On two existing approaches to statistical analysis of social media data

Martina Patone
Li-Chun Zhang

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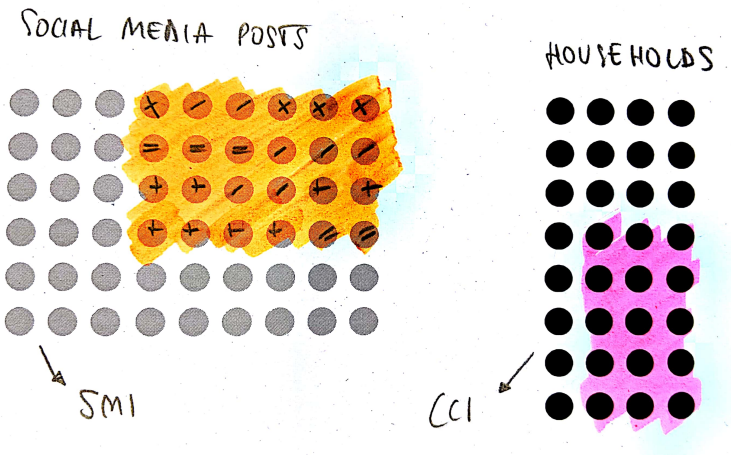
UNIVERSITY OF Southampton

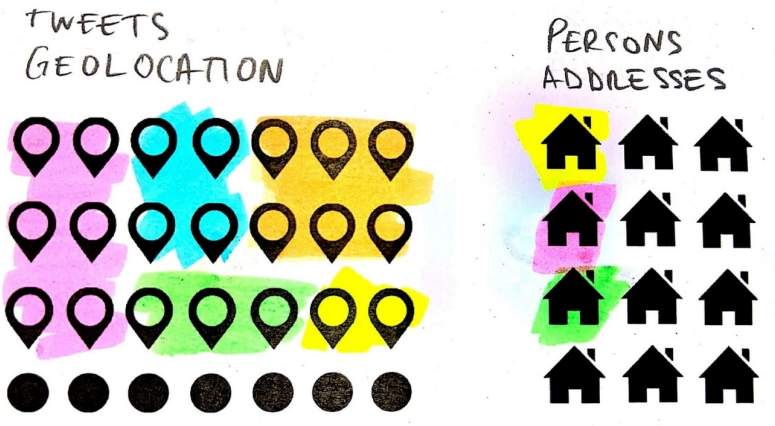
[dstl]

Web Science
Centre for Doctoral Training

The two existing approaches



Approach 1.

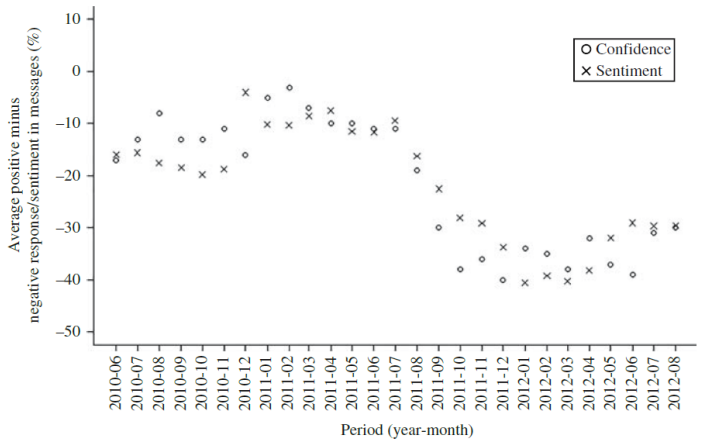


Approach 2.

1. The case of the SMI (Daas et al. 2015):
Can the SMI be used to replace the CCI?

2. Inferring users' residency via tweets (Swier et al. 2015):
Can geolocalised tweets be used to extract the residential address of an user?

The two existing approaches



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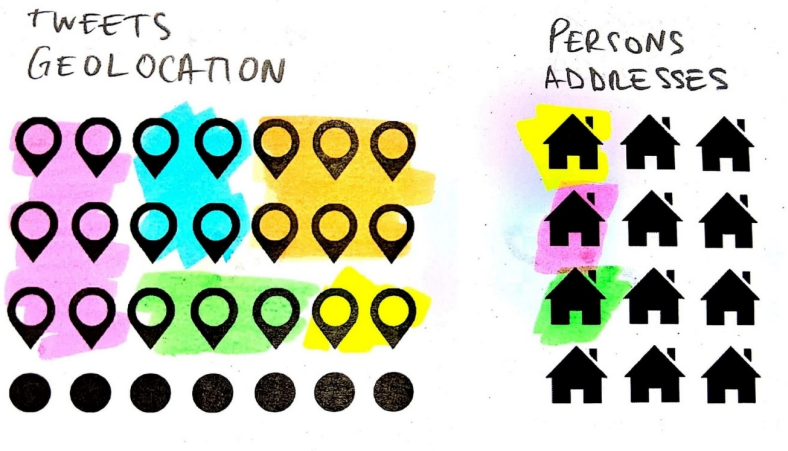

