A conceptual model for quality assessment of VGI for the purpose of flood management

Presenter: Lívia Castro Degrossi

Authors: Lívia Castro Degrossi, João Porto de Albuquerque,

Hongchao Fan and Alexander Zipf

degrossi@icmc.usp.br

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Agenda

- Introduction
- VGI Quality
- Conceptual Model
  - Information requirements
  - Quality requirements
  - Quality assessment (Cross-linked VGI)
- Final considerations

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Lívia Castro Degrossi
University of São Paulo
GIScience Group, Heidelberg University

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Introduction

- Flood management requires local and (near) real-time data
- Volunteered information can be used in areas where no other source of information is available
- The lack of quality can affect the usability of VGI
- How **cross-linked VGI** can be used to **assess the quality** of volunteered information in **flood management** domain
- A conceptual model to assess the **fitness of volunteered information** for the **purpose of flood management**

Lívia Castro Degrossi
University of São Paulo
GIScience Group, Heidelberg University

VGI Quality

- Different studies have been undertaken to assess the VGI quality
  - Internal quality: comparison with ground-truth data, intrinsic analysis etc.
  - External quality: it depends on the purpose for which the information will be used
- Hung et al. (2016) proposed a method to assess the credibility of VGI instances in flood management domain
  1) Digital Elevation Model (DEM)
  2) Flood risk zones
  3) Water resources areas
  4) Volunteered information

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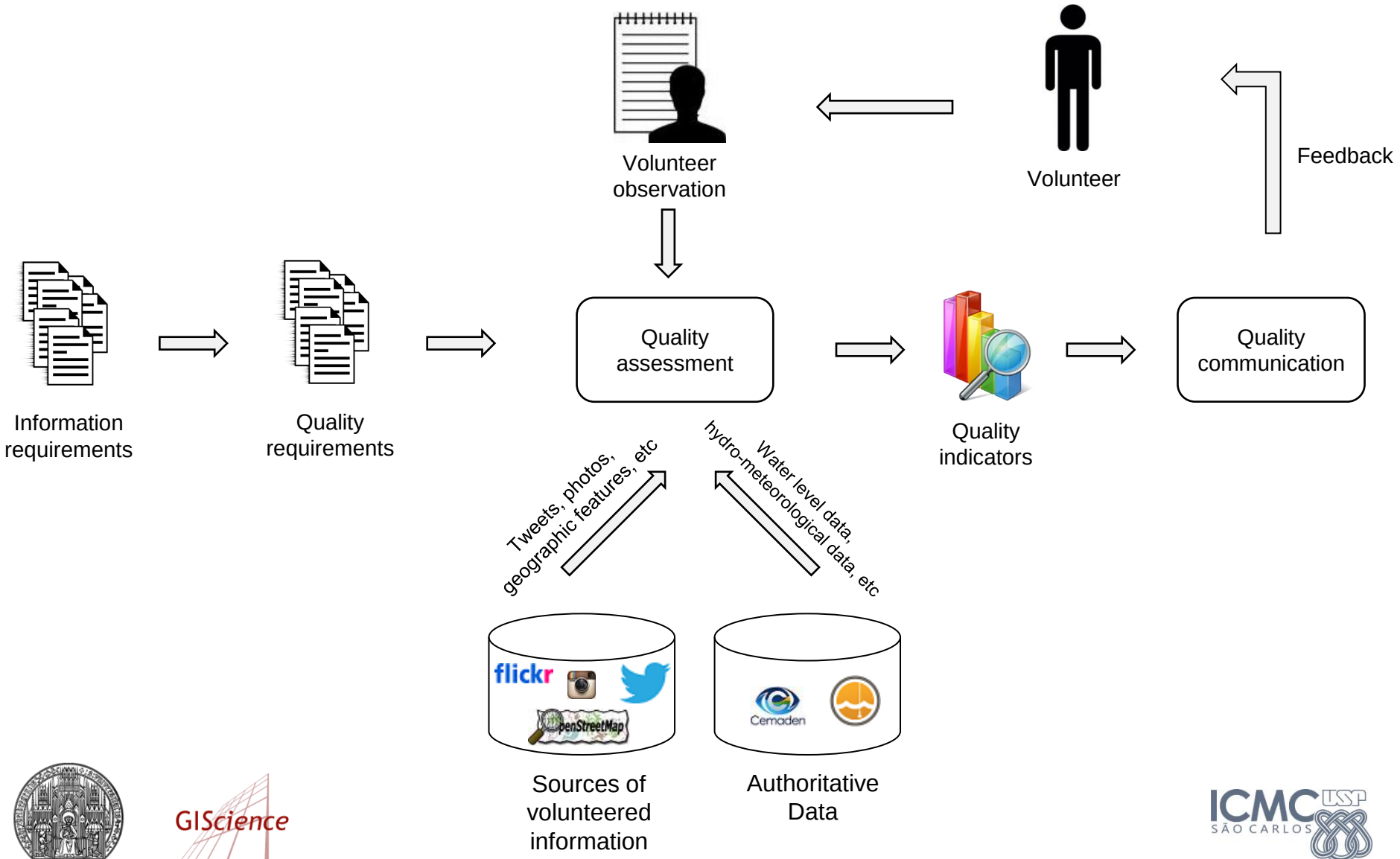
Conceptual Model



