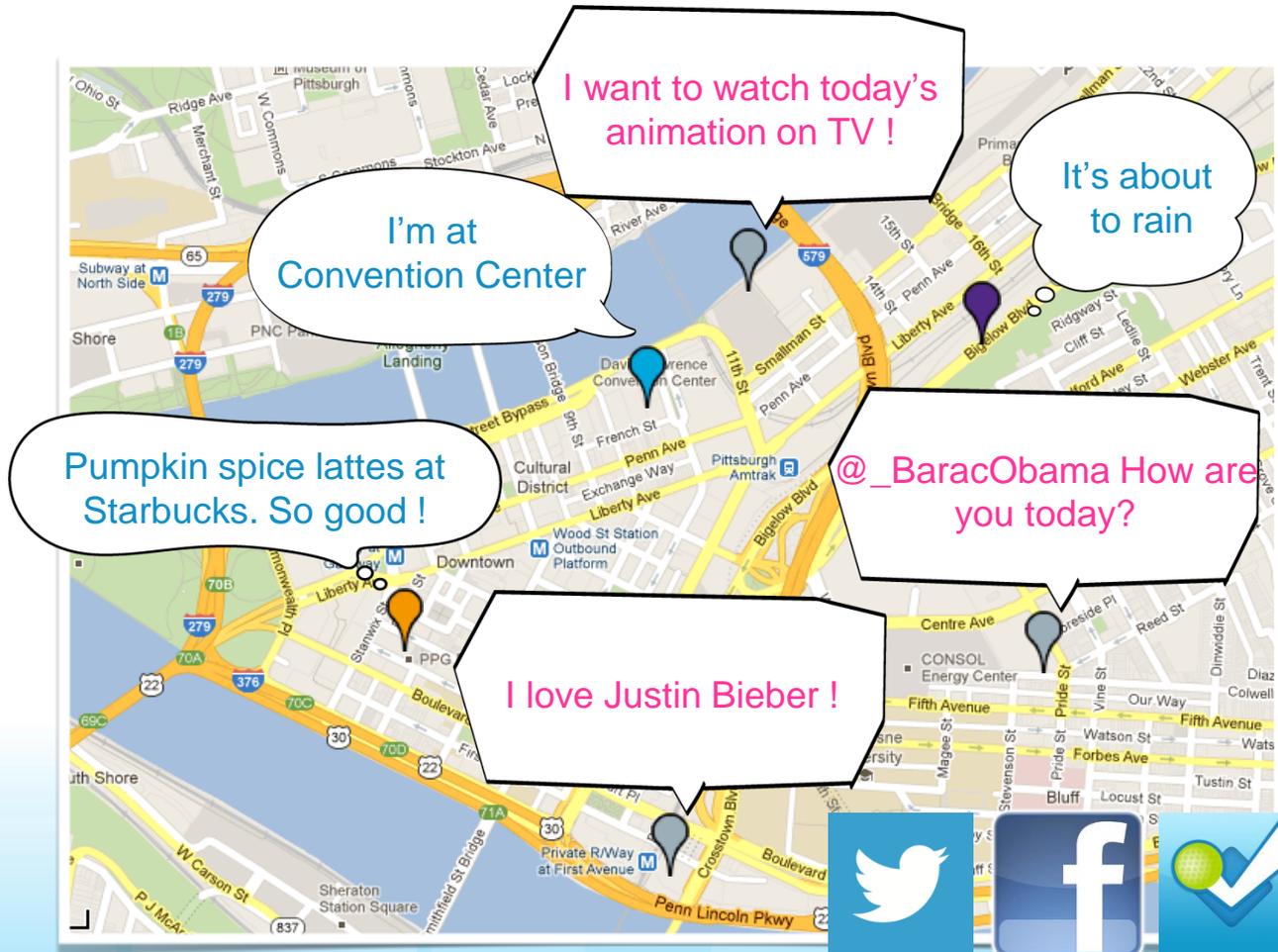
Background: Real World Event Detection with Location-Based Social Networks

- Real world event
- Structured as a collection of descriptive attributes
 - e.g. Place, Time, Content, ...
 - “Baseball game will be held at PNC park from 6:00 PM”
- However, attributes are often dynamic
 - e.g. Baseball game that gets postponed because of rain
 - e.g. A traffic accident occurring on a way and causing traffic congestion
- LBSN are suitable for extraction of dynamic information





Motivation: Geotagged tweets are not always useful for real world event detection!



Useful Tweets

Content is related to the location

Unuseful Tweets

Content is NOT related to the location



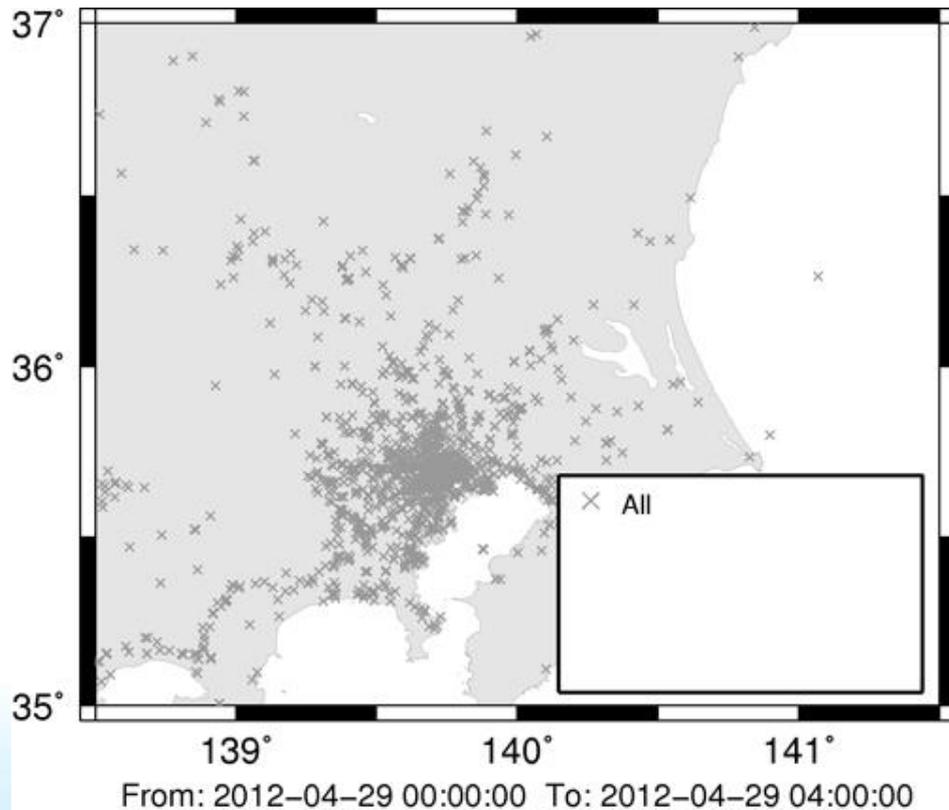
Place-triggered Geotagged Tweets

- Definition
 - Tweets that have both:
 - Geotag metadata
 - Content relevant to the associated location
- Research Goal
 - Detection
 - Classification
 - Application