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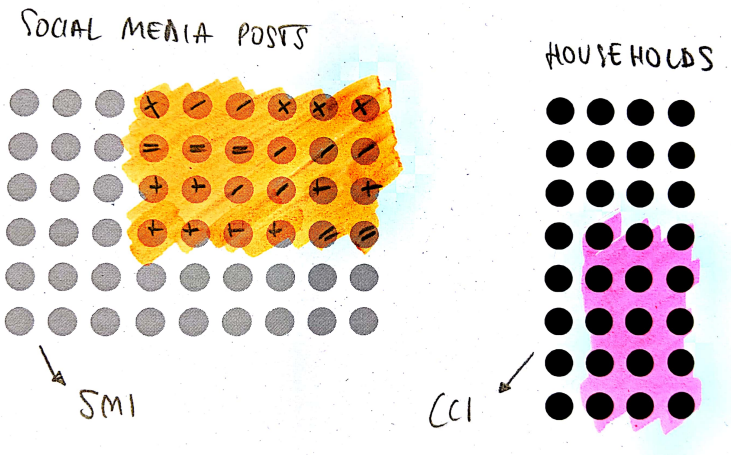

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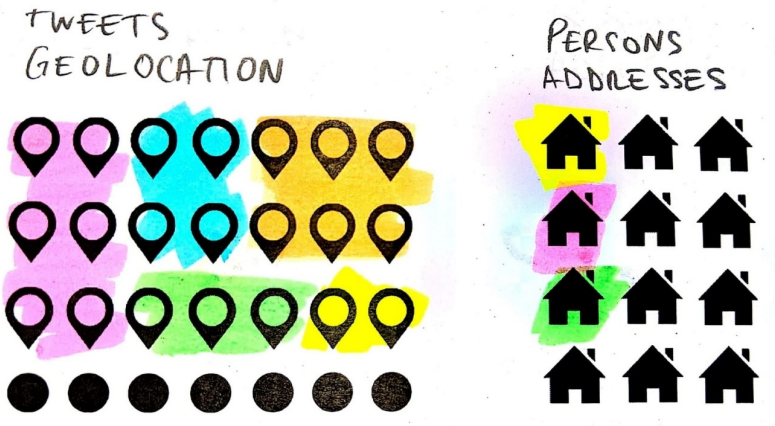

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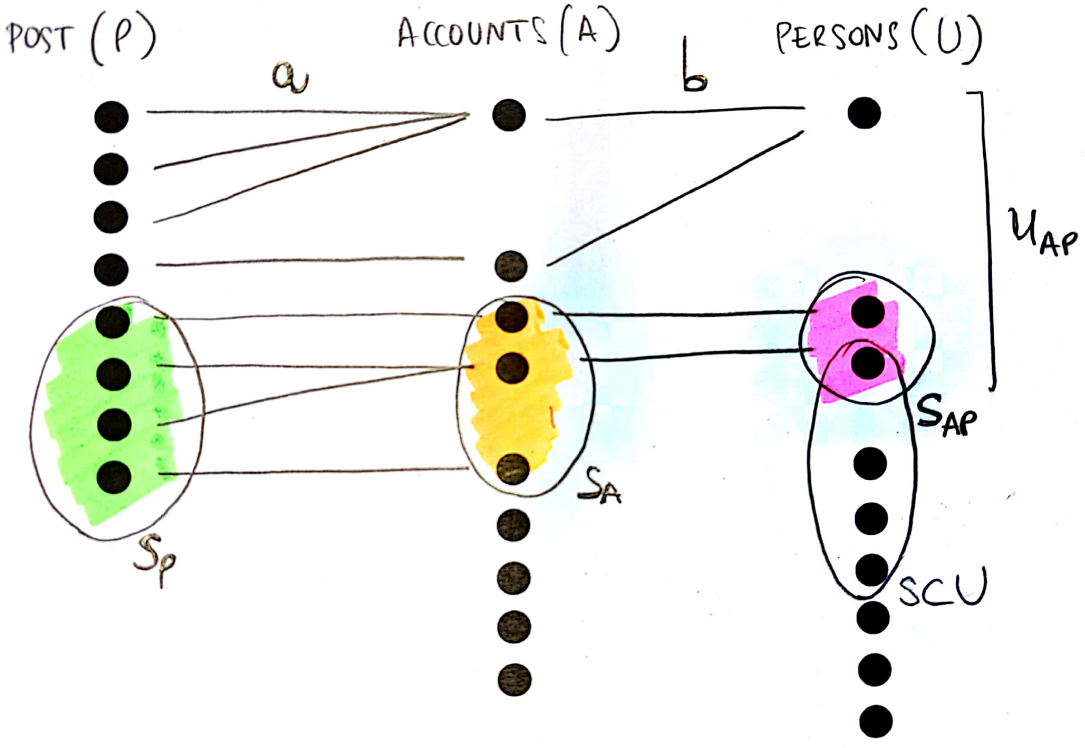
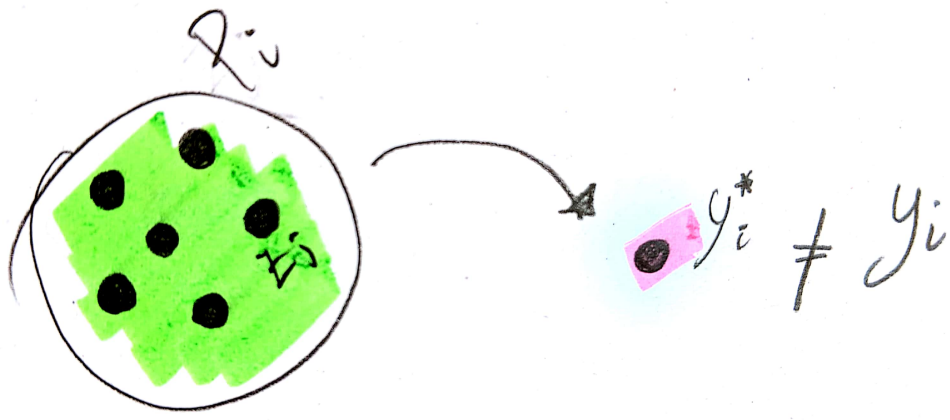
Representation