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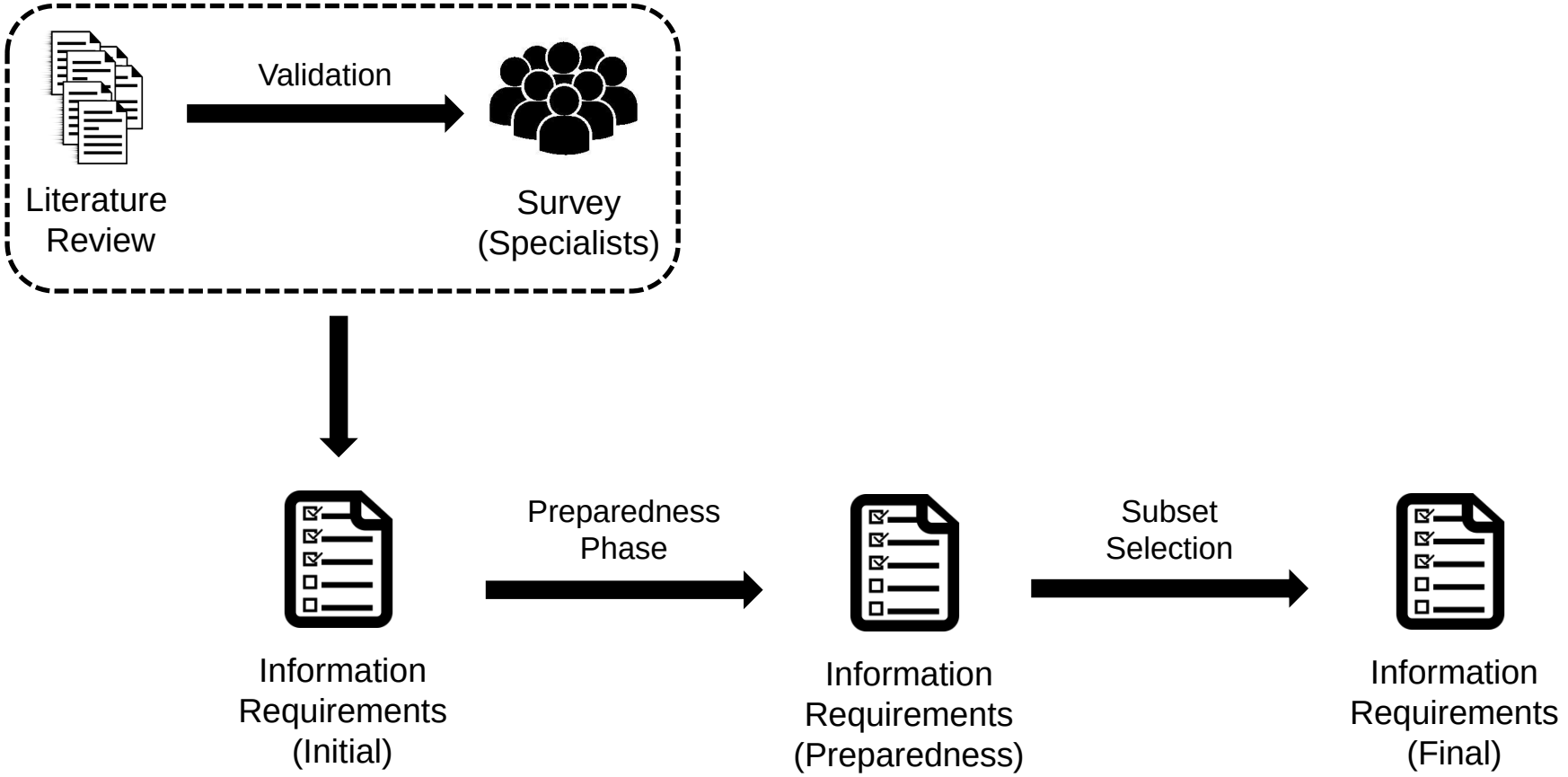
Information Requirements