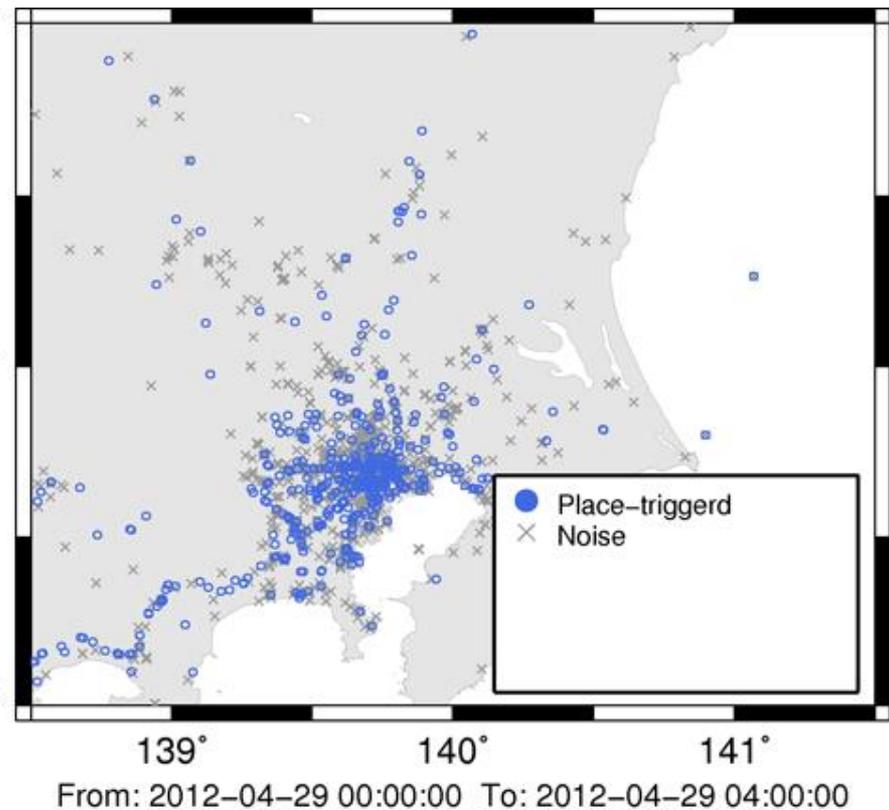


Detecting Place-triggered Geotagged Tweets

Without our system



With our system

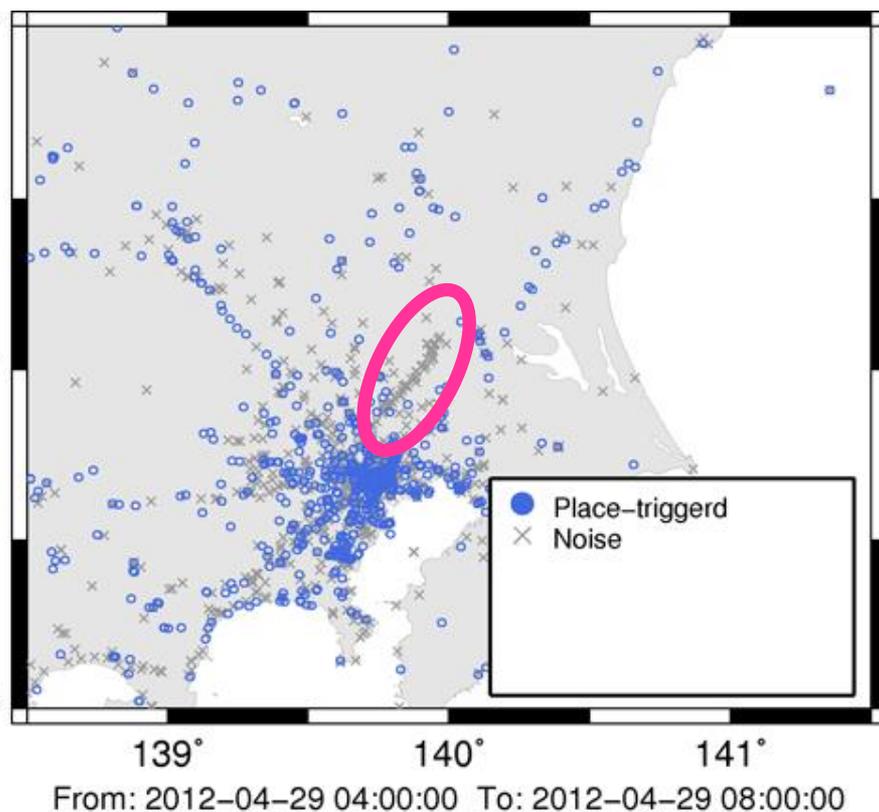
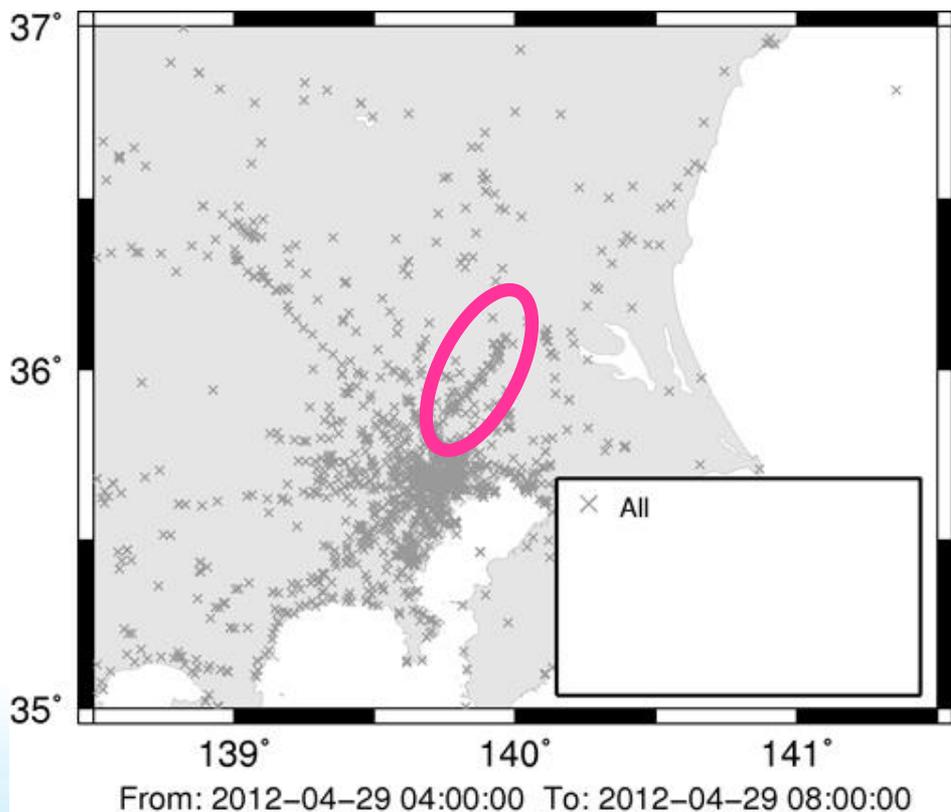




