LBS 2014
11th Symposium on Location-Based Services
Vienna, 26–28 November 2014

Expert

Citizens as Sensors:
One Step Up on the VGI Ladder

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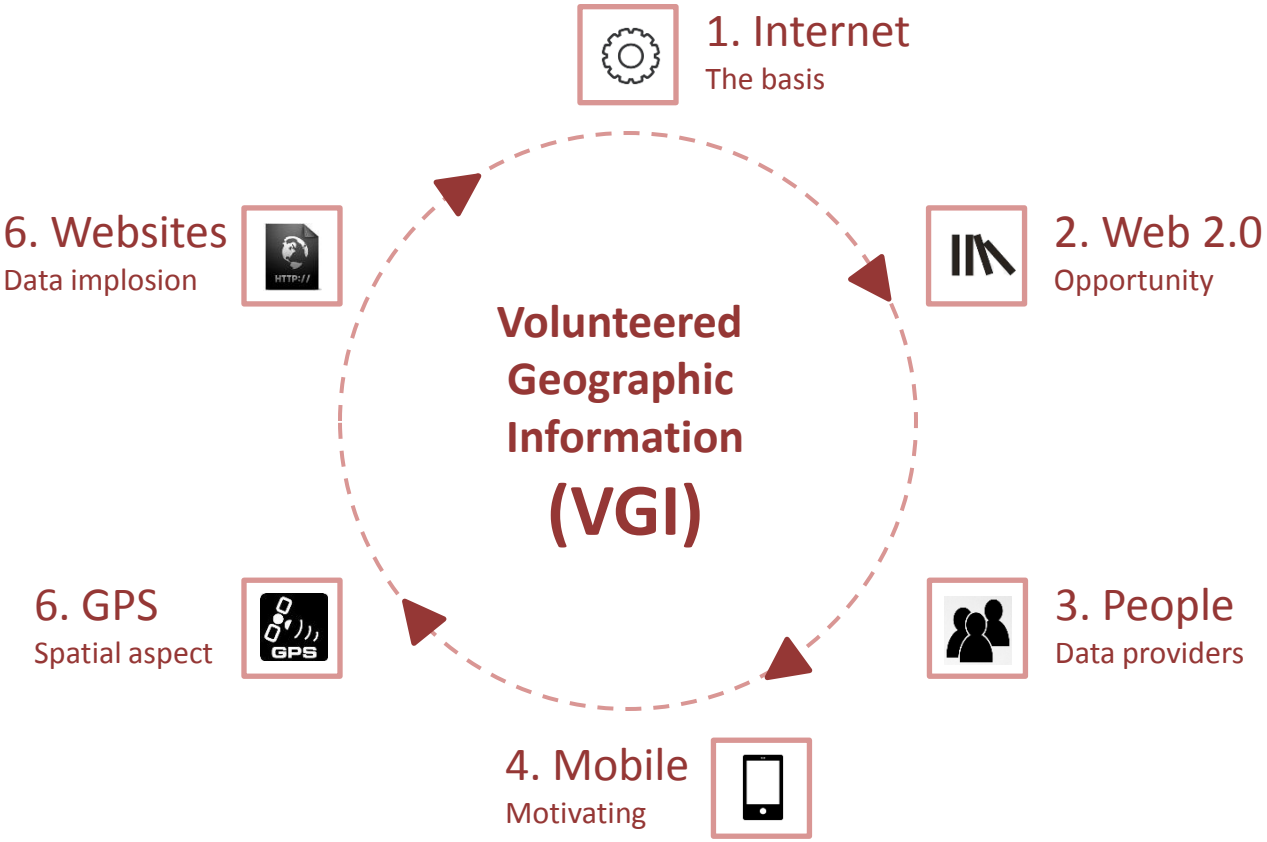
Outline

- **Problem definition** — VGI as a source of experience
- **Case study** — Optimum travel time path
- **Results and discussion**
- **Conclusion and future work**

Volunteered Geographic Information



Volunteered Geographic Information

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

(Thatcher, 2013)

Source of experience

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

Source of Information

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

Usage

Understanding

Quality

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

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Volunteered Geographic Information

An effort made to use VGI towards the belief that:

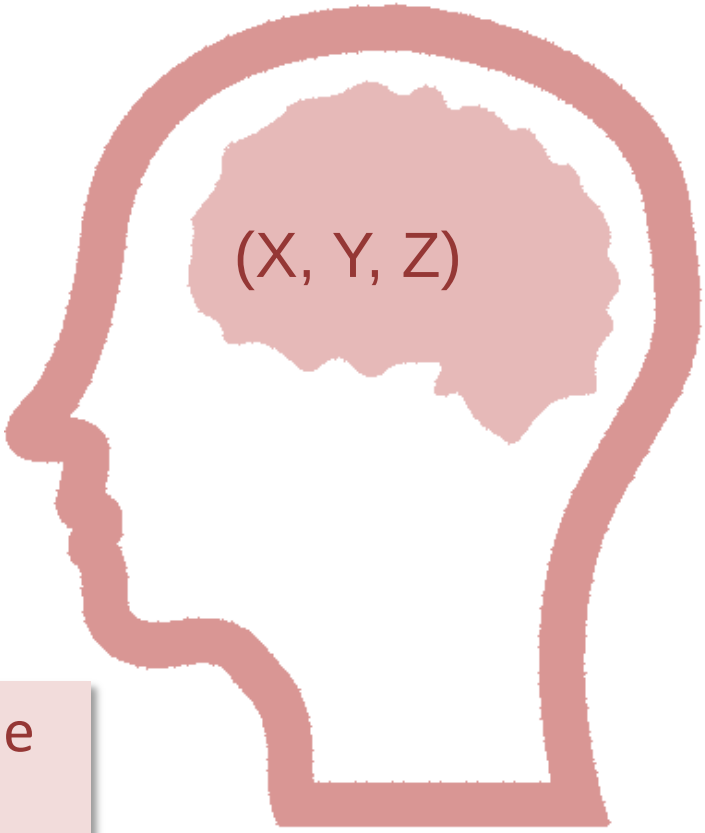
"GI science deals with the formal modelling of spatial process and interaction of humans with the environment in space and time".

(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

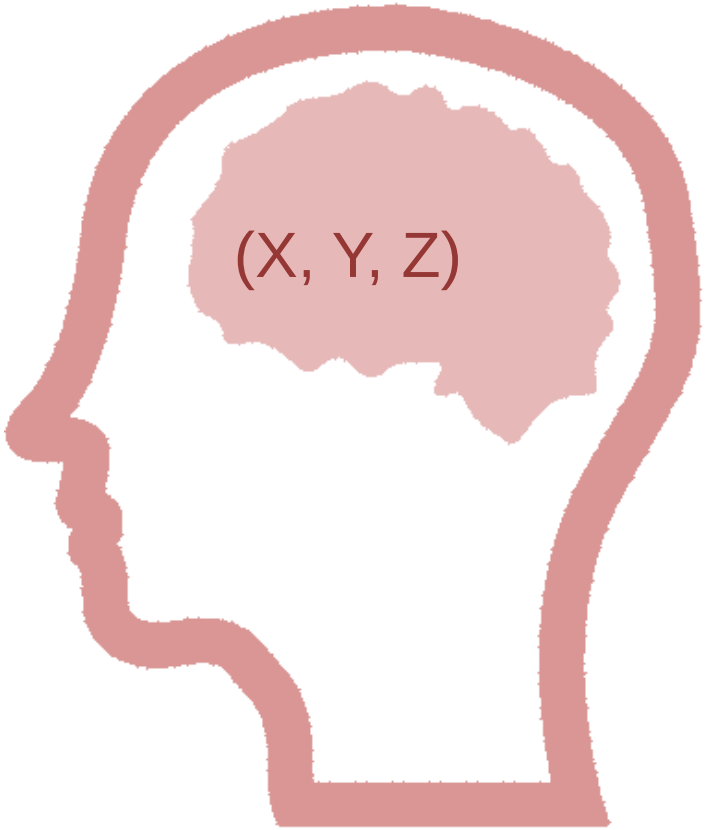
- **VGI** is more based on human cognition than on measurement
  - Degree of truth rather than accuracy
  - Credibility
    - Believability
    - Trustworthiness
    - Expertise



