

Price of Sensor Data in Participatory Sensing

Yoshito Tobe

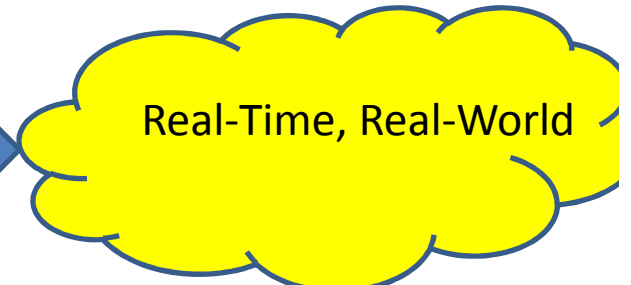
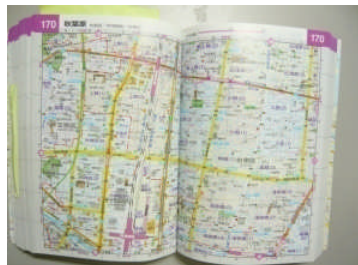
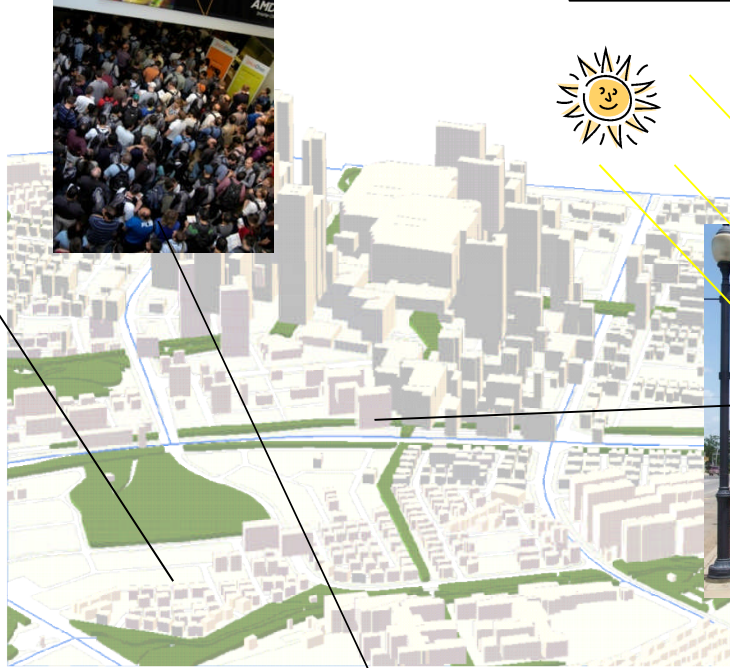
Aoyama Gakuin University