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University of São Paulo
GIScience Group, Heidelberg University

Information Requirements

Critical Infrastructures

Cross sections of rivers

Demographic Density Map

Extension and Depth Flooded Areas

Land Use Land Cover

Flood Prone Areas

Gauge Stations

Groundwater Models

Historical Flood Records

Evacuation Routes

Emergency Shelters

Hydrological Information

Water Level Condition

Soil Moisture Condition

Weather Data

Elements at risk

Hydro-meteorological Information

Digital Elevation Models

Landslide Prone Areas

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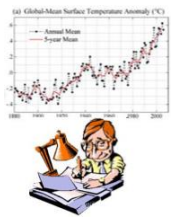
Information Requirements

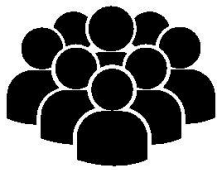
Flood Citizen Observatory

Extension and Depth Flooded Areas + Water Level Condition + Hydro-meteorological Information (Precipitation)

Decision Making



Hydrological Models



Citizens

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University of São Paulo
GIScience Group, Heidelberg University

Quality Requirements

- To verify the **plausibility** of an information:
- Context variables (Fava, 2015):
  - Location of volunteered information
    - Information in flood prone areas
    - Information near to the main river of the watershed

    → Positional Accuracy (Location correctness)
  - Number of volunteered information
    - In the same period of time
    - Over time

    → Completeness
  - Information before and during the rain
  - Information during the whole flood event

    → Temporal Quality (Currency of data)
  - Information before and after the highest water level

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University of São Paulo
GIScience Group, Heidelberg University

Quality Assessment

Research Question:

How can we use authoritative data, social media data and OpenStreetMap data to assess the quality of volunteered information from citizen observatories?

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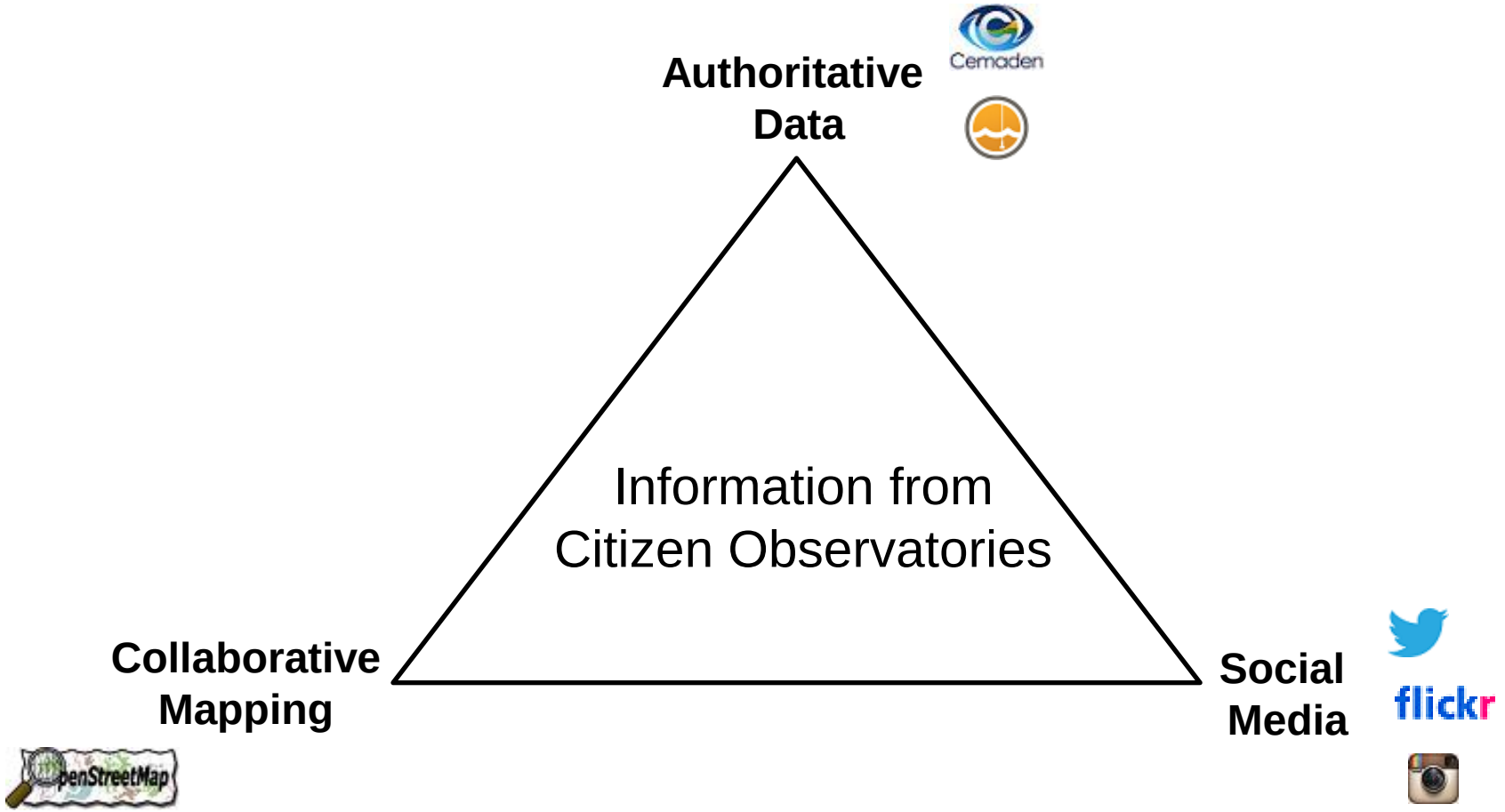
University of São Paulo
GIScience Group, Heidelberg University