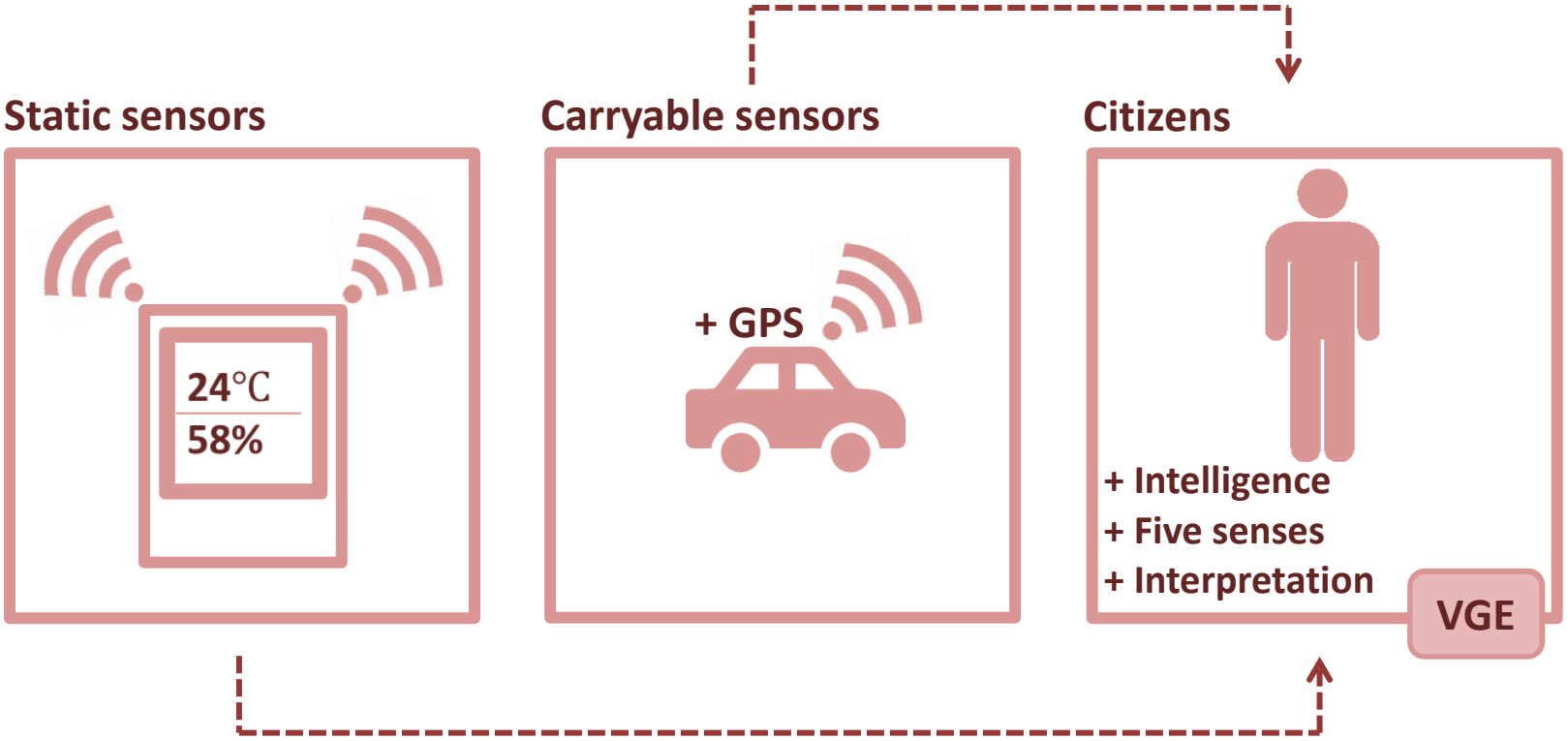
Users' experience has a direct effect on the reliability of the collected information.