Detecting Place-triggered Geotagged Tweets

Without our system

With our system

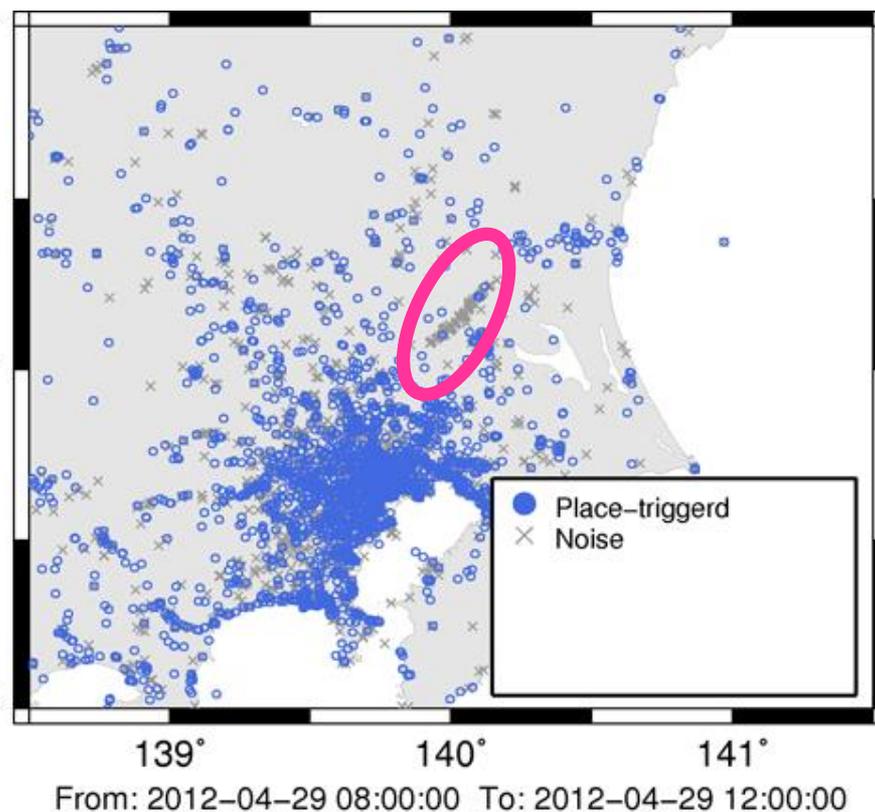
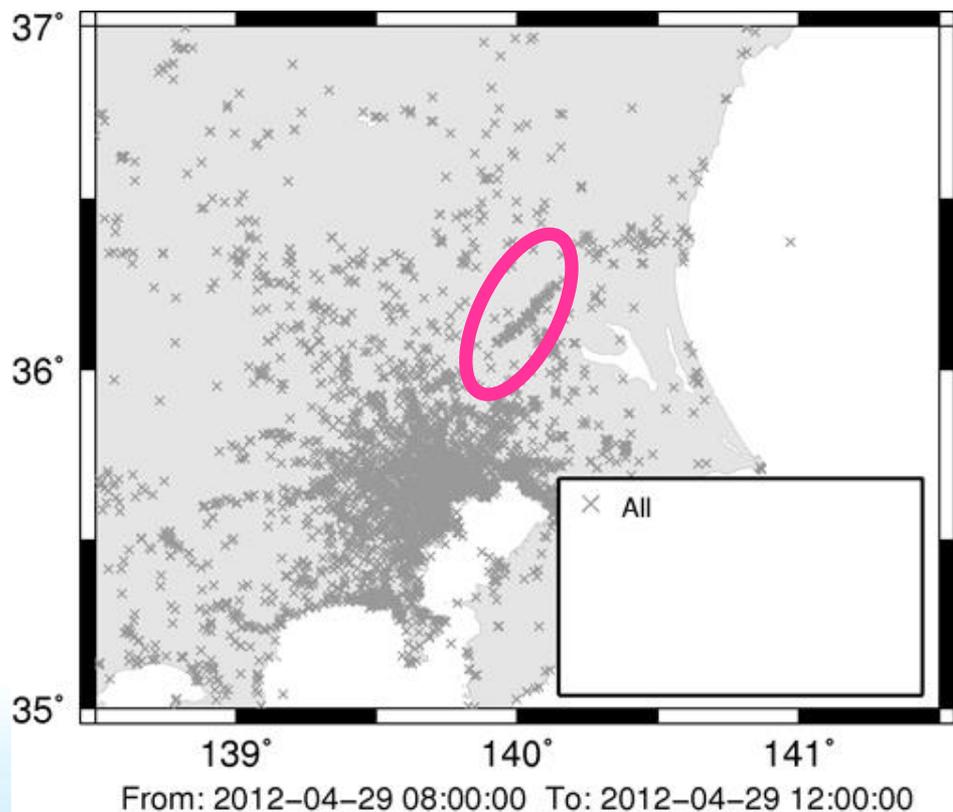