Quality Assessment



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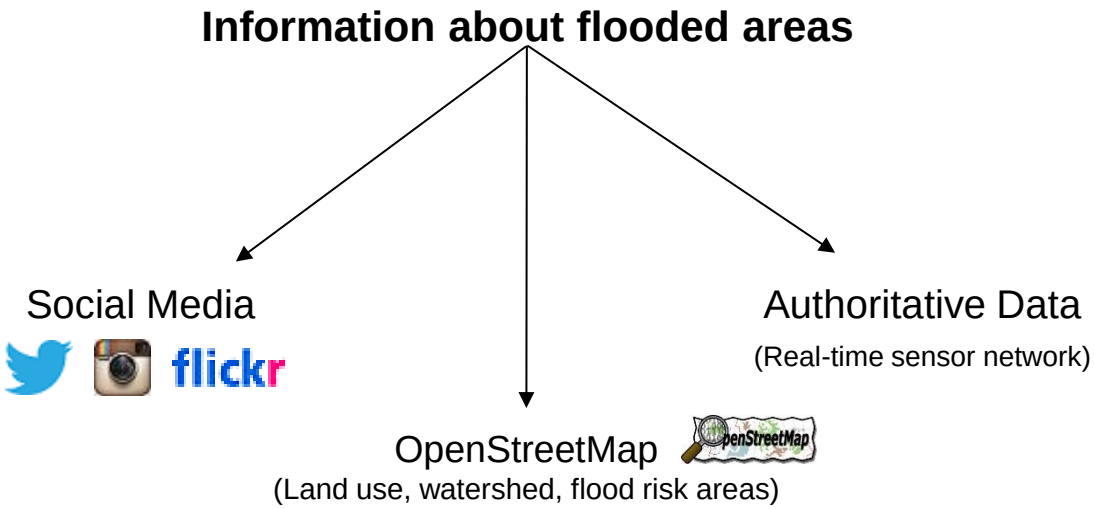
Quality Assessment



- Several works reporting the use of social media for event detection
- How do we detect flood events in social media on-the-fly? How do we measure the depth of a flooded area?
- Problem: probably there will be more reports in popular areas