Japan

SENSORIZED City

Social Phenomena

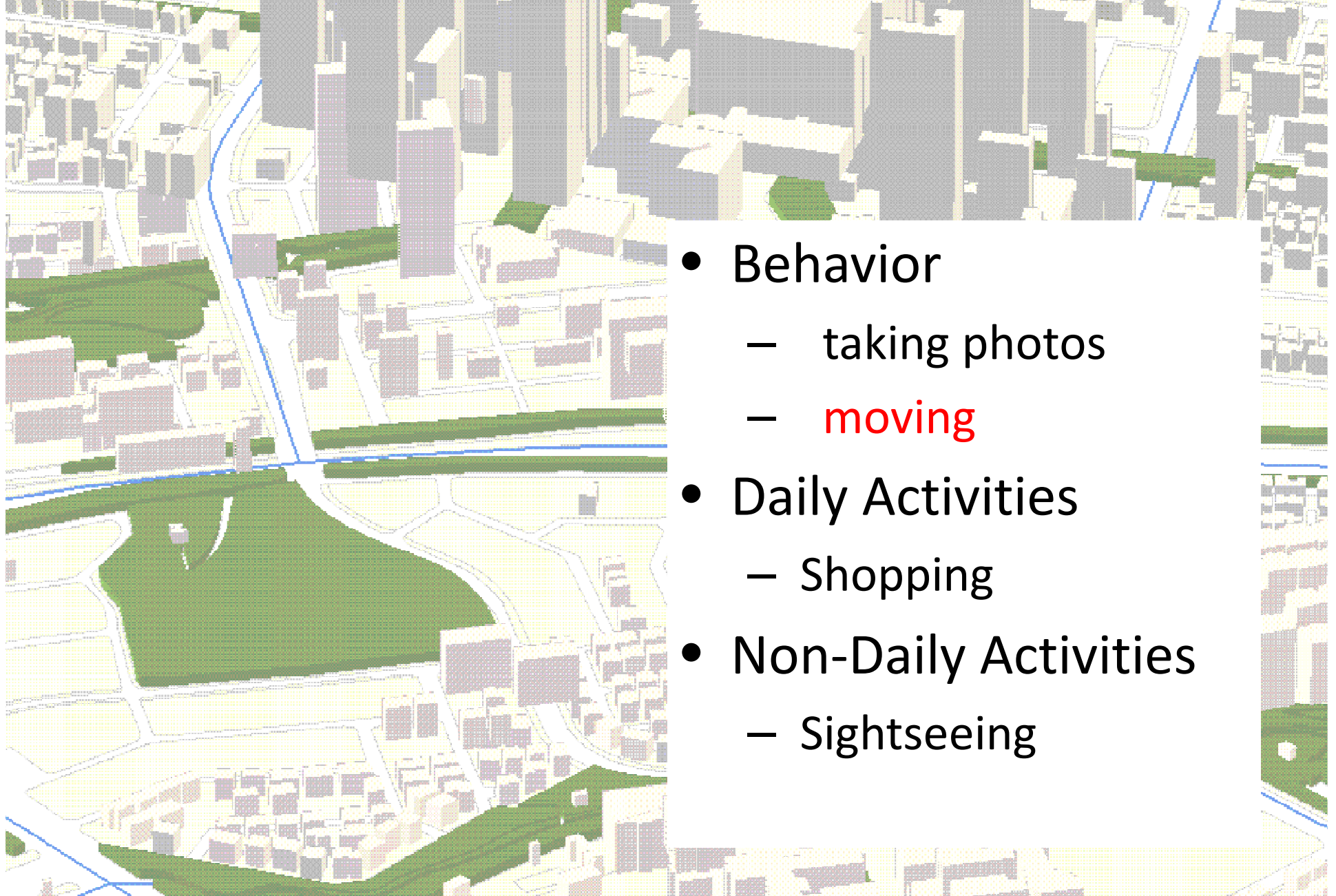
Natural Phenomena



Dynamic

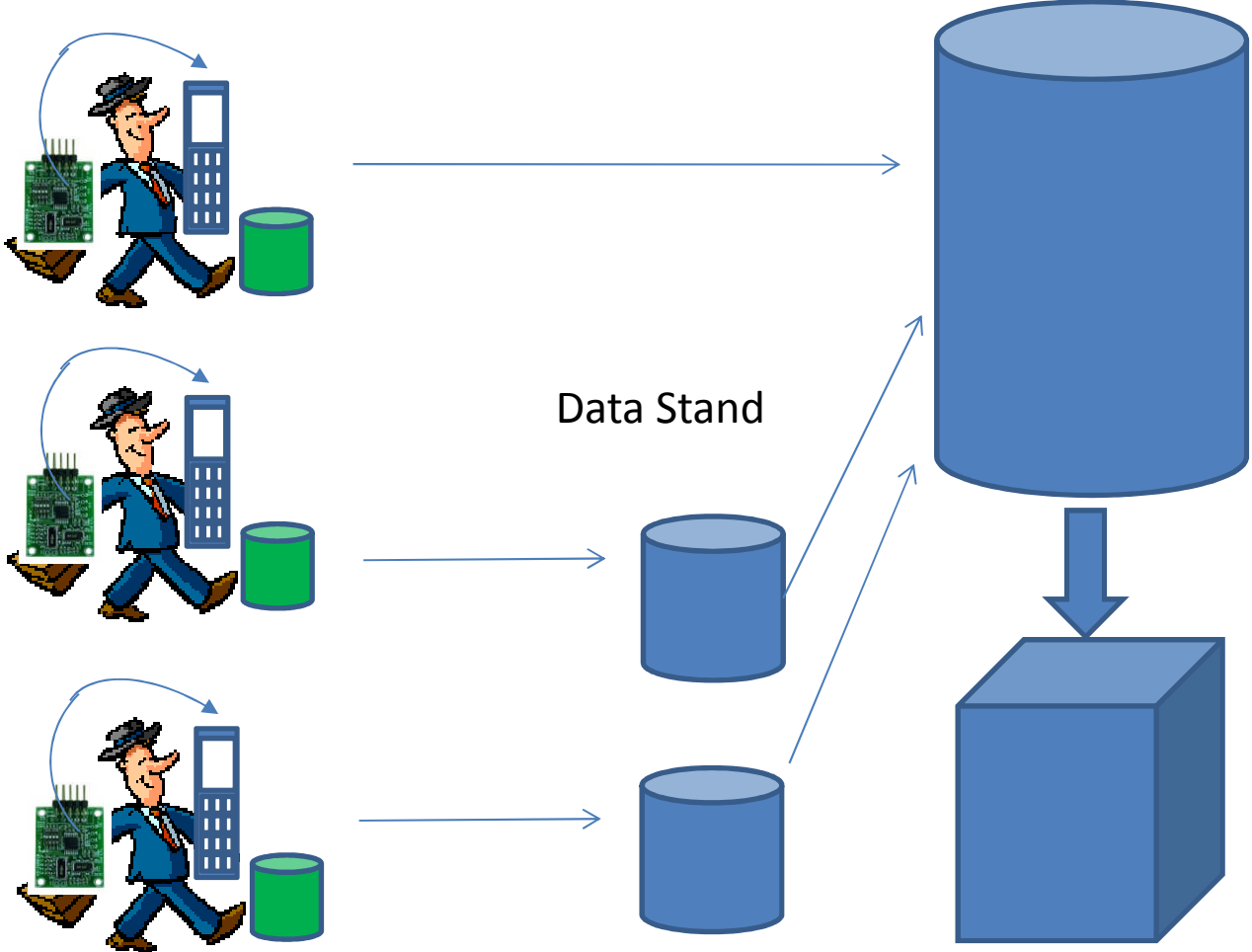
Real-Time, Real-World