Detecting Place-triggered Geotagged Tweets

Without our system

With our system

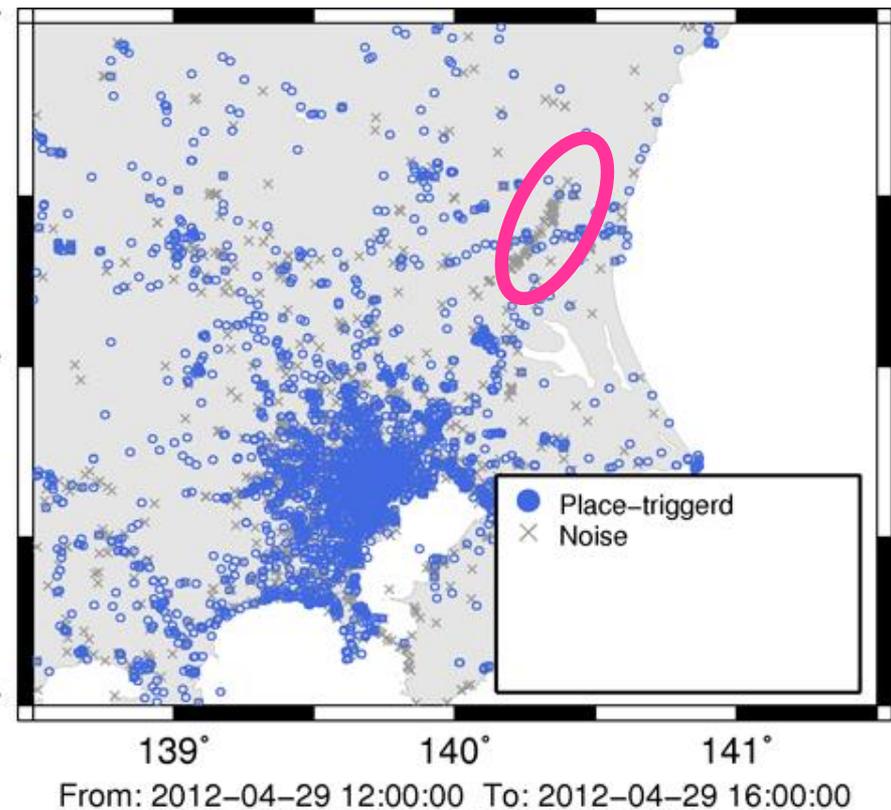
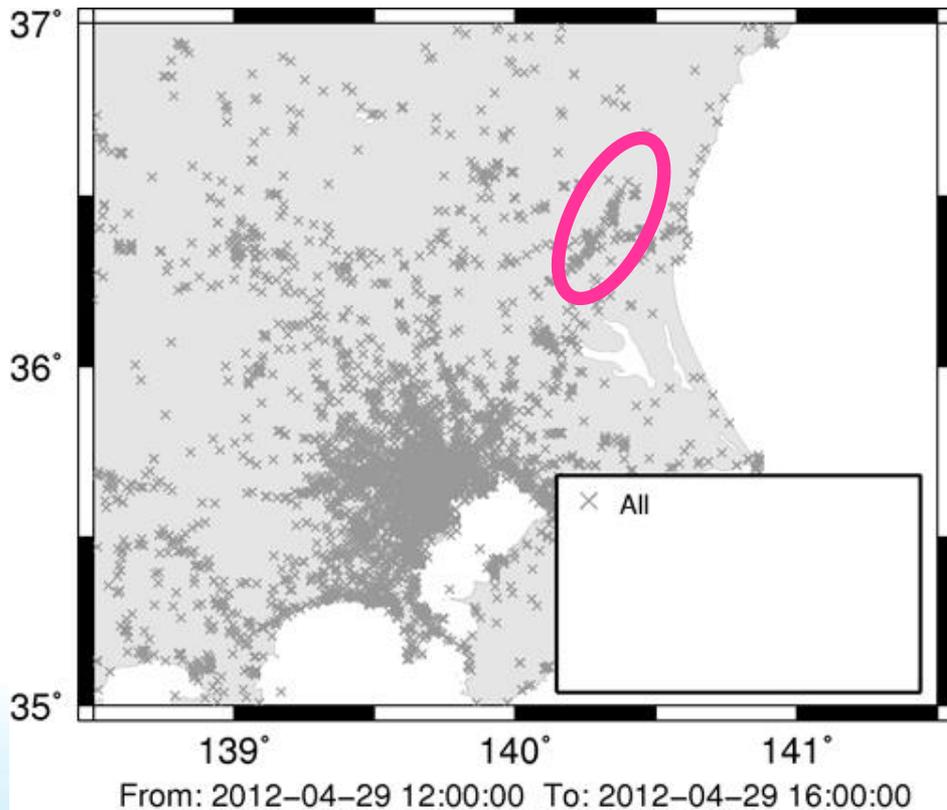




Detecting Place-triggered Geotagged Tweets

Without our system

With our system

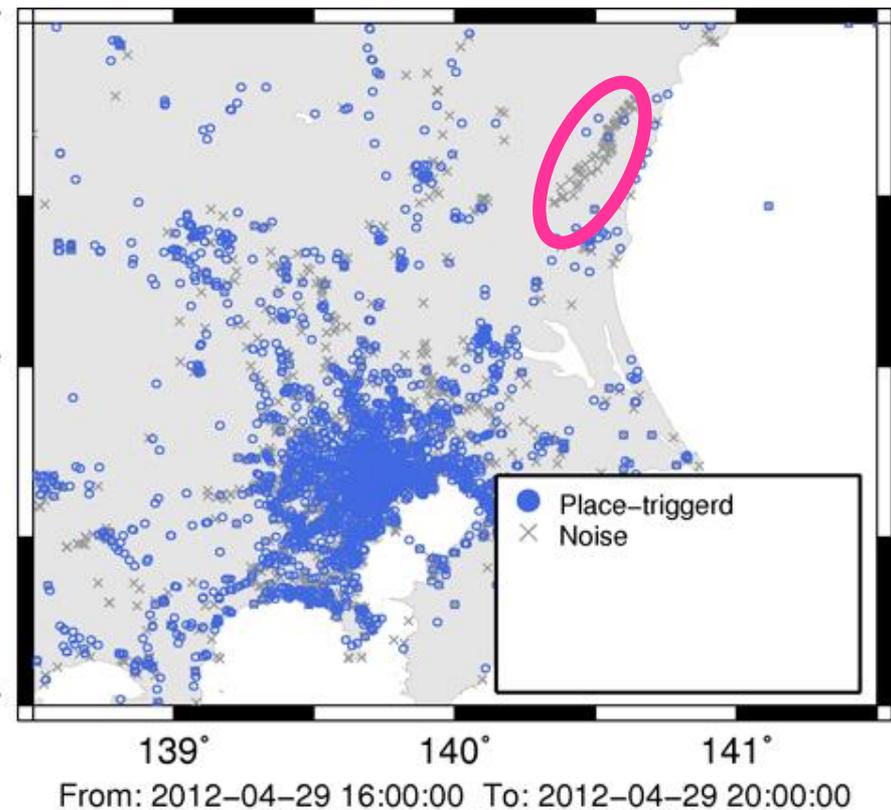
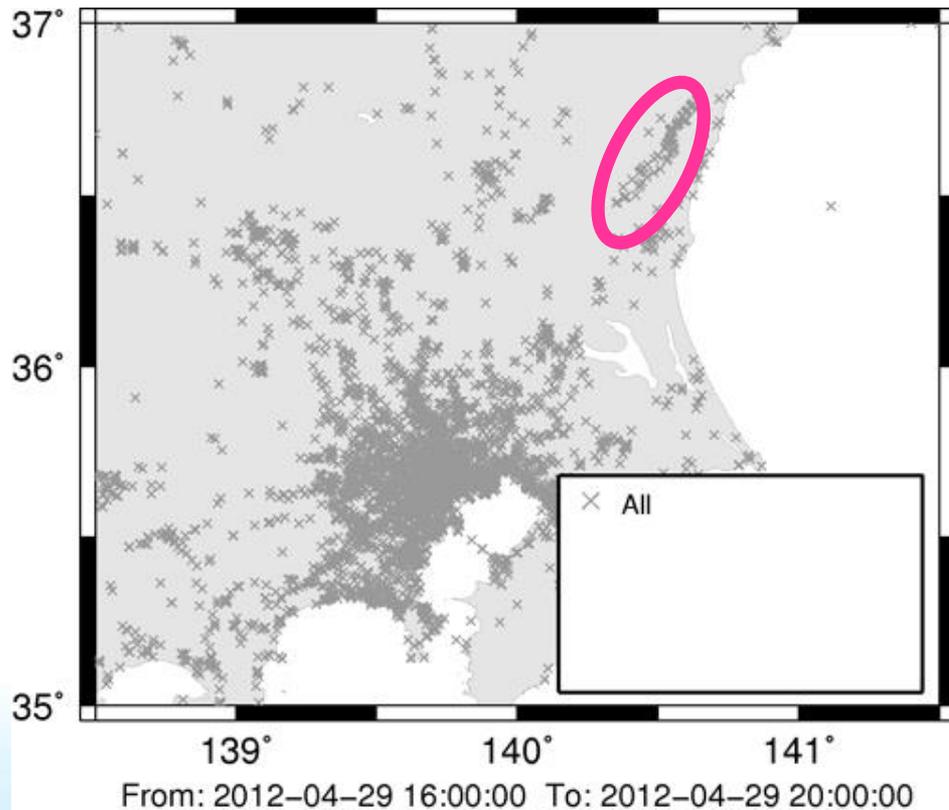




