

CIKM

2013

Predicting Trends in Social Networks via Dynamic Activeness Model

Shuyang Lin¹ Xiangnan Kong¹ Philip S. Yu^{1,2}

¹Department of Computer Science, University of Illinois at Chicago

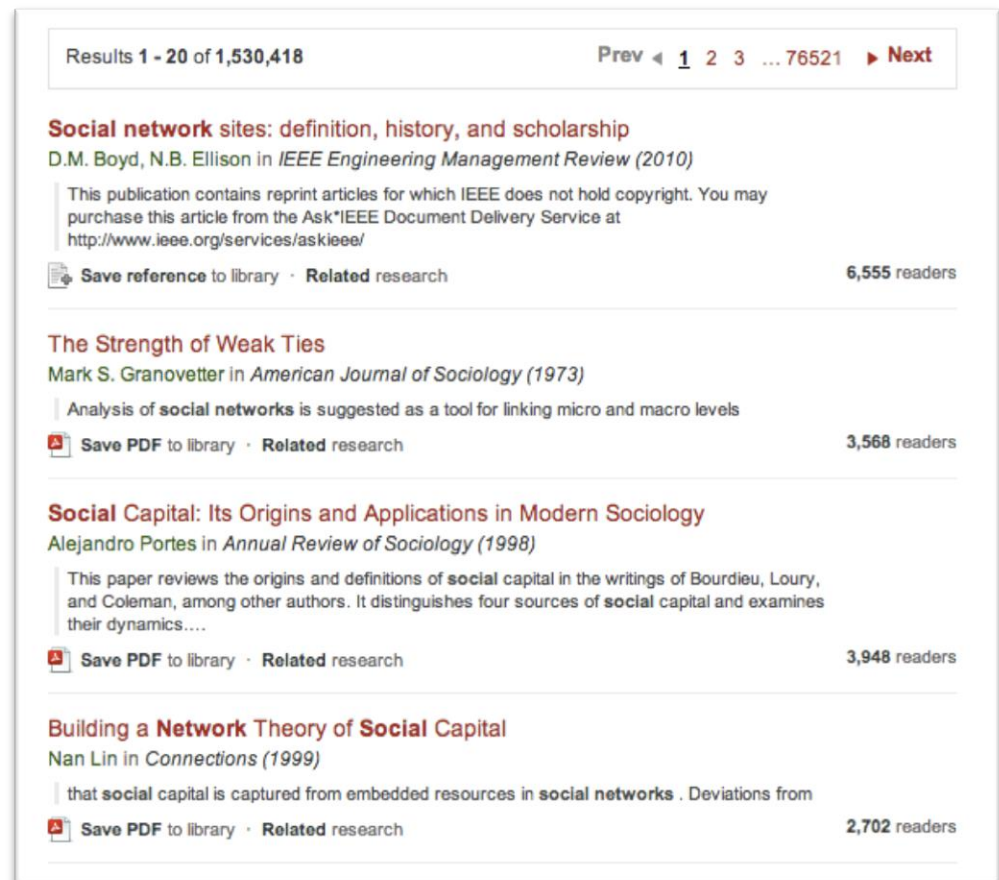
²Computer Science Department, King Abdulaziz University

What's a trend?

A trend is a sequence of actions taken by users in a social network.

Examples:

- Tweets that contain the hashtag “#CIKM” in Twitter.
- Papers that study the topic of social network in DBLP.



Results 1 - 20 of 1,530,418 Prev ◀ 1 2 3 ... 76521 ▶ Next

Social network sites: definition, history, and scholarship
D.M. Boyd, N.B. Ellison in *IEEE Engineering Management Review* (2010)
This publication contains reprint articles for which IEEE does not hold copyright. You may purchase this article from the Ask*IEEE Document Delivery Service at <http://www.ieee.org/services/askieee/>
Save reference to library · Related research 6,555 readers

The Strength of Weak Ties
Mark S. Granovetter in *American Journal of Sociology* (1973)
Analysis of **social networks** is suggested as a tool for linking micro and macro levels
Save PDF to library · Related research 3,568 readers

Social Capital: Its Origins and Applications in Modern Sociology
Alejandro Portes in *Annual Review of Sociology* (1998)
This paper reviews the origins and definitions of **social capital** in the writings of Bourdieu, Loury, and Coleman, among other authors. It distinguishes four sources of **social capital** and examines their dynamics....
Save PDF to library · Related research 3,948 readers