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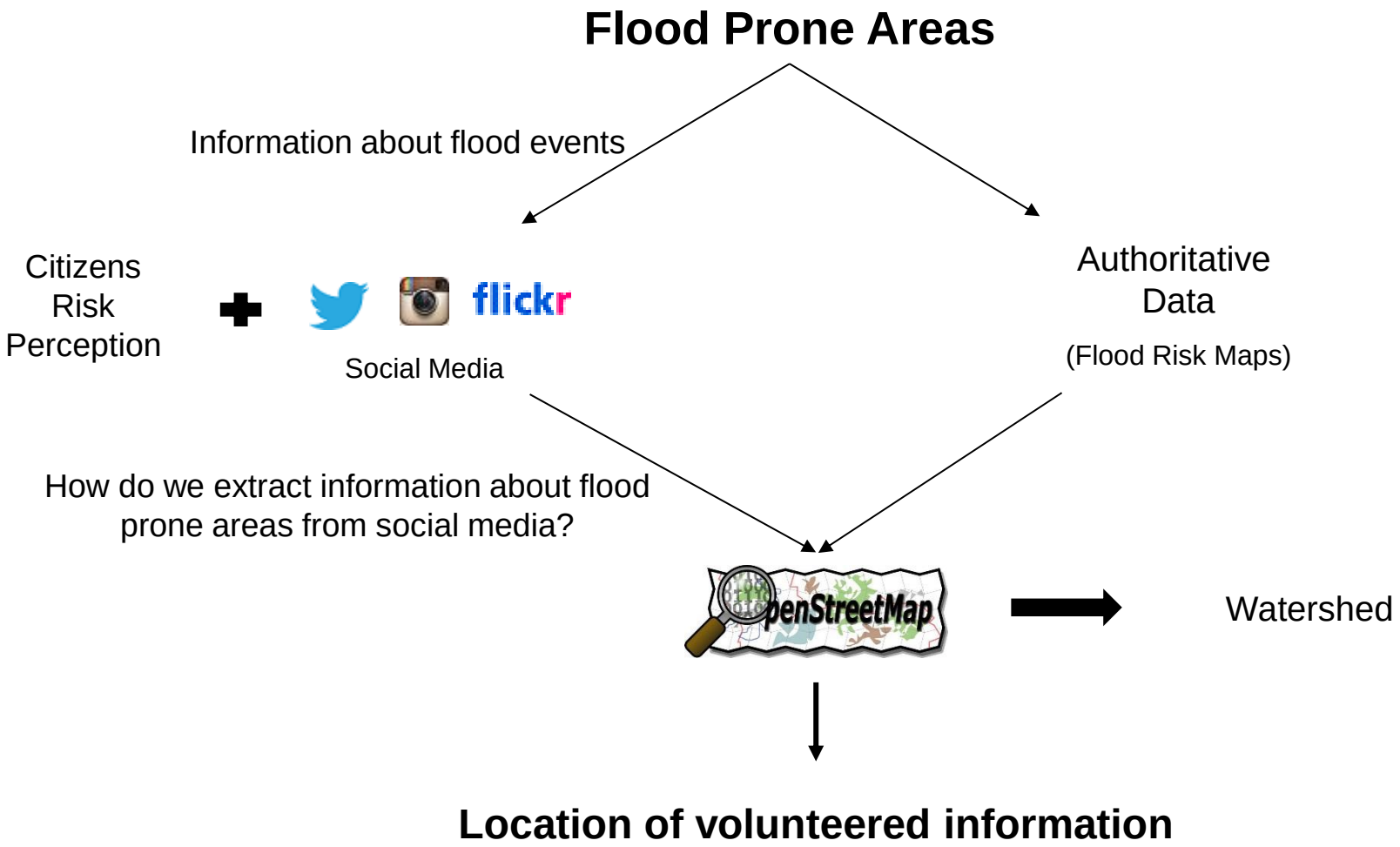
University of São Paulo
GIScience Group, Heidelberg University

Quality Assessment



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University of São Paulo
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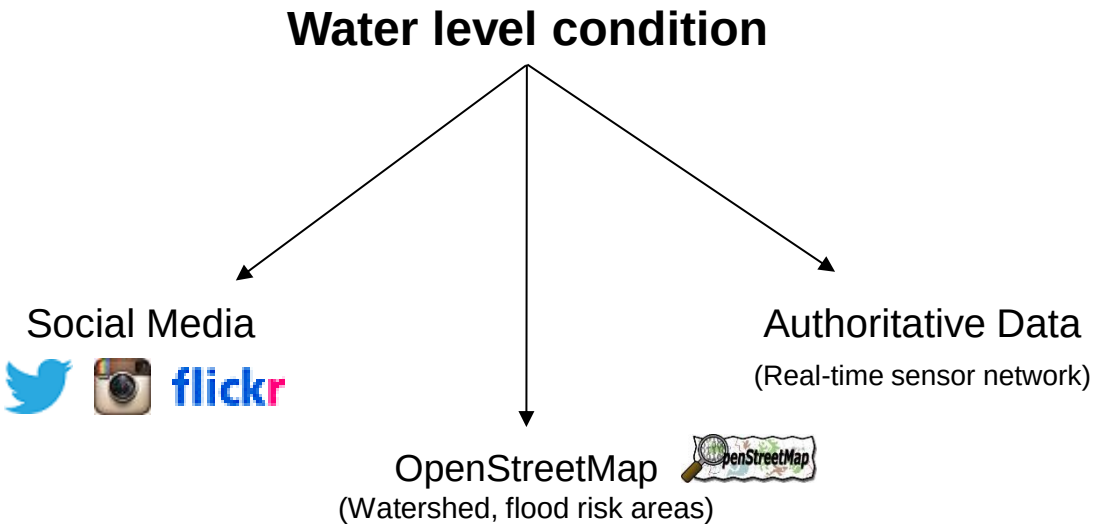
Quality Assessment