Utilization of Human's Behavior



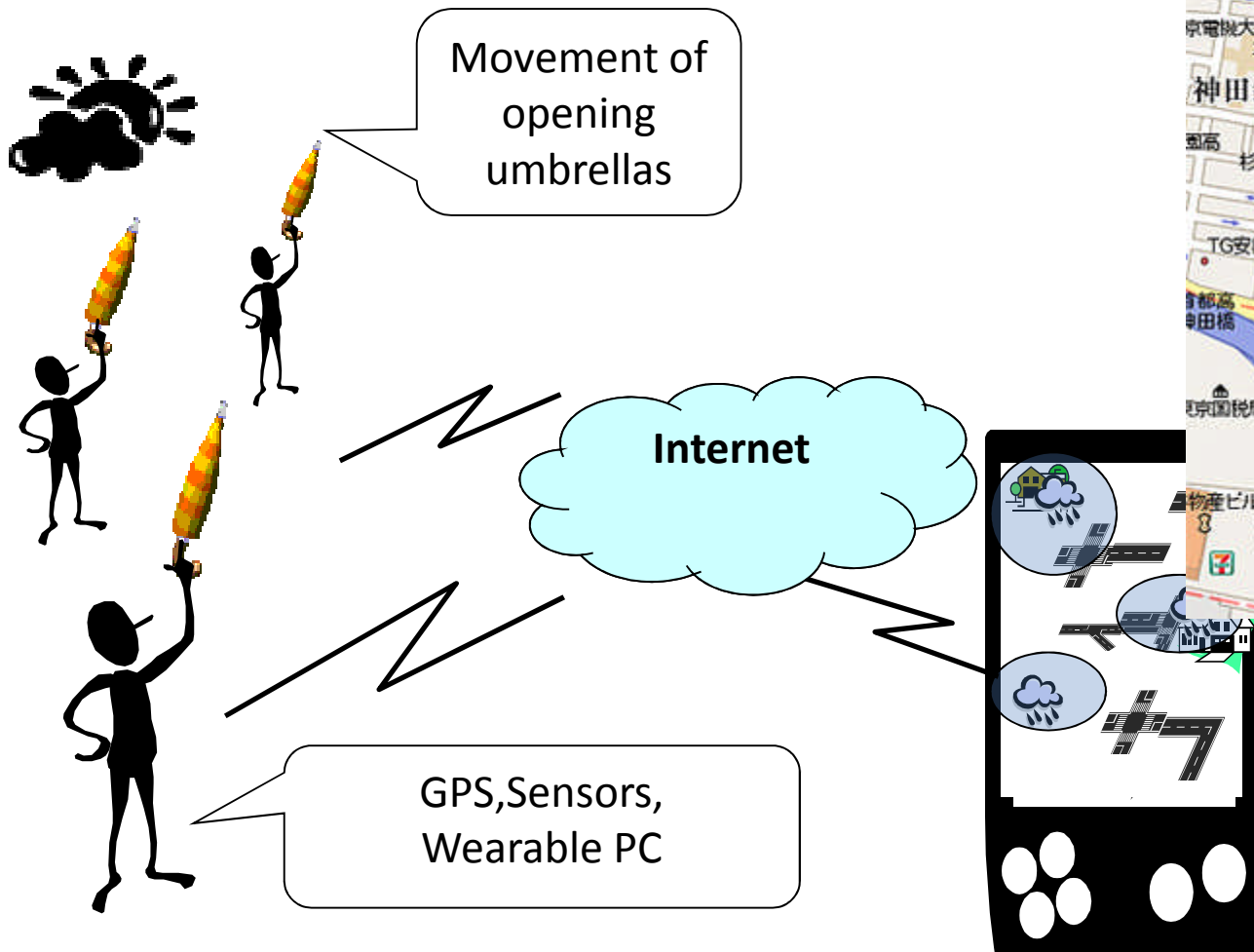
- Behavior
 - taking photos
 - **moving**
- Daily Activities
 - Shopping
- Non-Daily Activities
 - Sightseeing