Detecting Place-triggered Geotagged Tweets

Without our system

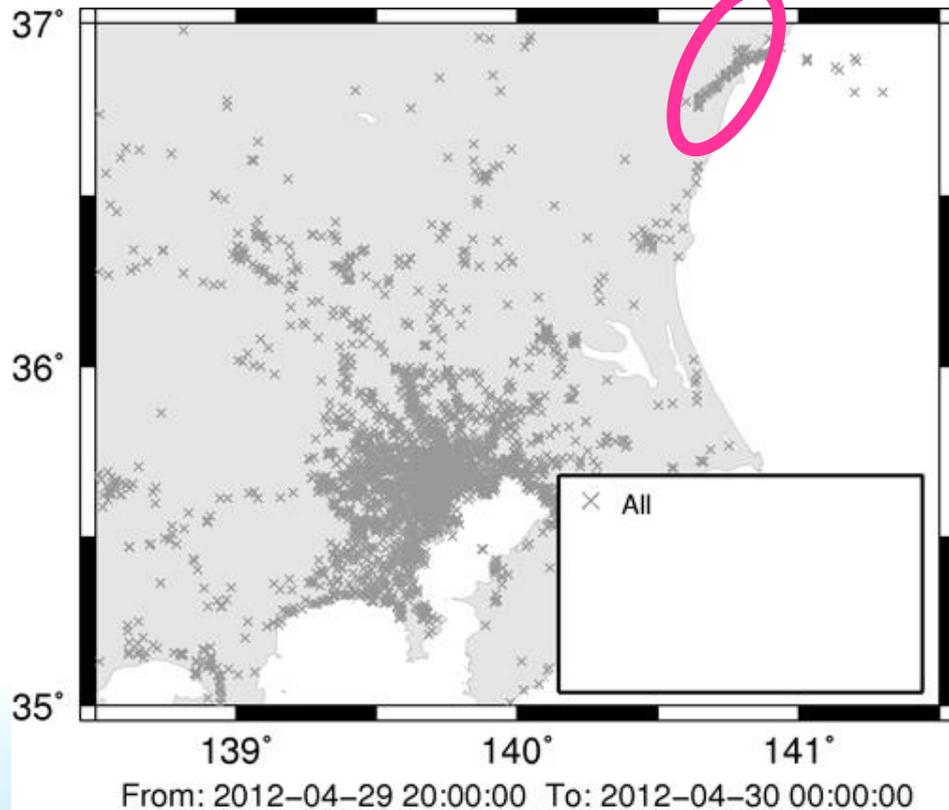
With our system



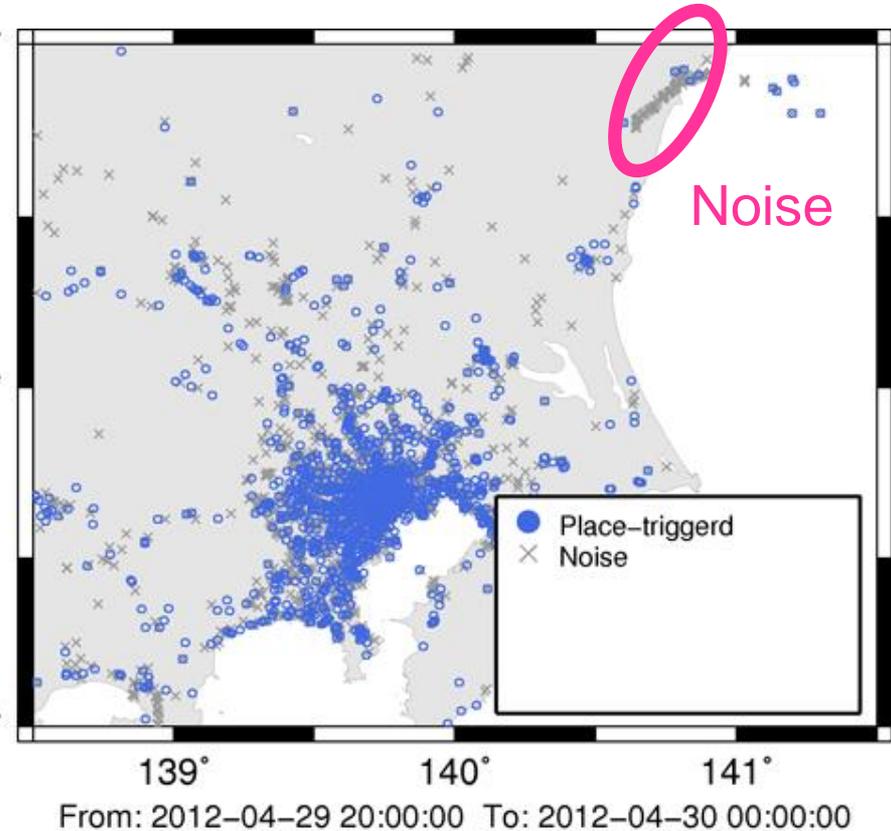


Detecting Place-triggered Geotagged Tweets

Without our system



With our system



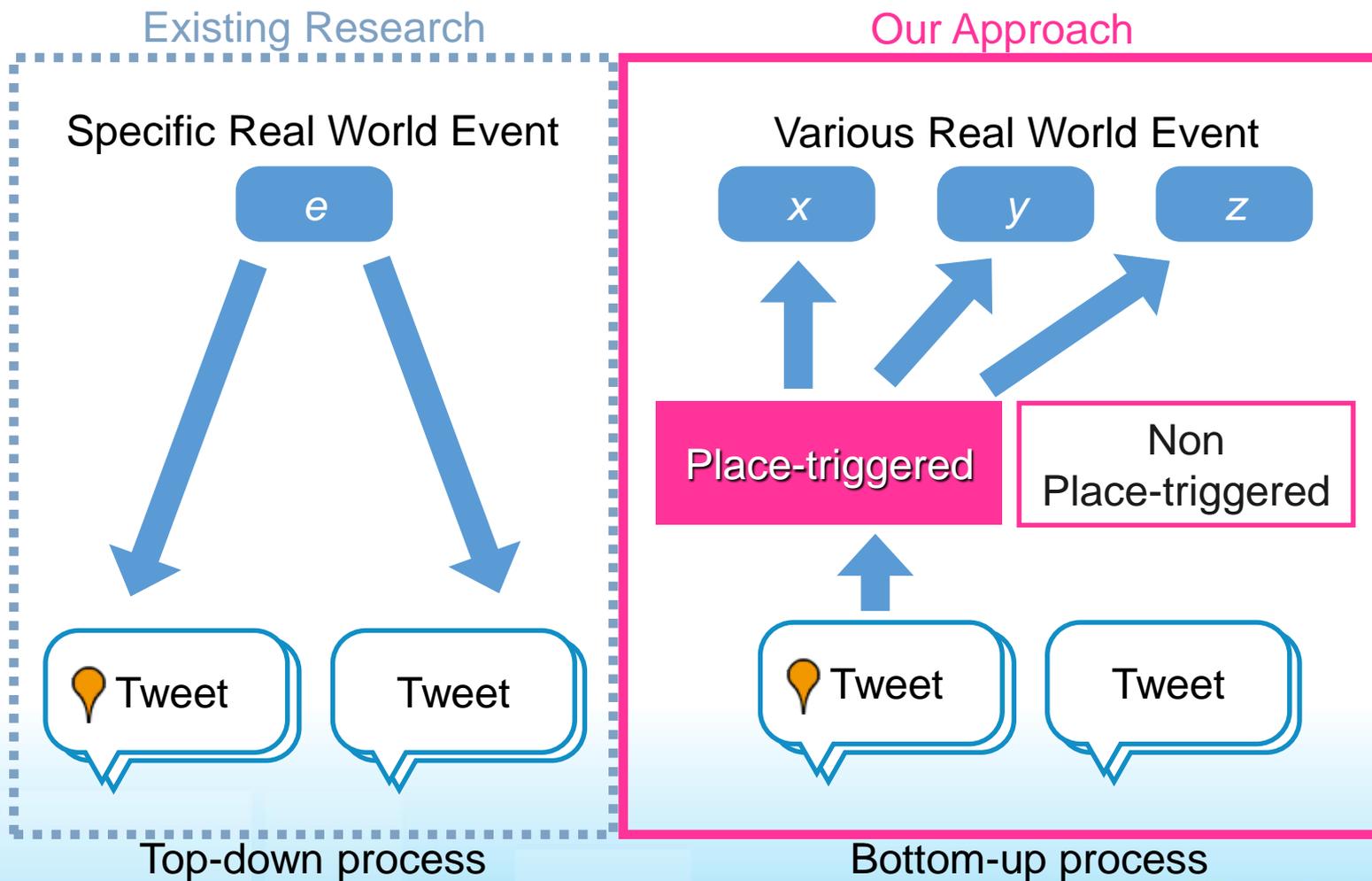


Related Work

- Earthquake shakes twitter users: Real-time event detection by social sensors.
 - T. Sakaki, M. Okazaki, and Y. Matsuo.
In Proceedings of the 19th International Conference on World Wide Web, pages 851–860, 2010.
- Measuring geographical regularities of crowd behaviors for twitter-based geo-social event detection.
 - R. Lee and K. Sumiya.
In Proceedings of the 2nd ACM SIGSPATIAL International Workshop on Location Based Social Networks, pages 1–10, 2010.