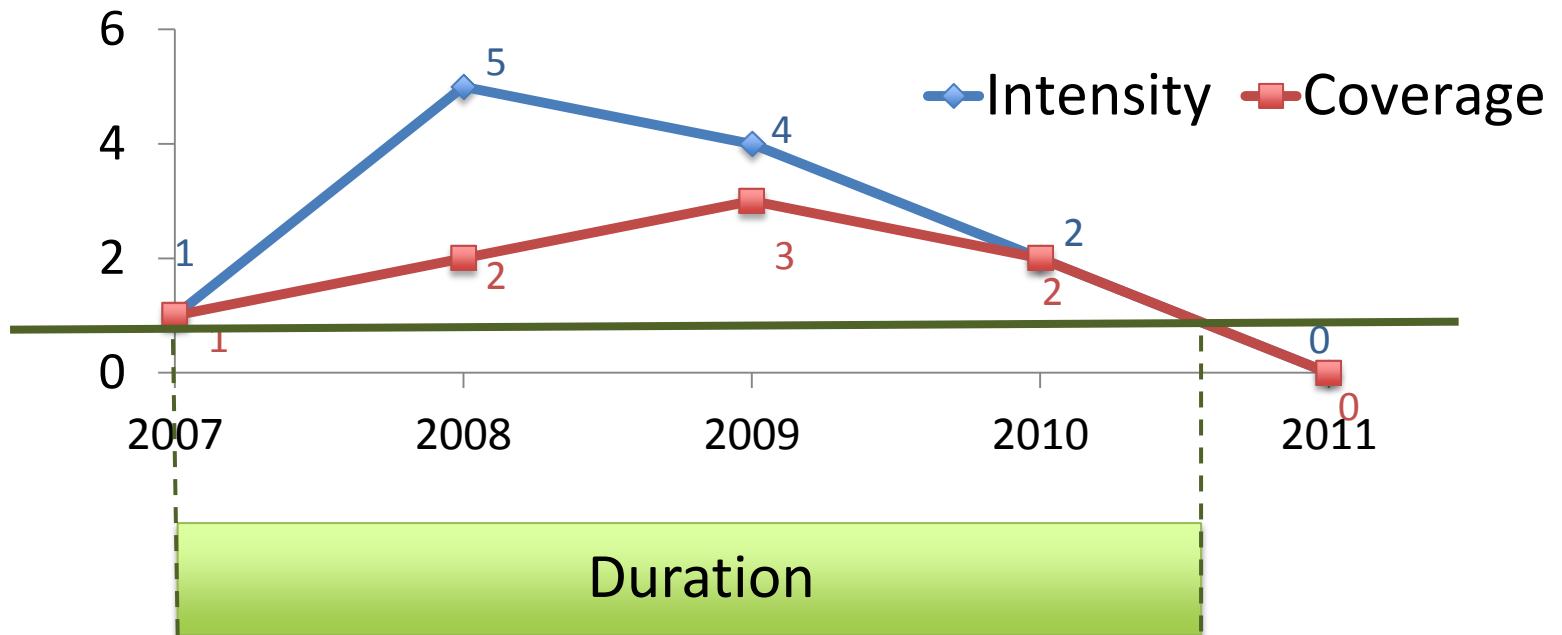
Building a Network Theory of Social Capital
Nan Lin in *Connections* (1999)
that **social capital** is captured from embedded resources in **social networks** . Deviations from
Save PDF to library · Related research 2,702 readers

Trend prediction applications

- **Scenario 1:** **Intensity**
 - an online video provider wants to predict how many times a video will be played by users in the next month.
- **Scenario 2:** **Coverage**
 - a disease control facility wants to predict how many people will suffer from a contagion in the following week.
- **Scenario 3:** **Duration**
 - a manufacturer wants to predict how long an existing product will continue to be popular.

