A Data-Driven Analysis to Question Epidemic Models for Citation Cascades on the Blogosphere

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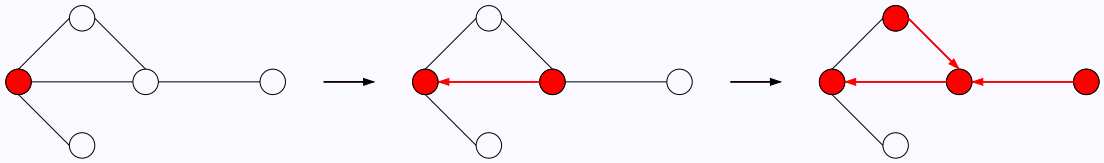
ICWSM-13

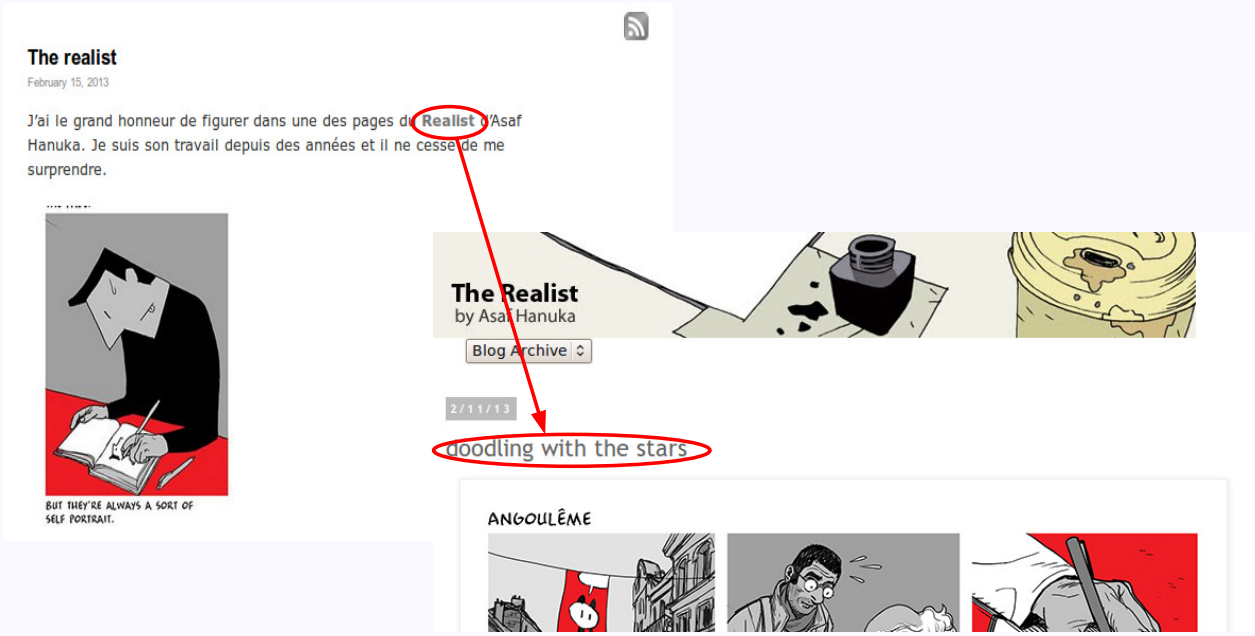
Context: epidemic-like spreading

Epidemic analogy



cascades, key-elements: **item** and **path**

Citations and cascades



Role of citations in information spreading?

Data

Raw dataset

Webfluence project

French-speaking blogosphere:

- $\sim$ 10,000 *A-list* blogs
- observed from February 1^{st} to July 1^{st} 2010
- $\sim$ 850,000 posts

Processing

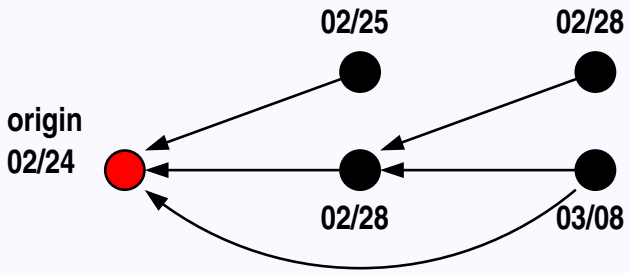
Among $\sim$ 1 million citations, selection:

- from the dataset to itself
- without self-citations

$\Rightarrow$ 3,199 blogs and 20,885 citations

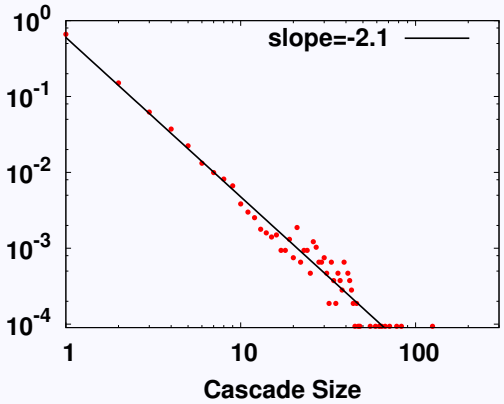
Structure of citation cascades

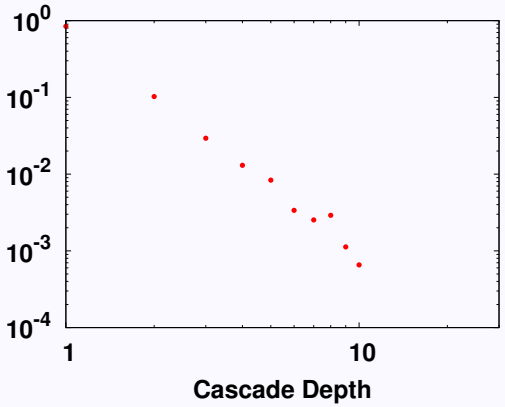
Directed Acyclic Graph (DAG)



characterized by size (number of posts) and depth (longest distance)

Basic features: comparison to literature



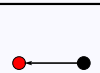
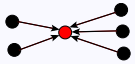


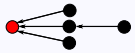
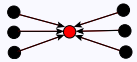
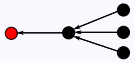
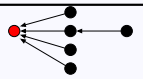
strong similarities with *Leskovec et al. (2007, 2008)*

ex: size distribution exponent 1.97 vs 2.10

Cascade frequencies

Comparing frequency rankings

Rank here	1	2	3	4	5	6	7
Rank in *L. et al.*	1	2	3	4	5	6	7
Shape							

8	9	10	11	12	12	14	15
10	11	8	9	13	14	15	12
							

Spearman coefficient : 0.95

What does it mean?

- similar information spreading mechanisms?
- ...
- consequence of trivial features (as posting activity)?

What do we need to observe such cascades?

Qualitative insights

Cascade topic definition

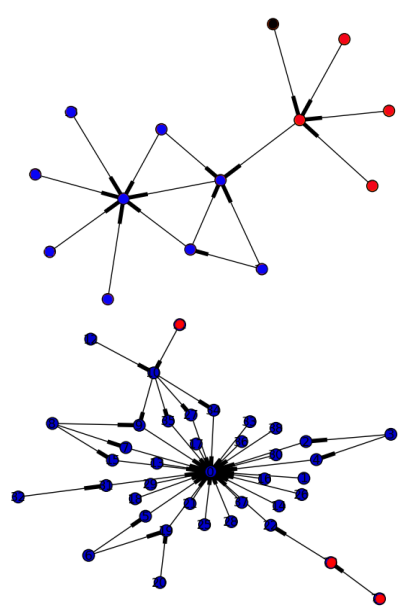
Expression or set of words such that:

- as many posts as possible address the topic
- two cascades may not have the same topic

Typical behaviors

topic mutations:

high topic unity cascades:



Frequent topic changes, particularly in chain-like patterns

Relation between structure and topic

Measuring topic-unity of a cascade

$$tu = \frac{|\mathcal{C}^*|}{|\mathcal{C}|}$$

$\mathcal{C}$: posts of the cascade

$\mathcal{C}^*$: posts of the cascade dealing with cascade topic

Measuring chain- or star-like cascades

$$sc = \frac{\sum_{x \in \mathcal{C}: n_i(x)=0} n_o(x) - 1}{\sum_{x \in \mathcal{C}} n_o(x) - 1}$$

$n_i(x)$ and $n_o(x)$: number of incoming and outgoing arcs from x

$$sc(chain) = 0,\ sc(star) = 1$$

Correlation tu-sc : 0.57 Spearman coefficient

(on a sample of 50 "large size" cascades)