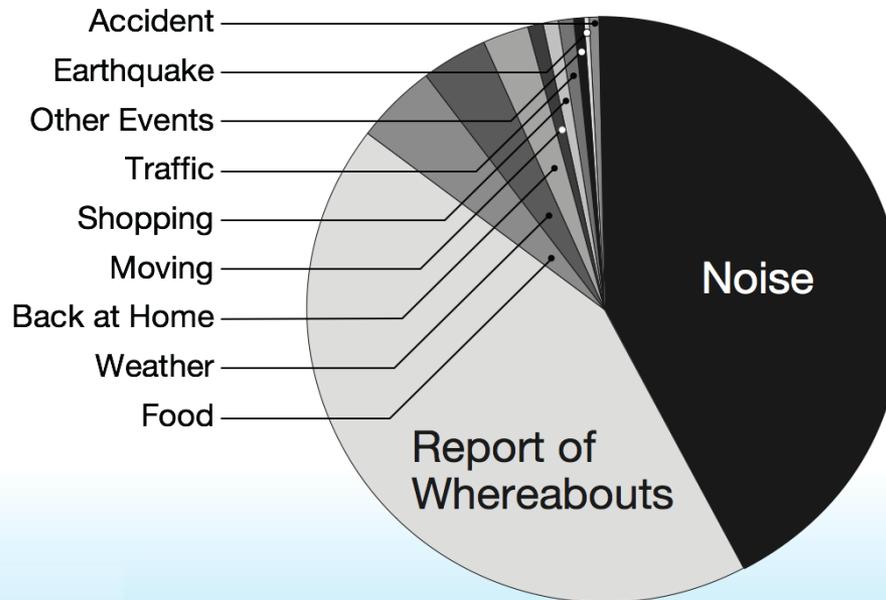


Comparison with Related Work



Preliminary Survey

- Geotagged tweets in Twitter around Japan
- Period: From 2011-11-21 to 2011-12-31
- Number of sample: 2,000
- Classified these tweets to certain types based on their content



Most of the tweets (42.5%) were classified as noise



Classification of the Place-triggered Geotagged Tweets

- Classified to Five types:
 - Report of whereabouts
 - A tweet that user refers to his/her current location
 - Food
 - A tweet where user shares information regarding current food or drink
 - Weather
 - A tweet about weather of the location
 - Back at home
 - A tweet where user reports the fact that he/she is back at home
 - Earthquake
 - A tweet in which user reports the feeling of the earthquake

