Identifying and Measuring User-on-User Influence in Social Networks

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A **Social Network** is a theoretical construction used in social science to study relationships between social units, and it describes the social structure determined by such interactions.
An influencer is an individual who disproportionately impact the spread of information or some other behavior of interest.

They exhibit some combination of desirable attributes.

- Credibility
- Expertise in a topic
- Enthusiasm
- Connectivity
- Centrality
1.- Until just a few years ago, most of the networks on which influence spread were unobservable.

2.- Observational data on diffusion is heavily biased towards “successful” events.
Challenges of the Problem

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Even on Twitter, successful cases of dissemination of information are rare.

(a). Frequency distribution of cascade sizes.

(b). Distribution of cascade depths.

Measures and Metrics

- **Influence**
  - Number of (original) publications
  - Actions over other users' publications
  - Content of the publications
  - Ratio of the users you recognize over those that recognize you

- **Activity**
  - Number of other users that recognize her/him (Followers, friends, subscribers, etc.)

- **Popularity**
  - ...
Centrality

Allows us to rank nodes according to their importance in the network

- Degree centrality,
- Closeness centrality,
- Betweenness centrality,
- PageRank,
- ...

Measures and Metrics

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Local or Topical influencers
GhostLink: Latent network inference for influence-aware recommendation

https://doi.org/10.1145/3308558.3313449
Latent network inference for influence-aware recommendation

Influence → Opinion conformity → Writing style

“… a user echoes/copies facets descriptions from peers (influencers) across multiple items.”

“I am fascinated by this movie’s non-linear narrative style, structural complexity, and cinematography…”

“I really like the seamless narrative style, and mature cinematography…”

Time
Latent network inference for influence-aware recommendation

Review content (overlap of preferences) → Influence graph

Temporal data

- Assumes that the topic of each word might be based on the preferences not only of the user, but of other users as well (the influencers).
Latent network inference for influence-aware recommendation

\[ \Theta_u = (\Theta_{u,1}, \Theta_{u,2}, ..., \Theta_{u,k}) \]

\[ \Psi_u = (\Psi_{u,1}, \Psi_{u,2}, ..., \Psi_{u,w}) \]

Potential influence set (IS_u)

Item (i)

\[ (d') \]

\[ W_{d_1}', W_{d_2}', W_{d_3}', ..., W_{Nd_1}' \]

Time

\[ 12:45 \]

\[ 15:50 \]

\[ 18:15 \]

\[ 20:35 \]

\[ 23:32 \]

\[ Z = (z_{1}', z_{2}', ..., z_{Nd}') \]
Constructing the influence network

\[ \psi_{u,v} = \frac{n(u, v, s = 1)}{\sum_{v' \neq v} n(u, v', s = 1)} \]

Number of topics copied by \( u \) from \( v \)

Number of topics copied by \( u \) from anyone else
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Measuring the influencers in the news media’s narrative

Conviction Narrative Theory

“A **conviction narrative** is the subjective and imagined unfolding of an event sequence and the emotion that that event evokes in the mind of the person conjuring the narrative”

- Object of the narrative
- Emotion the narrative evokes
- Topics
  - Sentiments
Measuring the influencers in the news media’s narrative

Agent

LDA

Objects (Topics)

[Brexit, Olympics, ..., Bank-rates]

keywords

positive

negative

t

Narrative (emotion) / time

t_1

t_2

|T| x |A| x |K|

#topics

#news sources

#days

LexisNexis Newsdesk dataset

- 113 Million articles
- 34 thousand news sources
- 6 May 2016 – 31 Dec 2016
Q: Are there any actors who lead the narrative of the rest of the online news media?

A: For each topics $K_i \rightarrow$ test if news source $A_j$’s sentiment on $K_i$ is a leading indicator for the ‘consensus’ of the other sources.

$$\text{consensus} = \text{average sentiment across all news source}$$
(excluding the source that is currently being tested)

Test *lead-lag relationship* by performing Granger causality test.

$A_j$ lead the consensus view if, for $K_i$, the time-series Granger-causes the consensus with p-value < 0.01.
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Measuring the influencers in the news media’s narrative

Percent of topics for which the source leads the consensus

- New York Times
- Telegraph
- Los Angeles Times
- Deutsche Welle
- CNN
- Melbourne Age
- France24
- ABC News
- This Day Online
- San Francisco Chronicle
- Vanguard
- Herald Sun
- New Zealand Herald
- Times Live South Africa
- News24
- Adelaide Now
- Stosh dot
- Sheffield Star
- MTV
- The Star.com.my
- CIO Magazine
- Daily Nation
- The Scotsman
- Philippine Daily Inquirer
- Alwaba

Percent of news sources that each source leads

- CNN
- Chicago Tribune
- Reuters
- Hello!
- Empire Online
- The Independent
- Al Jazeera
- CHINAdaily.com.cn
- Miami Herald
- EOnline.com
- Gulf Times
- Alwaba
- San Francisco Chronicle
- MTV
- This Day Online
- Toronto Star Online
- Washington Post
- Herald Sun
- Brisbane Times
- Vanguard
- Boston Globe
- Adweek Online
- Time
- Yorkshire Evening Post
Multiple definitions of *influencers* according to the specific application.

Very useful in numerous scenarios to identify the most “important” nodes in the network.

A few measures easy to calculate based on readily available properties of the nodes and the network.

More complex metrics can be used by inferring implicit relations.
THANKS!
Identifying and Measuring News Media influence in Social Networks

- Identify specific actors that might influence the narrative of the media.
- Measure the influence of these actors over the media.
- Measure the influence of some news outlets over the others.
- Look for a global impact of the news media narrative in the discourse of their followers.

The model tries to explain how political and economic forces control the mass media and exploit this dominance to create a global view that is biased to satisfy their own interest.