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



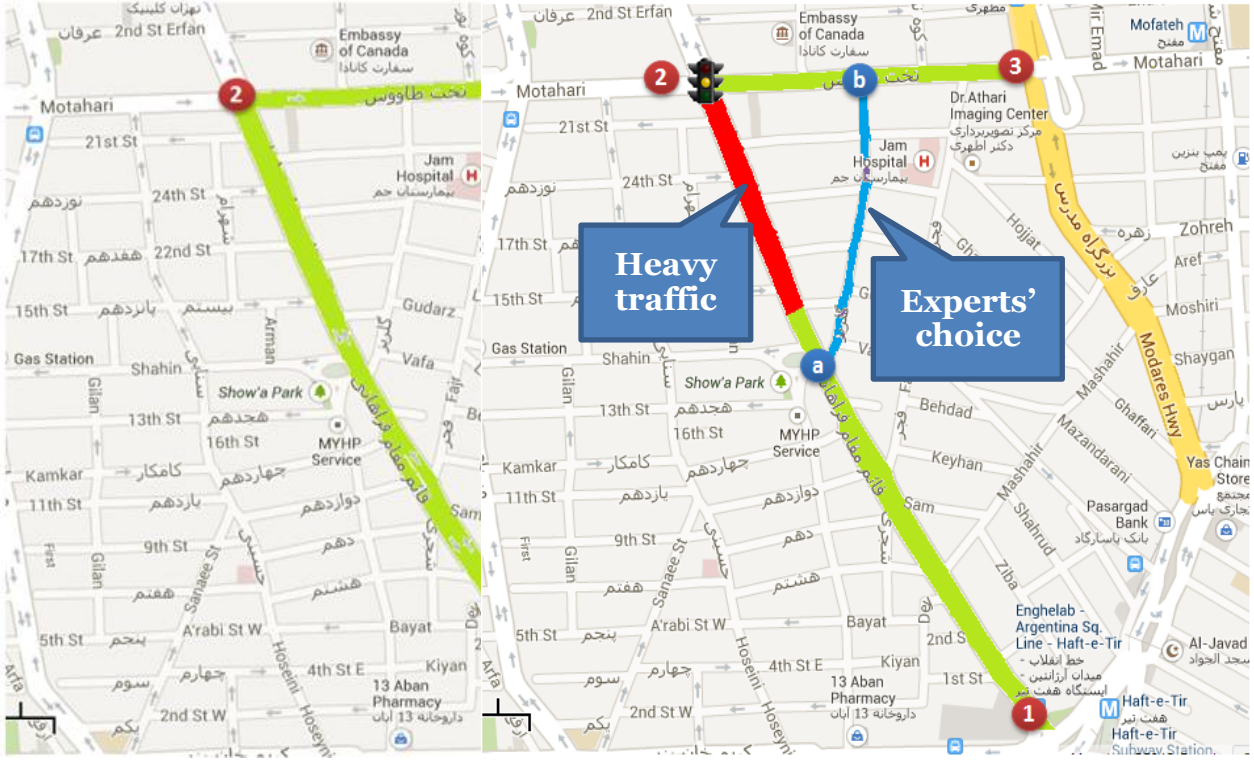
- Barriers of efficient deployment of navigation systems in Iran:

Case Study: Optimum Travel Time Path

  - Descriptive addressing

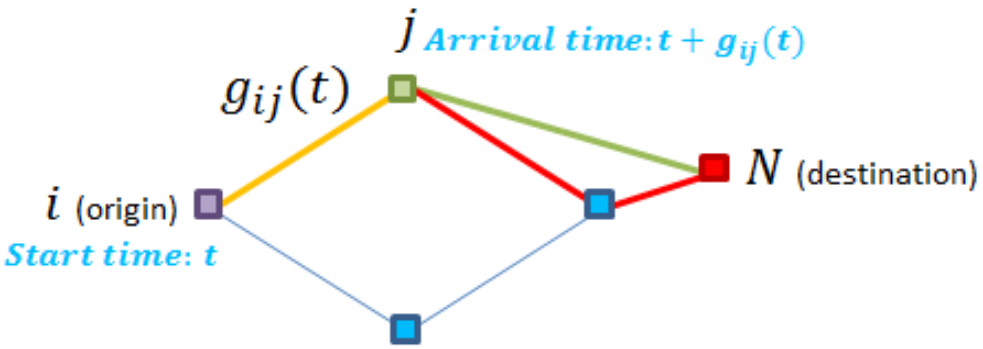
  - Expert users

Case Study: Optimum Travel Time Path



Time Dependent Path Finding

- Network equipped with travel time information (weights)