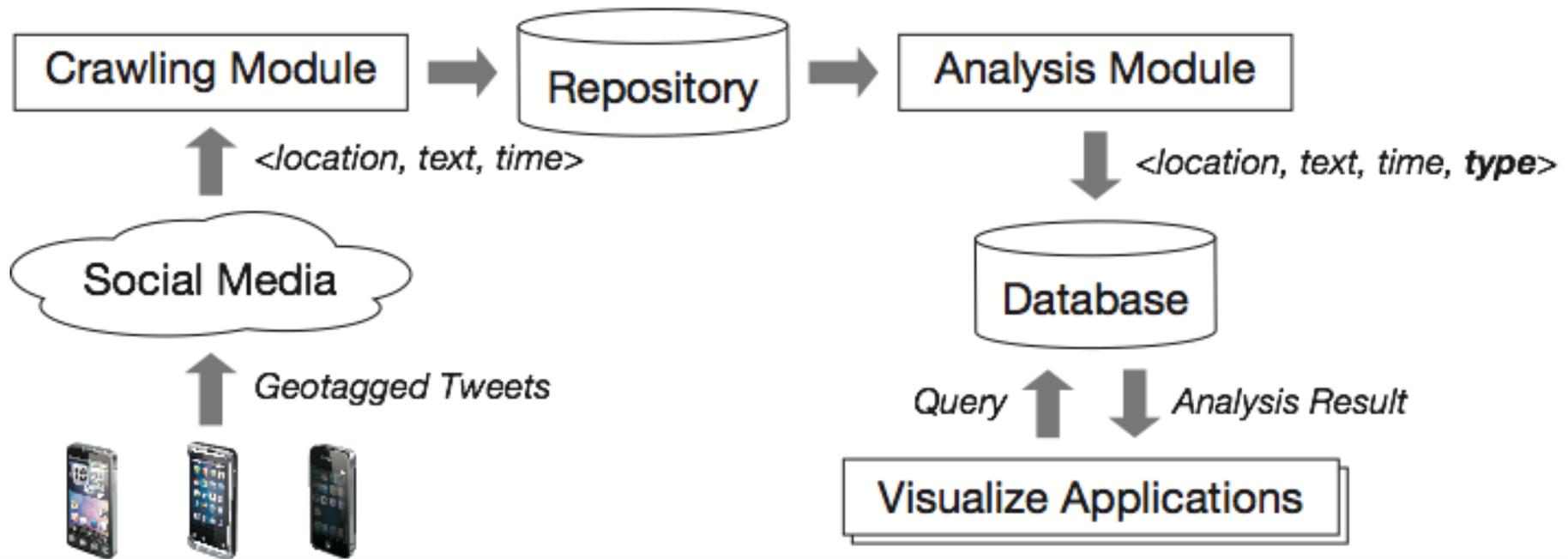


Approach

- How do we detect Place-triggered Geotagged Tweets?
- We started with straightforward approach
 - Report of whereabouts
 - Detecting checkin activity (Foursquare, Loctouch, Imakoko-now)
 - Food, Weather, Back at home and Earthquake
 - Naive keyword matching method with dictionary
 - We assume that people tend to classify tweets mainly by distinctive keywords

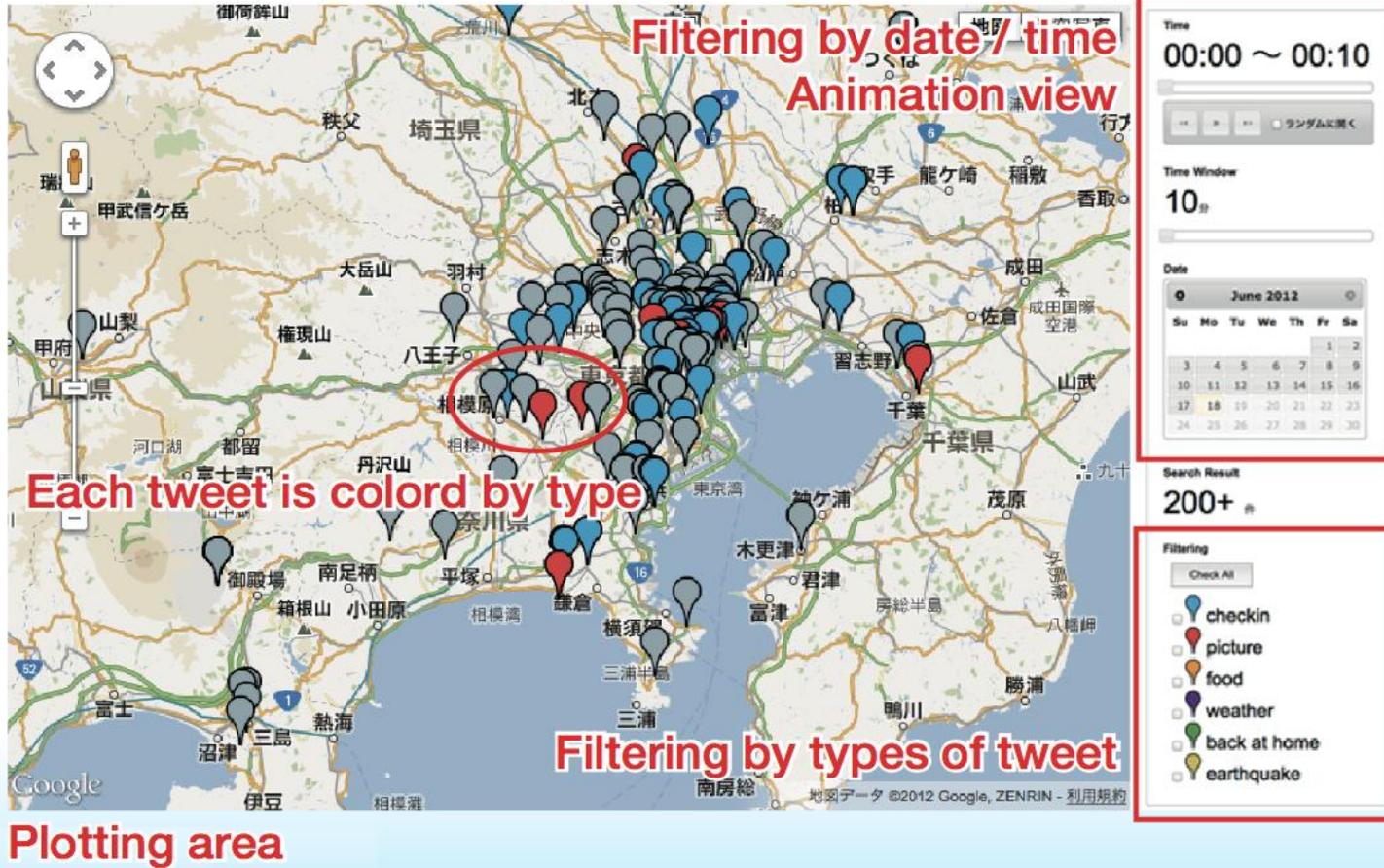


Design and Implementation





Interactive Visualization of Place-triggered Geotagged Tweets



March 14, 2012 without Food Filter

場所誘因型位置情報付き発言の検出と可視化

Detection and Visualization of Place-triggered Geotagged Tweets

[Top](#) | [Demo](#) | [解説](#)



時間帯

12:02 ~ 13:02

Navigation controls for the time range, including a slider and a button labeled "ランダムに開く" (Randomly open).

