Citizens as Sensors:
One Step Up on the VGI Ladder

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Volunteered Geographic Information (VGI)

1. Internet
   The basis

2. Web 2.0
   Opportunity

3. People
   Data providers

4. Mobile
   Motivating

5. GPS
   Spatial aspect

6. Websites
   Data implosion

Problem Definition

Results and Discussion

Conclusion and Future Work
Volunteered Geographic Information

“A range of geo-collaboration projects in which individuals voluntarily collect, maintain and visualize information”.

(Thatcher, 2013)
Problem Definition

Source of Information

Providing better solutions for other users to take that action as an expert

Source of experience

Mining the information collected by a group of users who are experts in a specific spatial action

Understanding quality

Extracting the experience that exists in the volunteered geographic information provided by experts in a specific action

VGI

4
Volunteered Geographic Information

An effort made to use VGI towards the belief that:

“GI science deals with the formal modelling of spatial process and interaction of humans with the environment in space and time”.

(Frank, 2000)

- Volunteered Geographic Services (VGS)
- Extracting large-scale patterns through correlating spatial data obtained from the general public and human social behavior
VGI, Spatial Cognition and Experience

• **VGI** is more based on human cognition than on measurement
  – Degree of truth rather than accuracy
  – Credibility
    • Believability
    • Trustworthiness
    • Expertise

Users’ experience has a direct effect on the reliability of the collected information.
VGI, Spatial Cognition and Experience

- **VGI** is collected by people who live in the environment
  - Interaction with environment through spatial cognition

- A cognitive map that contains
  - Spatial elements
  - Experience on how to take an action
VGI, Spatial Cognition and Experience

Static sensors

+ GPS

Carryable sensors

+ Intelligence
+ Five senses
+ Interpretation

Citizens

24°C 58%

VGE
• Barriers of efficient deployment of navigation systems in Iran:

**Case Study: Optimum Travel Time Path**

– Descriptive addressing

– Expert users
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Case Study: Optimum Travel Time Path
Time Dependent Path Finding

- Network equipped with travel time information (weights)

\[ f_i(t) = \min \left( g_{ij}(t) + f_j(t + g_{ij}(t)) \right), \quad i = 1, 2, \ldots, N \]
Routing Algorithm

- Fu’s algorithm
  - Considers both dynamic and stochastic characteristics
  - Estimates edges travel times through Taylor expansion
  - Splits day time to continuous time intervals
Routing Algorithm

Entrance time: $Y_i$

Link travel time: $X_a$

Arrival time: $Y_j = Y_i + X_a$

Stochastic nature: $E[Y_j] = E[Y_i] + E[\mu_X(Y_i)]$

First order expansion:
$$E[\mu_X(Y_i)] = \mu_X(E[Y_i])$$

Second order expansion:
$$E[\mu_X(Y_i)] = \mu_X(E[Y_i]) + 0.5 \mu_X(E[Y_i]) \cdot Var[Y_i]$$
Results and Discussion

- Tehran as case study
- Taxi drivers as experts
- Storing data collected by experts
  - Different days of week and times of day
- Deploying Fu's model
  - Calculating edges weights
  - Computing the optimum path

+ GPS
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Conclusion

• VGI as an implicit source of user’s experience

• From VGI to VGE

• Travelling as an expert!
Future Work

• More evaluations than travelling time

• Assigning a degree of truth and credibility to the inputs

• Integration of expert’s data and online traffic data
Thank you for your attention!
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