Human Probes



Umbrella Human Probes

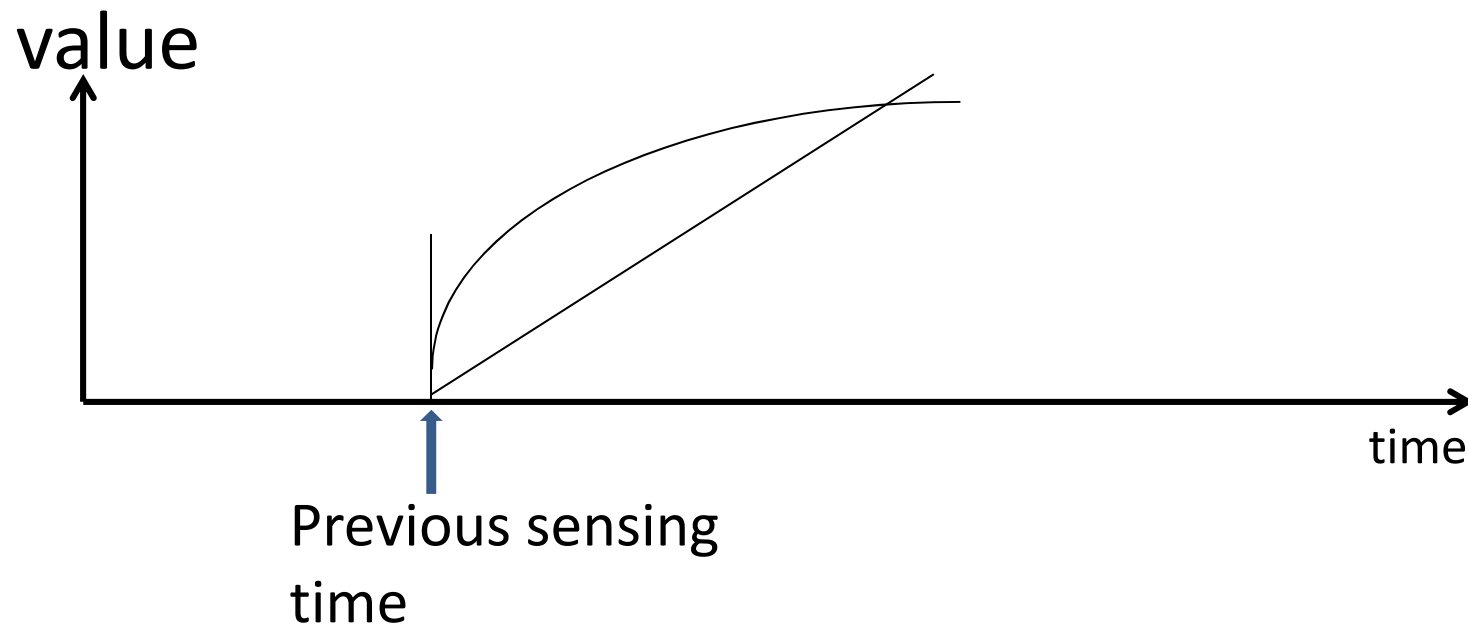
[TDU,2005]