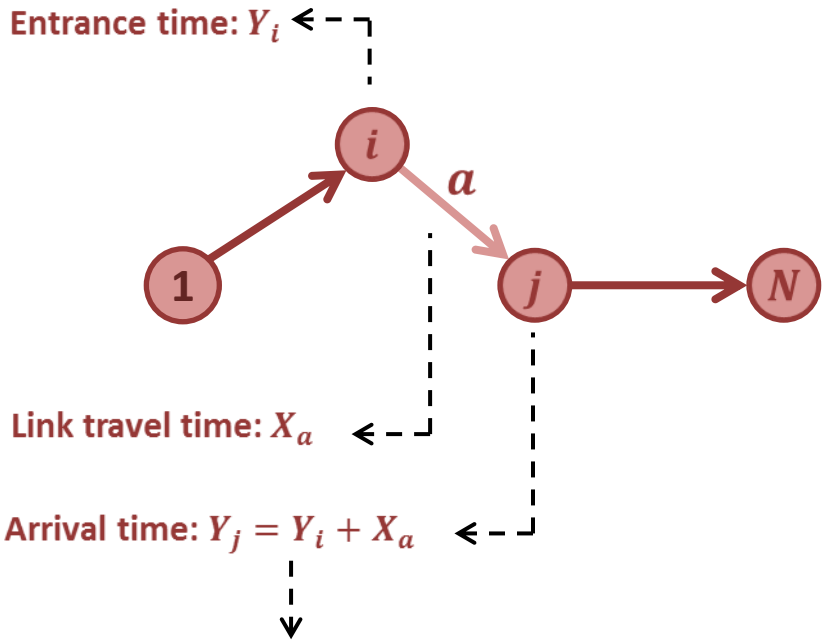


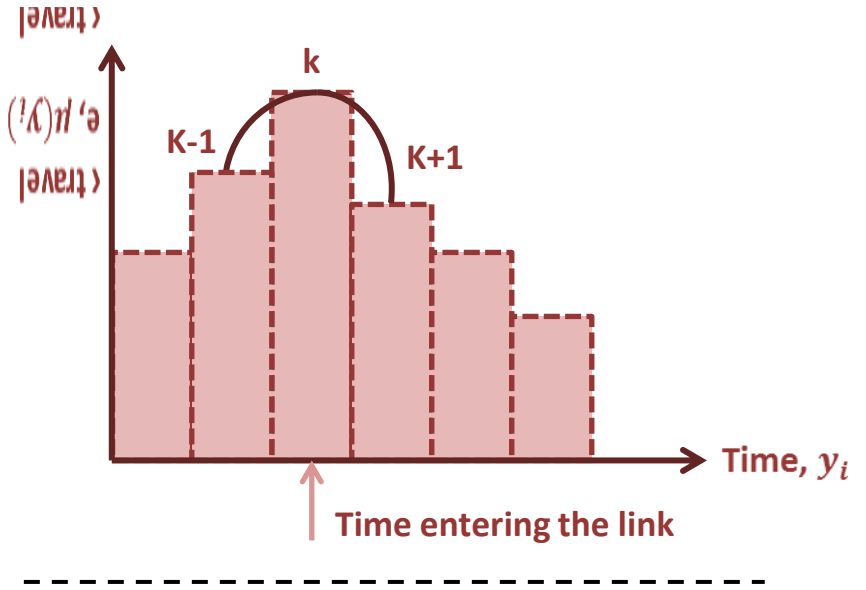
$$f_i(t) = \min\left(g_{ij}(t) + f_j(t + g_{ij}(t))\right), \quad i = 1, 2, \ldots, N$$

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





First order expansion:

$$E[\mu_{X_a}(y_i)] = \mu_{X_a}(E[Y_i])$$

Second order expansion:

$$E[\mu_{X_a}(y_i)] = \mu_{X_a}(E[Y_i]) + 0.5\mu_{X_a}(E[Y_i]).Var[Y_i]$$

Results and Discussion

- Tehran as case study
- Taxi dri
- Storing
  - Diffe
- Deploy
  - Calcu
  - Comp

+ GPS

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1438 sec


940 sec


225 sec


823 sec


796 sec


212 sec

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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