GIScience Workshop on VGI for Science: Quality and Credibility

Volunteered Geographic Science?

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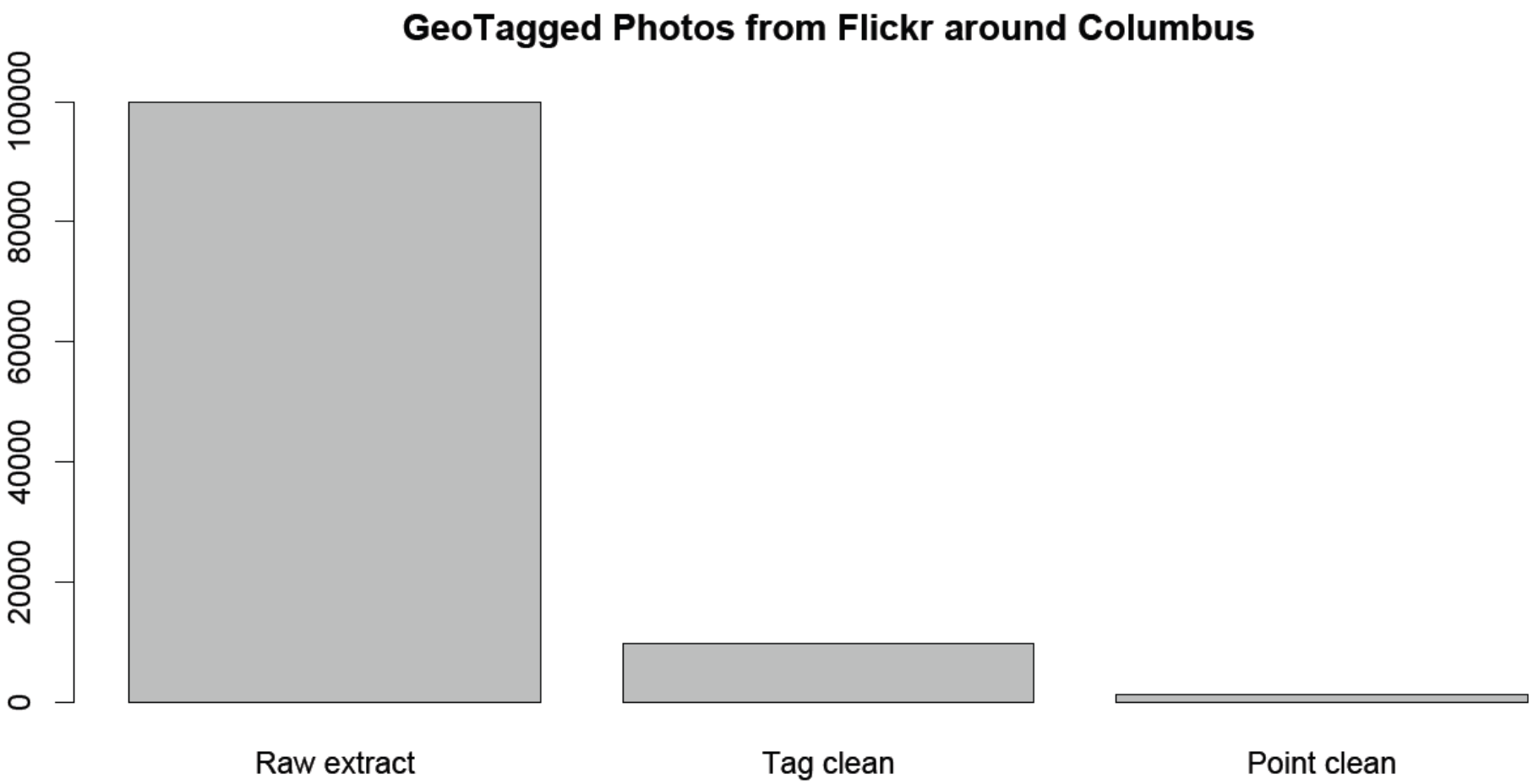
Q. Do you think the volume of VGI available in your area of research and/or practice is adequate or deficient? If deficient, what can be done ~~to increase it~~?

to make use of what is available?