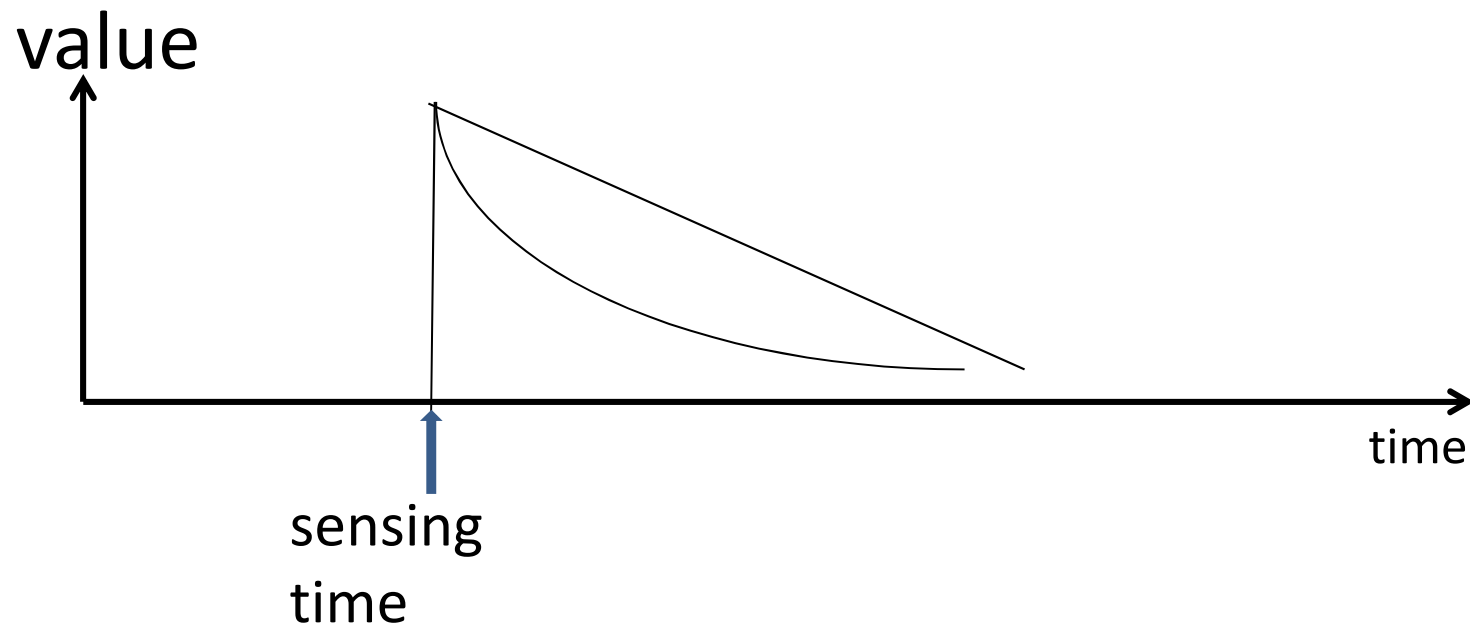
Value

- V1: Value of pre-sensed data with sensed time
- V2: Value of post-sensed data with elapsed time
- V3: Value of pre-sensed data in spatial correlation
- V4: Value of post-sensed data in spatial correlation
- V5: Value of pre-sensed data from demand
- V6: Value of post-sensed data from demand

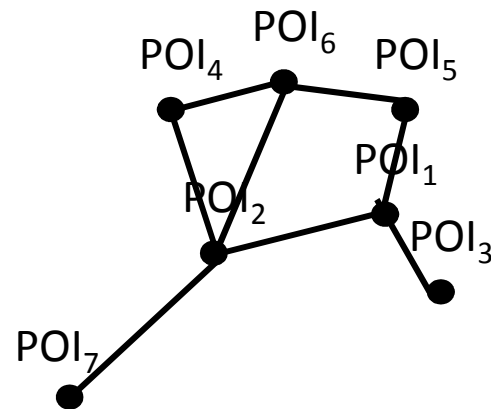
Value of pre-sensed data with sensed time



Value of post-sensed data with elapsed time

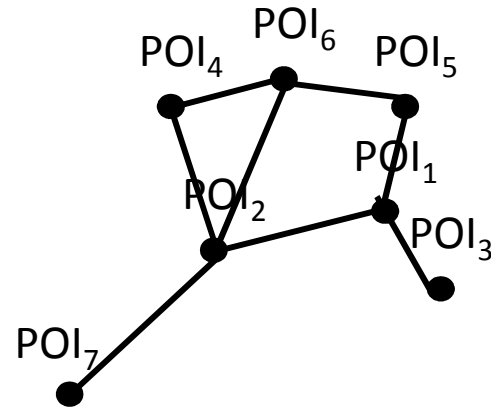


Value of data in spatial correlation



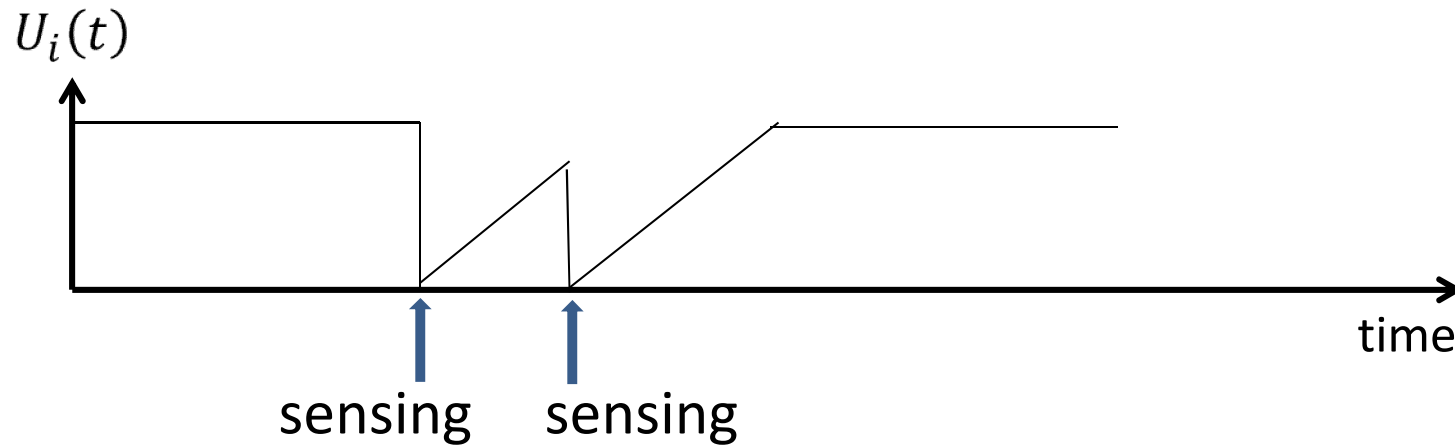
$$\text{Value}(\text{POI}_i) = \sum A_{ij} * \text{Value}(\text{POI}_j)$$