表示時間

60分

日付選択

March 2012						
Su	Mo	Tu	We	Th	Fr	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17

March 14, 2012 with Food Filter

場所誘因型位置情報付き発言の検出と可視化

Detection and Visualization of Place-triggered Geotagged Tweets

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時間帯

12:02 ~ 13:02



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60分



日付選択

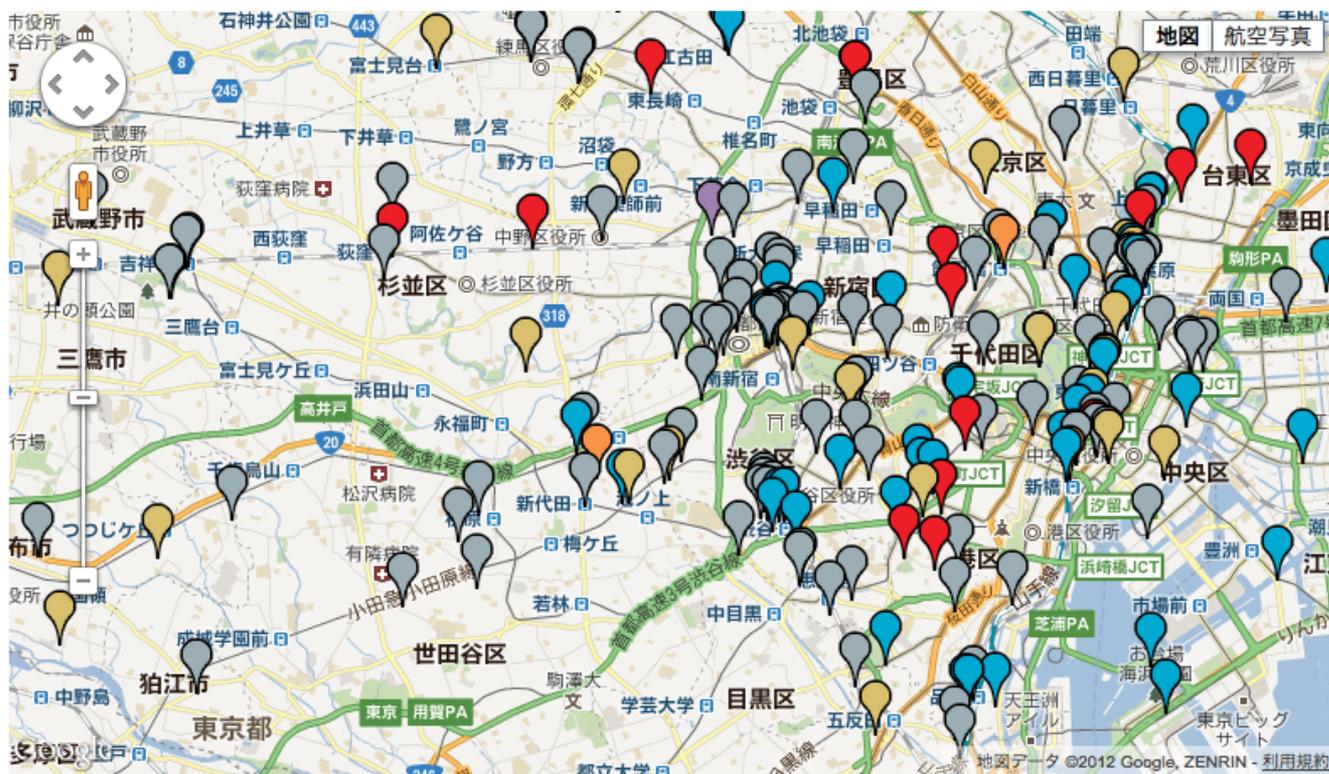
March 2012						
Su	Mo	Tu	We	Th	Fr	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17

March 14, 2012 without Earthquake Filter

場所誘因型位置情報付き発言の検出と可視化

Detection and Visualization of Place-triggered Geotagged Tweets

[Top](#) | [Demo](#) | [解説](#)



時間帯

20:30 ~ 21:30

<< >> ランダムに開く

表示時間

60分

日付選択

March 2012						
Su	Mo	Tu	We	Th	Fr	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17

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March 14, 2012 with Earthquake Filter

場所誘因型位置情報付き発言の検出と可視化

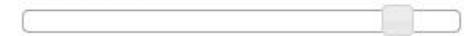
Detection and Visualization of Place-triggered Geotagged Tweets

[Top](#) | [Demo](#) | [解説](#)



時間帯

20:30 ~ 21:30



<< >> ランダムに開く

表示時間

60分



日付選択

March 2012						
Su	Mo	Tu	We	Th	Fr	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17						



Evaluation

- Methodology
 - Creating Ground-truth
 - Asked 18 third party people to classify tweets
 - 12 men in their 20s
 - 2 men in their 30s
 - 5 women in their 20s
 - Dataset
 - Geotagged tweets nearby Japan
 - Period: From 2012-01-01 to 2012-03-31
 - Total amount: 4,524,257
 - Each participants reviewed 500 tweets which were randomly sampled from the dataset



Evaluation Results

* Harmonic mean

Type of Tweets	Precision	Recall	F-measure
Report of whereabouts	93.18%	77.16%	84.42%
Food	53.6%	17.8%	26.7%
Weather	57%	21%	30%
Back at Home	54%	23%	32%
Earthquake	76%	66%	71%

Table 1. Classification result by the system

	Positive	Negative
TRUE	40.09%	False Negative 15.84%
FALSE	False Positive 2.18%	41.89%

Table 2. Accuracy rate of detecting place-triggered geotagged tweets



Future Work

- Expanding the classification
 - Expand to other countries
 - More complete categories
- Improving detection accuracy
 - Linguistic analysis, slang
- Discovering real events
 - Automatic event detection
 - Temporal-spatial analysis should be investigated



Conclusion

- Capturing Urban Context
 - Limitations: Useful and harmful
 - Anonymity Set and Privacy Enhancement
 - Visualization Problem
 - Small Anonymity Set Problem
 - Possibilities
 - Hybrid Sensing Model
 - Crowdsourcing and Gamification
 - Real-Time Dynamic Event Analysis
- **Place-triggered Geotagged Tweets Analysis**
 - Detecting Five types of the place-triggered geotagged tweets
 - Report of whereabouts, Food, Weather, Back at home and Earthquake
 - Showed that the system can detect place-triggered geotagged tweets with an overall accuracy of 82%

Thank you!

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