- Do people share information about water level in the riverbed in social media? If they do, how do they share? Is there a pattern?
- How can we use real-time sensor data to assess VGI quality?

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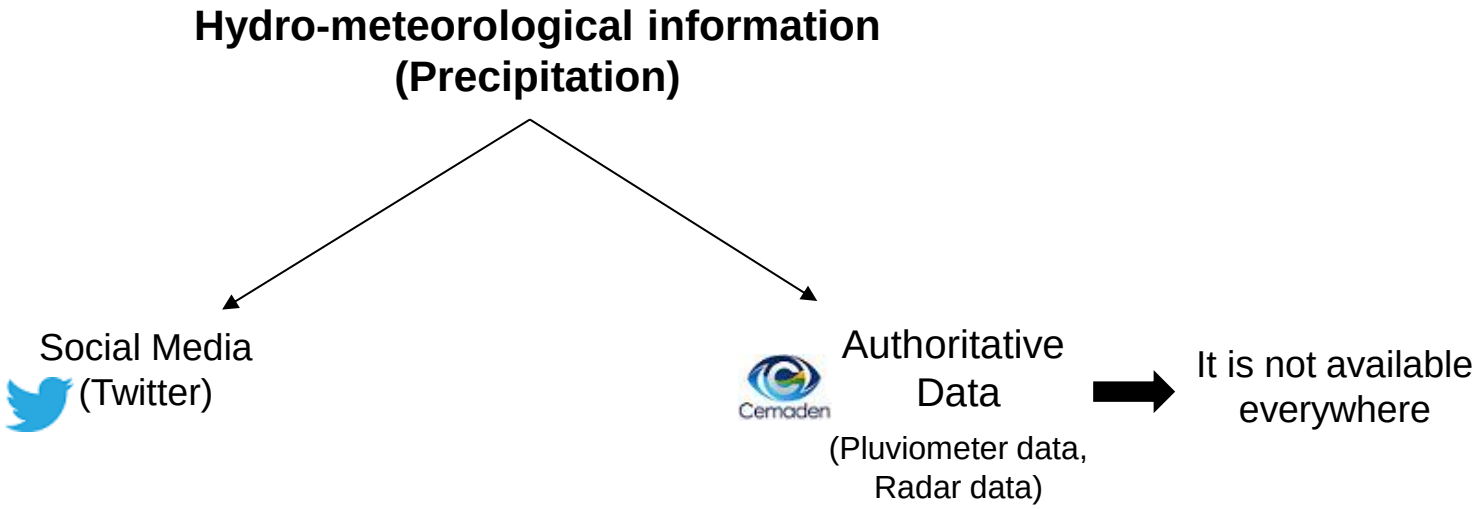

- How do we identity a rain event? When should we start to “measure”?
- There is an evidence (preliminary study) of a **weak correlation** between the **distance** of a tweet to a flooded area, identified based on pluviometer data, and its **relevance**
- **Problem:** it was identified after a flood event. It is possible to identify a rain event before a flood event?

Lívia Castro Degrossi
University of São Paulo
GIScience Group, Heidelberg University

Final Considerations

- A conceptual model for quality assessment of volunteered geographic information for the purpose of flood management
- The quality assessment method combines cross-linked VGI and authoritative data
- How real-time sensor data can be used to assess VGI quality

References

- Fava, M. C. (2015). *Modelo de Alerta Hidrológico com Base Participativa usando Sistema de Informações Voluntárias para Previsão de Enchentes*. University of São Paulo.

- Hung, K.-C., Kalantari, M., & Rajabifard, A. (2016). Methods for assessing the credibility of volunteered geographic information in flood response: A case study in Brisbane, Australia. *Applied Geography*, *68*, 37–47. http://doi.org/10.1016/j.apgeog.2016.01.005

Thank you!

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