Value from Demand



Value(POI_i) = How much data(POI_i)
is requested

Utility Function



$$U_i(t) = \max(U_{min}, \min(U_{max}, a(t - t_i)))$$

$U_i(t)$ = Utility at POI i at time t

U_{min} = Minimum utility

U_{max} = Maximum utility

a = Constant

t = Current time

t_i = Latest sensing time at POI i

Panel SMART: Smart Environments: How Smart Can They Be?

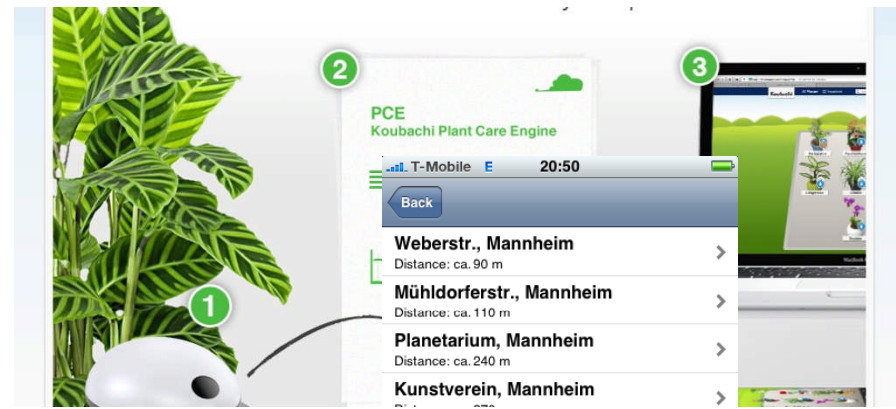
Michael Massoth

University of Applied Sciences Darmstadt
Department of Computer Science, Germany
SMART 2013, 25th June, Rome, Italy



We will become *smarter* 😊

- Remote tracking and control
- Location Based Services
- Mobile social networks
- Augmented Reality



Traffic will become **more safe**

- **Car2Car Communication**
<http://www.car-to-car.org/>



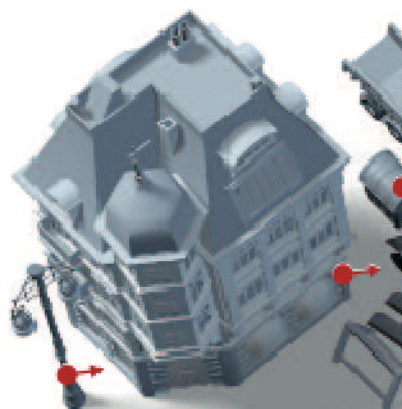
Industry will become **more safe**

- **Example: Collaborative business items (CoBis)**
<http://www.cobis-online.de>



Cities become more "intelligent"

- Smart-City-Concept
z.B. <http://www.sm>



Rund 10 000 Sensoren, verteilt an Hauswänden, Laternen, Masten oder im Straßenasphalt, messen Lichteinfall, Lärmpegel, Verkehrsaufkommen und melden Staus.

Taxis, Busse, Polizeiwagen geben ständig ihren Standort durch und übertragen Messwerte der jeweiligen Umgebung.



Smart Cities as source for Big Data



Problemstellen werden automatisch den zuständigen Stellen der Stadtverwaltung gemeldet.

logischen Vorgaben bewässern.

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Critical: Privacy and Data Protection

"Ubicomp might lead directly to a future of safe, efficient, **soulless**, and **merciless universal surveillance**" (Rheingold 1994)

..., these systems bring about so far **inconceivable** levels of surveillance, collection of personal data, their merging and continuous transfer and processing, **creating unprecedented threats to privacy and data protection** (Cas 2011)

- Cas (2011). Ubiquitous Computing, Privacy and Data Protection: Options and Limitations to Reconcile the Unprecedented Contradictions. In Computers, privacy and data protection: an element of choice. Springer Netherlands.
- Rheingold, H. (1994). PARC is Back. Wired 2.02. Available from http://www.wired.com/wired/archive/2.02/parc_pr.html