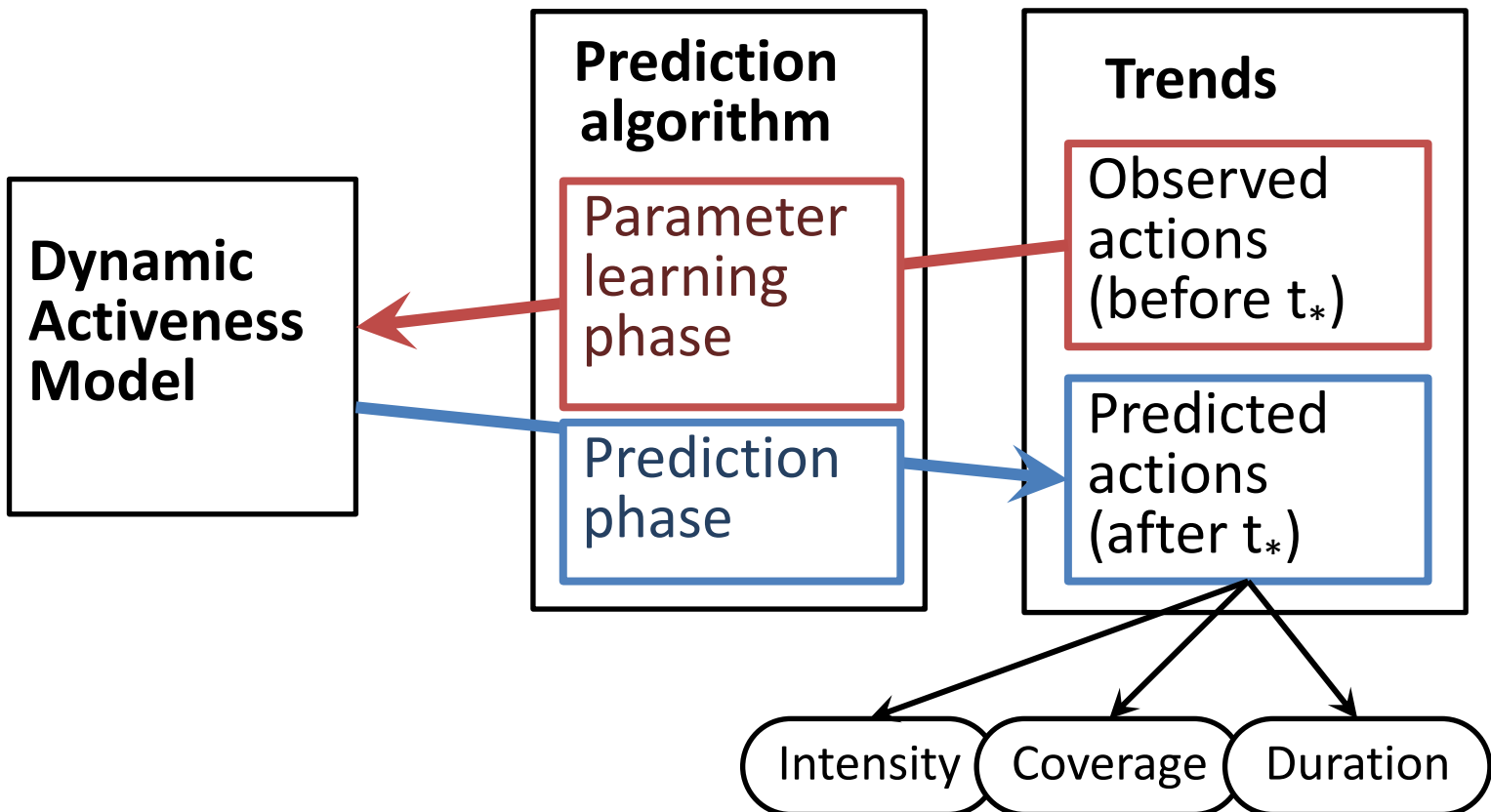
Characteristics of a trend: Intensity, Coverage and Duration