A: deficient, usually

Filtering out noise that comes with volume



- Is Flickr is an extreme case?
  - massive duplication
  - bulk tagging
  - non-geographical content
  - not intended as a mapping platform
  - multiple, conflicting objectives in how users are creating, submitting data, and variable relationships to 'geography'

1) Classification of VGI

Figure 2.5: VGI framework

Scientific knowledge VGI Type 1	Local knowledge VGI Type 2	Personal knowledge VGI Type 3
- volunteered - Objective - Structured - 2 way or n way - Digitizing, GPS, twitter - Only points or points, lines, polygons	- facilitated-VGI - Subjective - Unstructured - 1 way, 2 way or n way - Selection, Drawing, geocoding - Points, lines, polygons	- Kept private - Subjective - Unstructured - n way - Location through networks, geocoding - Only points

Deparday 2010

VGI & Syndromic Surveillance

- Syndromic surveillance: using automated data acquisition / statistical alerts to monitor disease indicators to detect outbreaks of disease earlier than would otherwise be possible with traditional public health methods

Syndromic Data Sources

EARLY DETECTION → LATER DETECTION

GOLD STANDARDS

ANIMALS

- Vets
- Zoos
- Agribusiness

Environmental

- Pollen counts
- Humidity
- Temperature
- Wind Speed/ direct.
- Allergy Index
- Pollution

HUMAN BEHAVIORS

- OTC Pharm
- Absenteeism
- Utilities
- Coughs
- Web Queries
- Traffic
- Survey
- Public Transport
- Cafeteria
- Video Surv
- Newsgroup

NON TRADITIONAL USES

- Tests ordered
- Complaints
- Poison Centers
- 911 Calls
- EMS Runs
- Nurse Calls
- ER Visits
- Prescriptions
- Radiograph Reports

CLINICAL DATA

- Test Results
- Diagnosis
- Influenza isolates
- Medical Examiner

GOLD STANDARDS

- Test Results
- Sentinel MD
- Investi-gations

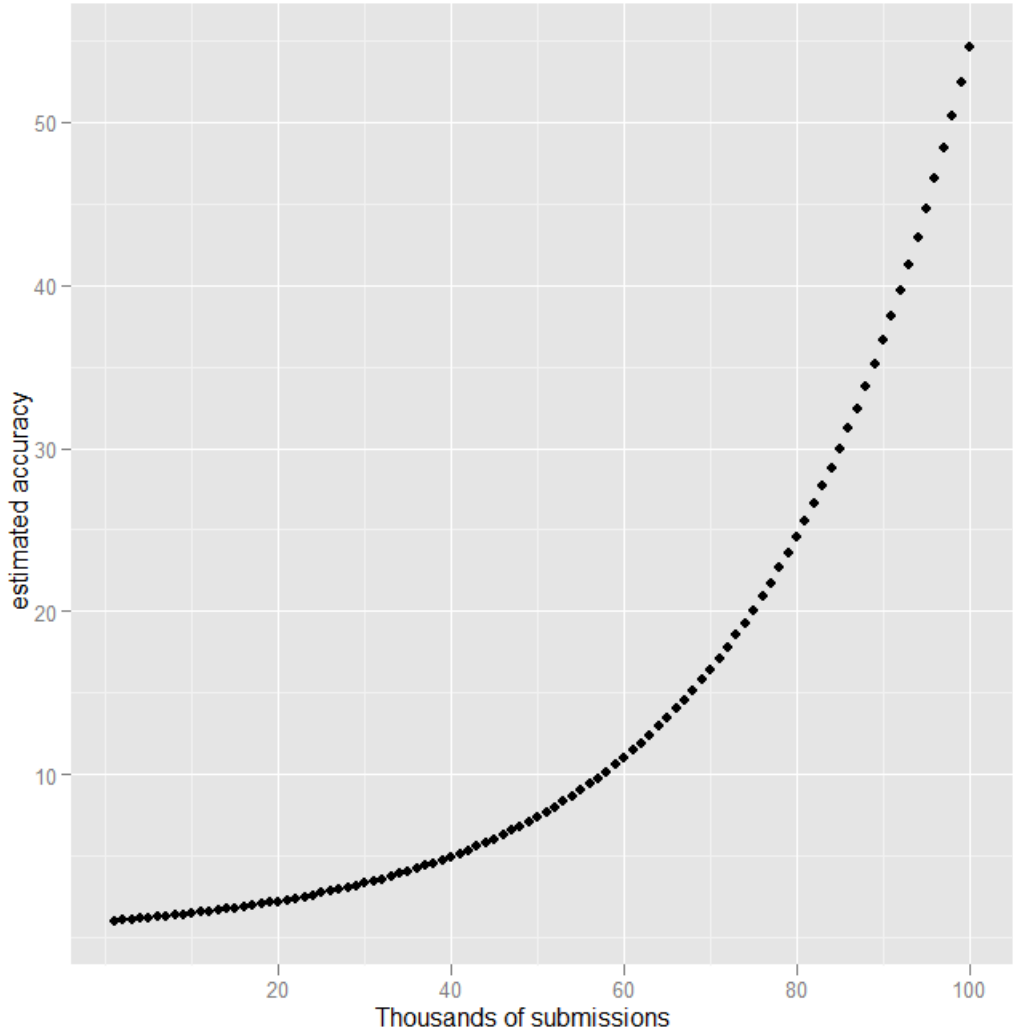
Source: Henry R. Rolka

How does VGI differ from syndromic surveillance

- Datasets used in syndromic surveillance differ with respect to volume:
  - behaviour oriented: large volume
  - services oriented: medium volume
  - pathogen oriented: low volume

- SS generally has a clear, narrowly defined objective

Can we establish a relationship between VGI usability and volume for a given context?