Connection only between s_P and $s^* = b(a(s_P)) \cap U$

1. **One-phase**: $s_P \subseteq P$ the observed set, U Dutch households;
2. **Two-phase**: $s^* \subseteq U$ the observed set, U UK residents.

Measurement



1. **One-phase**: z_j, $j \in s_P$ the observed sentiment for post j;

2. **Two-phase**: $y_i^* = \tau(z_j, j \in P_i)$ the observed address of the anchor point for person $i \in s^*$.

One-phase: formal interpretation of Daas et al. (2015)

One-phase: use the observed data $(z_j, s_{P,t})$ to aim at the same parameter $\theta = \theta(y_U)$

$$\theta = \xi(\mathbf{z_{s_{P,t}}}) = \theta(\mathbf{y_U})$$

$$\mathsf{SMI}_t = \xi(z_{s_{P,t}})$$
$$\mathsf{SMI}_t = \xi_t + d_t$$
$$E(d_t) = 0, V(d_t) = \eta_t^2 (\approx 0)$$

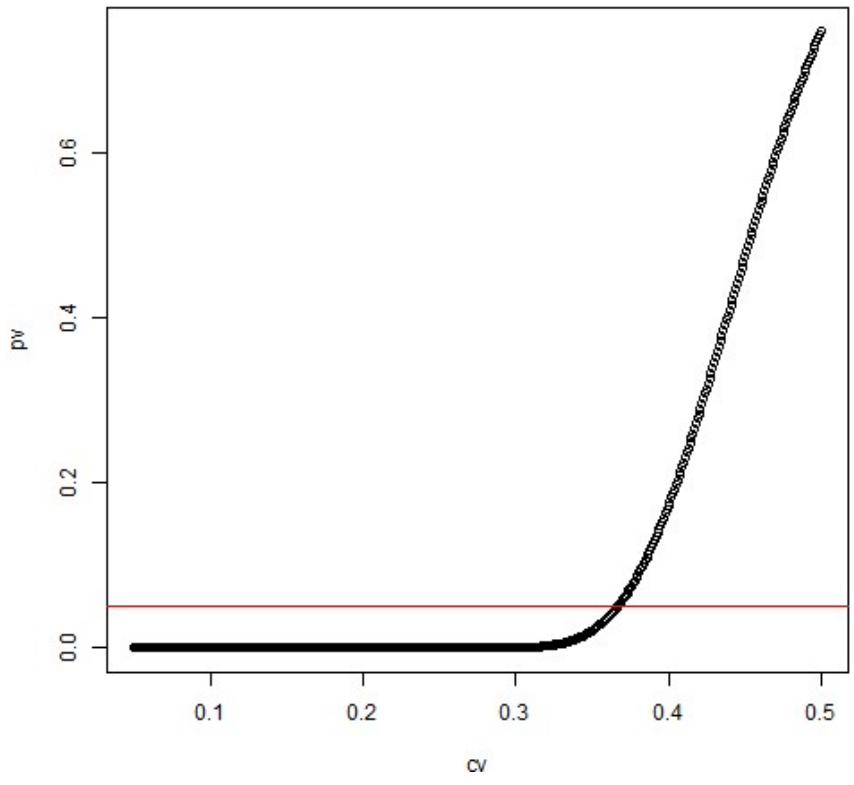
$$\mathsf{CCI}_t = \theta(y_{s_t})$$
$$\mathsf{CCI}_t = \theta_t + e_t$$
$$e_t \sim \mathcal{N}(0, \sigma_t^2)$$