Risk: <http://pleaserobme.com>



Risk: <http://icanstalku.com>

The screenshot shows a browser window with the title "I Can Stalk U - Raising awareness about inadvertent information sharing". The address bar contains "http://www.icanstalku.com/why.php". The page features a dark background with a close-up of a human eye on the left. The main heading is "I Can Stalk U" with the subtitle "Raising awareness about inadvertent information sharing". A navigation menu includes "Home", "How", "Why", "About Us", and "Contact Us". The "Why?" section contains the following text: "Everyone loves to post things to their Twitter account. Every day, people post things about the minutiae in their lives, from where they had lunch to what their kids are doing. People also are using services that allow them to post photos of these things. Because after all, a picture is worth a thousand words and isn't limited to 140 characters. This seems great, but did you know that for a lot of folks, whenever they post a photo of their lunch or kids, also included in their thousand words are details about their exact location of where they took the photo?". A "Links" section lists: "Mayhemic Labs", "PaulDotCom", "SANS ISC", "Electronic Frontier Foundation", and "Center for Democracy & Technology". A blue vertical scrollbar is visible on the right side of the page.

Risk: Tracking devices

- <http://www.boycottgillette.com/>



Protection of Privacy ?



facebook

Mark Zuckerberg, Januar 2010, CEO & Founder, Facebook:

*People have really gotten comfortable not only sharing more information and different kinds, but more openly and with more people. **That social norm is just something that has evolved over time.***

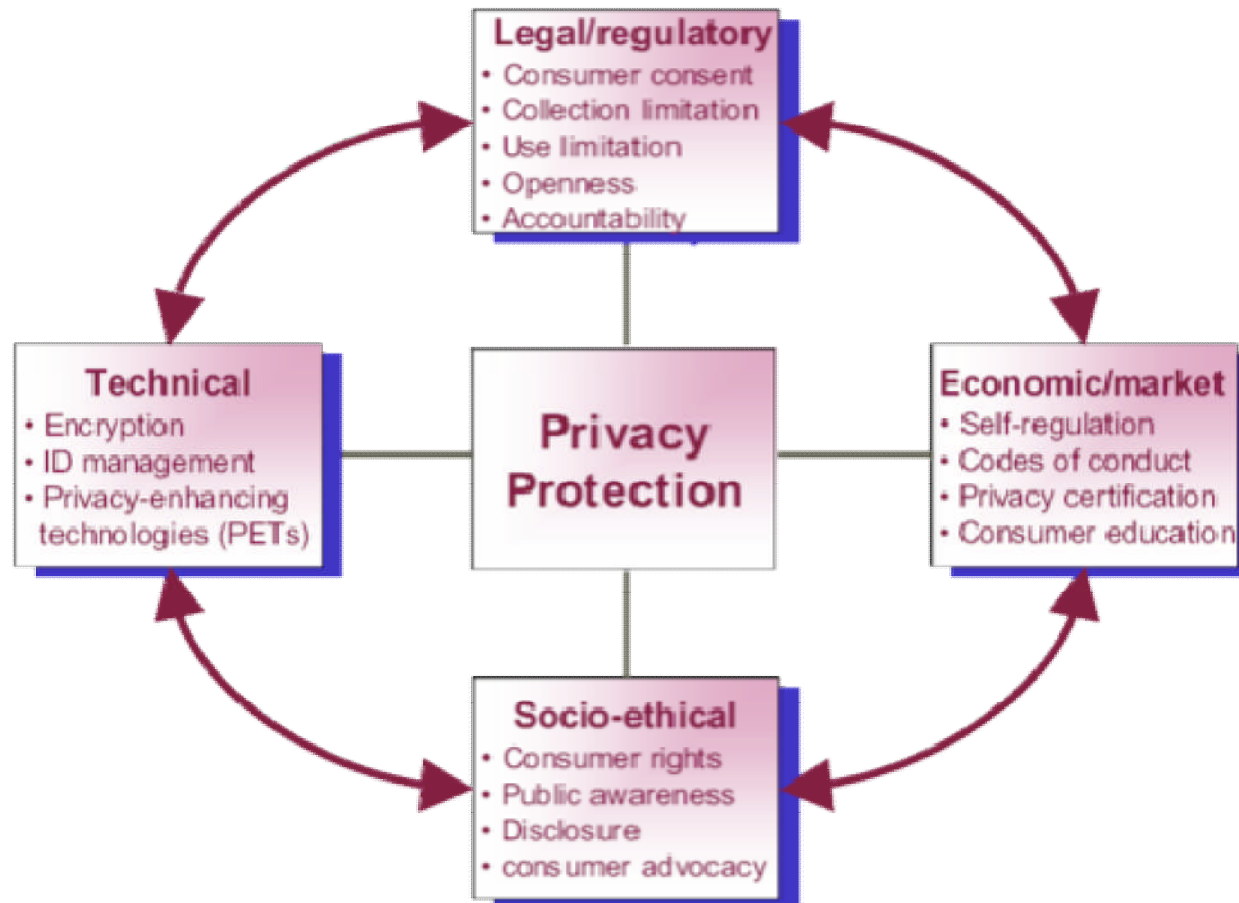


Google

Eric Schmidt, Dezember 2009, CEO, Google:

***If you have something that you don't want anyone to know, maybe you shouldn't be doing it in the first place.** If you really need that kind of privacy, the reality is that search engines – including Google – do retain this information for some time and it's important, for example, that we are all subject in the United States to the Patriot Act and it is possible that all that information could be made available to the authorities.*

Privacy Protection is interdisciplinary



Source: *The Internet of Things* - International Telecommunication Union (ITU) Internet Report, 2005

**THANK YOU VERY MUCH FOR
YOUR ATTENTION!**



Any Questions



Panel SMART: Smart Environments: How Smart Can They Be?