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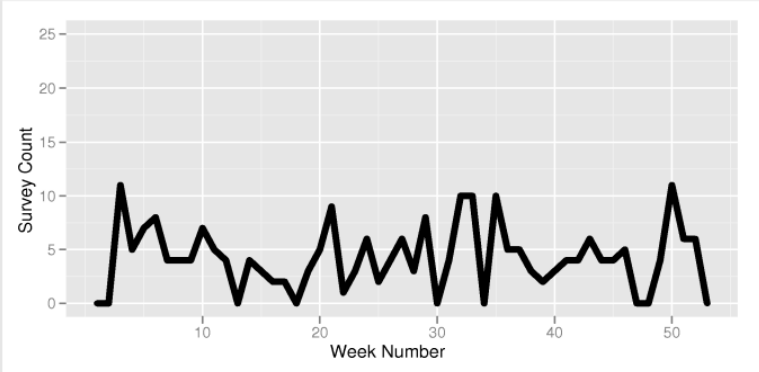
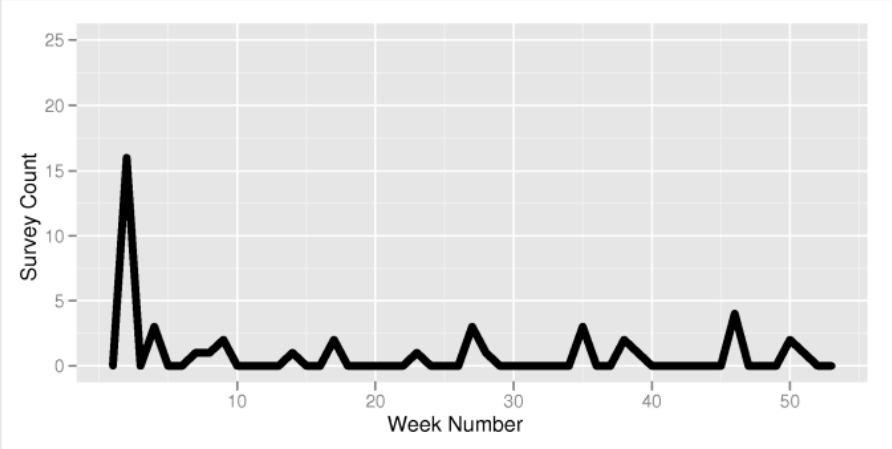


Survey Date	Species	Reported Symptoms	Suspected Diagnoses
01/12/09	cattle	lameness	Footrot
01/12/09	cattle	decreased feed intake/milk production	OTHER diagnosis
01/12/09	cattle	decreased feed intake/milk production	Bloat
01/12/09	cattle	decreased feed intake/milk production	Bacteremia/Septicemia
01/13/09	cattle	respiratory signs	[illegible]
01/13/09	cattle	decreased feed intake/milk production	[illegible]
01/13/09	cattle	decreased feed intake/milk production	[illegible]
01/16/09	cattle	decreased feed intake/milk production	[illegible]
01/16/09	cattle	decreased feed intake/milk production	[illegible]
01/16/09	cattle	decreased feed intake/milk production	[illegible]
01/16/09	cattle	decreased feed intake/milk production	[illegible]
01/19/09	cattle	decreased feed intake/milk production	[illegible]
01/19/09	cattle	decreased feed intake/milk production	[illegible]
01/19/09	cattle	decreased feed intake/milk production	[illegible]
01/22/09	cattle	decreased feed intake/milk production	[illegible]
01/22/09	cattle	decreased feed intake/milk production	[illegible]
01/26/09	cattle	decreased feed intake/milk production	[illegible]
01/27/09	cattle	decreased feed intake/milk production	[illegible]
01/27/09	cattle	decreased feed intake/milk production	[illegible]
01/28/09	cattle	lameness	[illegible]