Can the SMI replace the CCI?: $\theta_t = \xi_t$

One-phase: statistical validation

Test: $H_0 : \theta_t - \xi_t = \mu$ *vs.* $H_1 : \theta_t - \xi_t \neq \mu$;

Under H_0: $X_t = \mathsf{CCI}_t - \mathsf{SMI}_t = \mu + e_t$ with $e_t \sim \mathcal{N}(0, \sigma_t^2)$;



p-value exceeds 0.05 for $cv > 0.367$

Two-phase: formal interpretation of Swier et al. (2015)

Two-phase: transform the social media dataset (z_j, s_P) in a pseudo-survey dataset (y_i^*, s^*)

$$s_P \xrightarrow{a} s_A \xrightarrow{b} s^* \subset U \qquad \textit{representation}$$

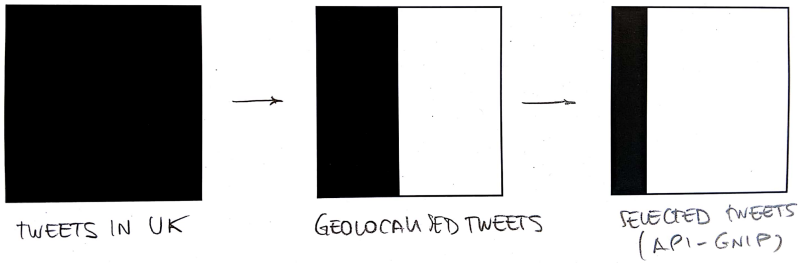
$$z_j \rightarrow y_i^* (\neq y_i),\ j \in P_i \qquad \textit{measurement}$$

Statistical analysis is performed on (y_i^*, s^*)

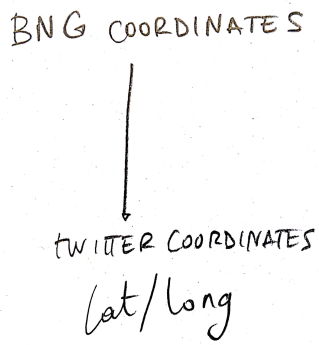
Two-phase: data quality

1^{st} **phase**: social media dataset

Representation

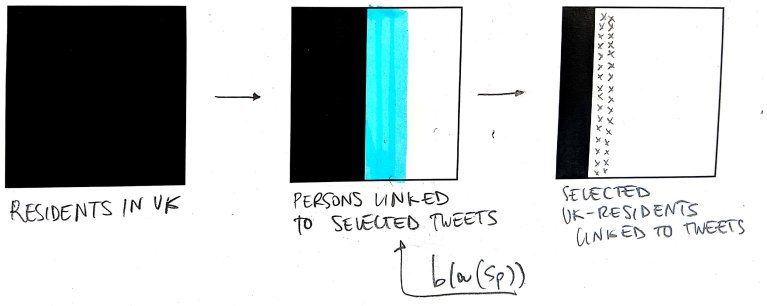


Measurement



2^{nd} **phase**: pseudo-survey dataset

Representation



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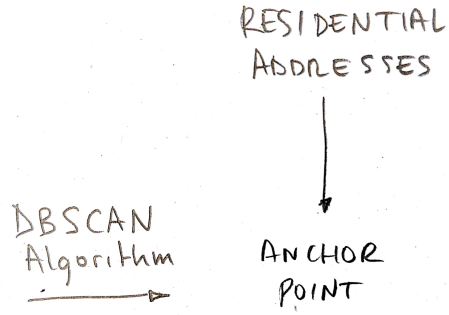

One-phase and Two-phase: discussion

	One-phase (z_j, s_P)	Two-phase (y_i^*, s^*)
(z_j, P)	non-probability sample $s_p \subset P$ unknown selection	not of interest
(y_i^*, s^*)	need weighting	feasible
(y_i, s^*)	need weighting measurement consideration	feasible measurement consideration
(y_i^*, U)	test parameters need survey data	non-probability sample $s^* \subset U$ unknown selection
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