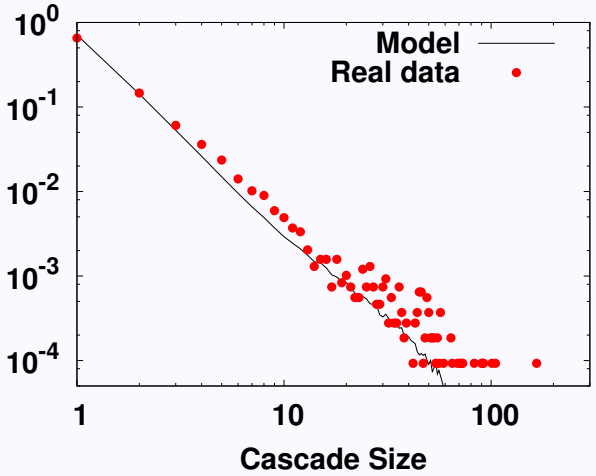
Model with uncorrelated citations

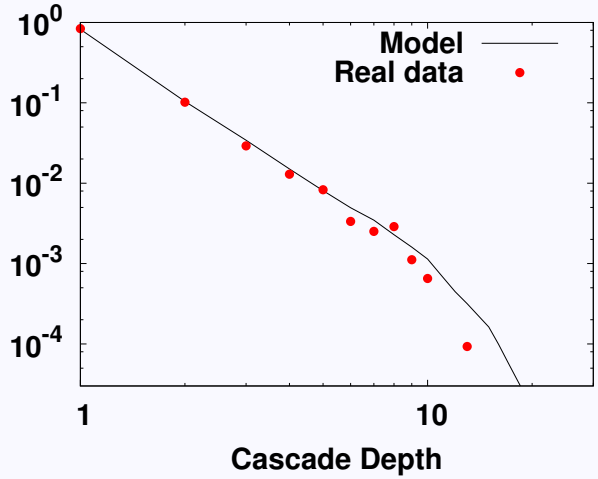
Ingredients

- same posting and citing activity of blog A
- but citing any post of blog B
- keep the same global distribution of latencies

No explicit reference to the content of posts

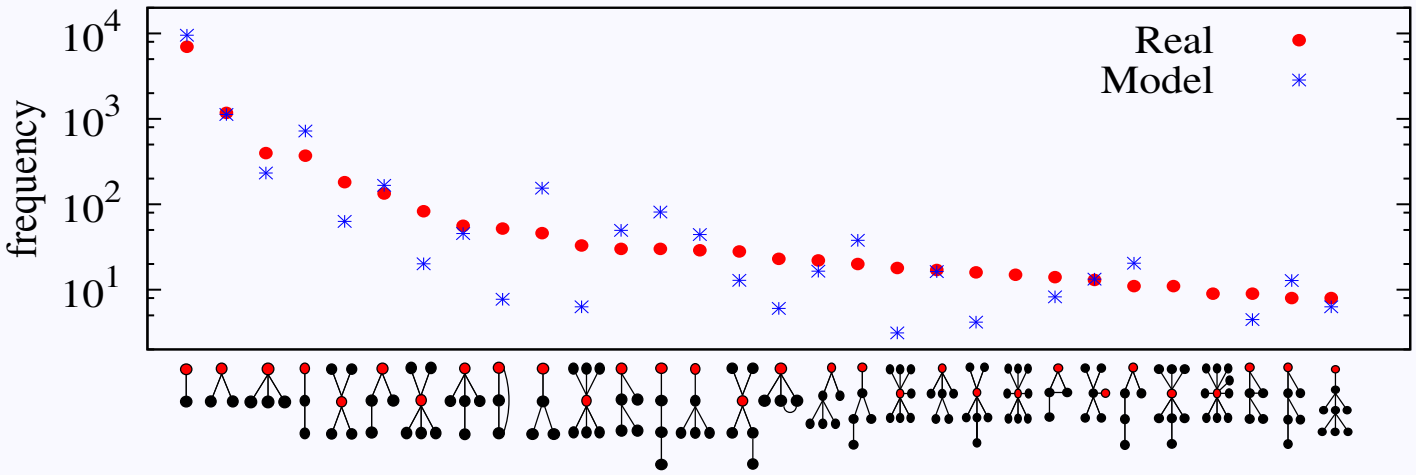
Results on basic features





Model with uncorrelated citations

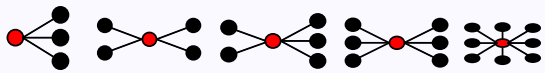
Results on cascades ranking



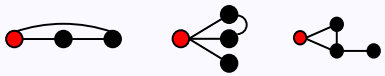
Spearman coefficient : 0.76

Underestimated cascades:

star-like cascades:



moral cycles cascades:



Conclusion

Questioning the epidemic analogy

- who cites whom and when mostly governs cascade shapes
- no clear notion of item spreading through citations

Clues to look for information spreading?

- specific patterns

  ex: star-like and cyclic cascades

- cross-check with other information sources

  ex: text-mining tools, multimedia contents

- constrained social networks

  ex: microblogging platforms, games

Thank you for your attention