Vet ID 26



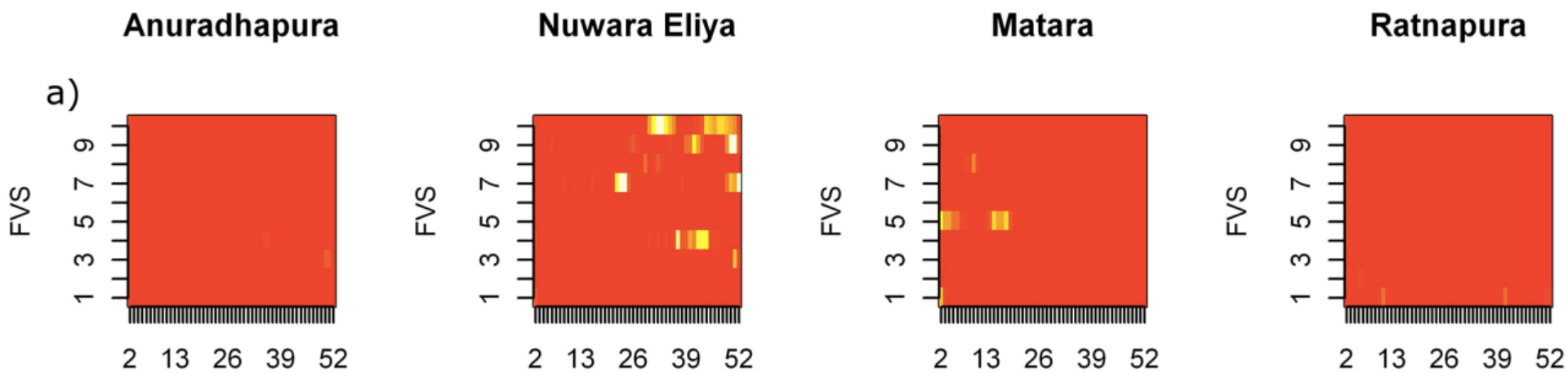
Survey Date	Species	Reported Symptoms	Suspected Diagnoses
01/08/09	buffalo	decreased feed intake/milk production	OTHER diagnosis
01/08/09	buffalo	decreased feed intake/milk production	Malnutrition
01/08/09	cattle	decreased feed intake/milk production	Mastitis
01/08/09	cattle	decreased feed intake/milk production	Bloat
01/08/09	cattle	decreased feed intake/milk production	Bloat
01/08/09	poultry	decreased egg production/weight gain/ appetite	IBD/gumboro
01/08/09	poultry	decreased egg production/weight gain/ appetite	Heat stress
01/08/09	poultry	decreased egg production/weight gain/ appetite	Coccidiosis
01/09/09	buffalo	decreased feed intake/milk production	OTHER diagnosis
01/09/09	cattle	decreased feed intake/milk production	Mastitis
01/09/09	cattle	decreased feed intake/milk production	Malnutrition
01/09/09	cattle	decreased feed intake/milk production	Bloat

Robertson, C., Sawford, K., Gunawardana, W.S.N., Nelson, T.A., Nathoo, F., & Stephen, C. (2011). A hidden markov model for analysis of frontline veterinary data for emerging zoonotic disease surveillance. PLoS One.

2) Statistical modelling for usability

Parameter	Posterior mean (95% credible interval)	Standard deviation
μ_1	0.34 (0.28–0.41)	0.10
μ_2	6.65 (6.05–7.29)	0.05
Training	1.19 (1.08–1.32)	0.05
Years	0.59 (0.55–0.63)	0.03
Male	0.90 (0.84–0.96)	0.03

doi:10.1371/journal.pone.0024833.t003



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3) System-level Contextual Factors

- **Scale** - The spatial and temporal extent of the system (e.g., local/regional/national/ international)
- **Scope** - The intended target of the system (e.g., single disease/multiple disease, single host/multiple host, known pathogens/unknown pathogens)
- **Function** - The objective(s) of the systems (outbreak detection, outbreak characterization, outbreak control, case detection, situational awareness, biosecurity and preparedness
- **Disease characteristics** - Is the pathogen infectious? Is this a chronic disease? How does it spread? What is known about the epidemiology of the pathogen?
- **Technical** - The level of technological sophistication in the design of the system and its users (data type and quality, algorithm performance, computing infrastructure and/or reliability, user expertise)

Robertson, C., T.A. Nelson, Y.C. MacNab, and A.B. Lawson. 2010. Review of Methods for Space-time Disease Surveillance. Spatial and Spatio-temporal Epidemiology.

2. How easy is it to collect VGI for scientific experiments? What can be done to ensure that VGI is as useful as possible in science?

- What is the relationship between data volume, access, and intrinsic quality?
  - easier to access = ↑ volume = ↓ quality?? (flickr)
  - difficult to access = ↑ volume = ↑ quality?? (proprietary Big Data sets)
- How can classification of VGI sources pre-condition our understanding of these relationships? How can we automatically classify a new source?
- What systemic factors of the research need need to be considered in the evaluation of VGI for scientific research?
  - space / time scale (& extent)
  - objectives: ground truth / validation, characterization / description
  - method: observational, experimental
- What methods are there for meeting our needs based on these criteria?
  - statistical modelling
  - quality metrics and aggregate indices
  - visualization