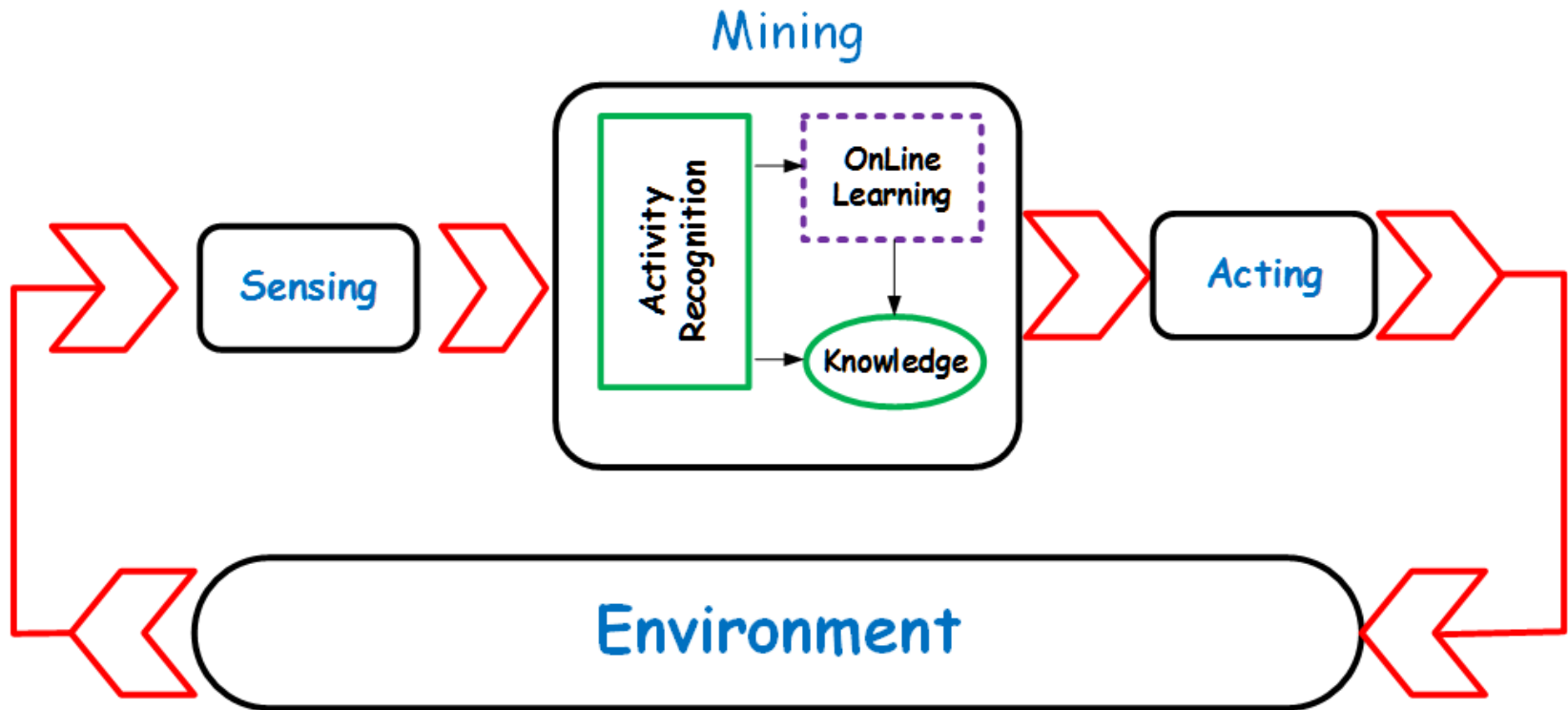
Mining process in SE ?

Abdenour Bouzouane
abdenour.bouzouane@uqac.ca

Université du Québec à Chicoutimi, Canada

Built-in mining cycle

- Systematic integration of the mining process in every daily life objects !



The dilemma...futur ?

- Many research projects with great results but there does not seem to be a system:
 - ❖ Learns quickly from few examples ?
 - ❖ High accuracy and independance of the domain ?
 - ❖ Delivers an understandable user profile ?
 - ❖