	2007	2008	2009	2010	2011
User 1	1	3	2	1	0
User 2	0	2	1	0	0
User 3	0	0	1	1	0



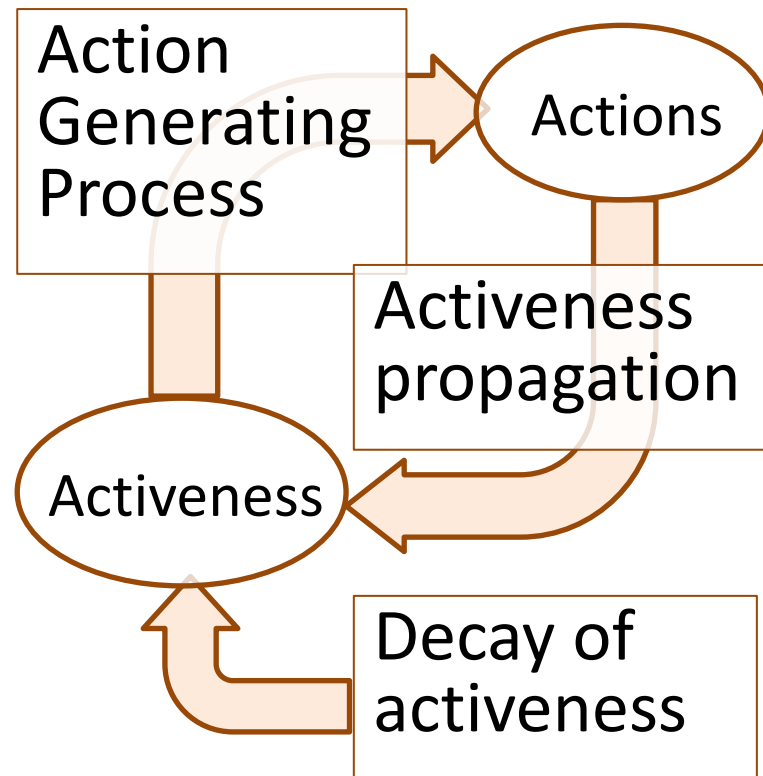
Trend prediction problem

- Given the actions of a trend before t_* , predict the coverage, intensity and duration after t_* .

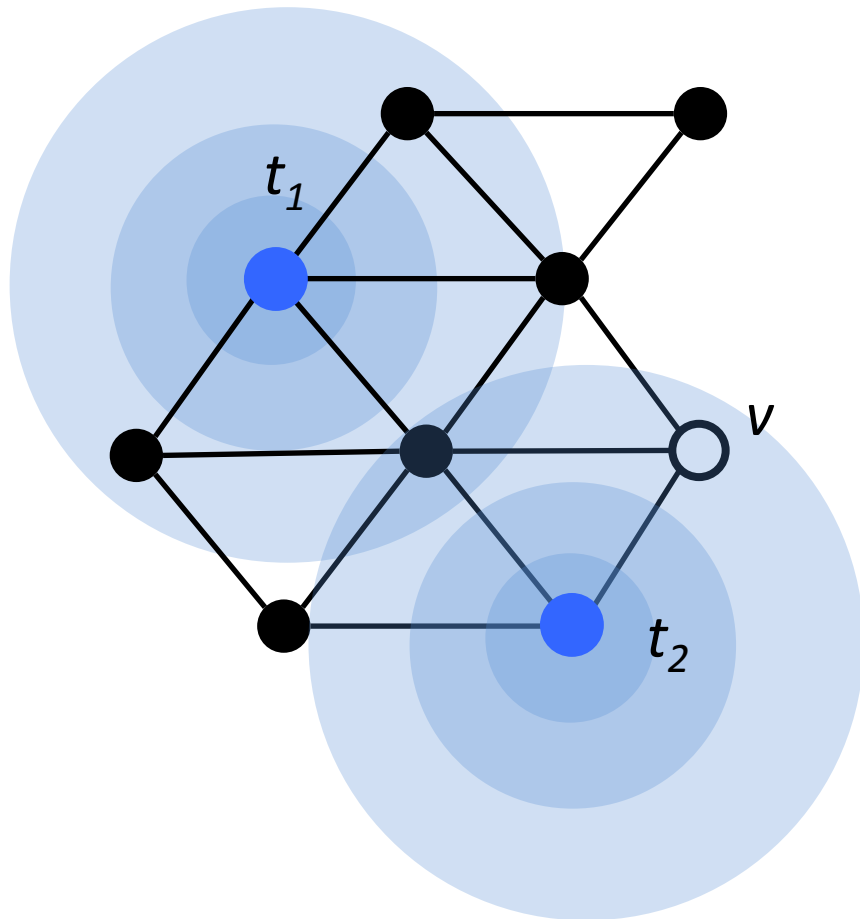


Dynamic Activeness (DA) model

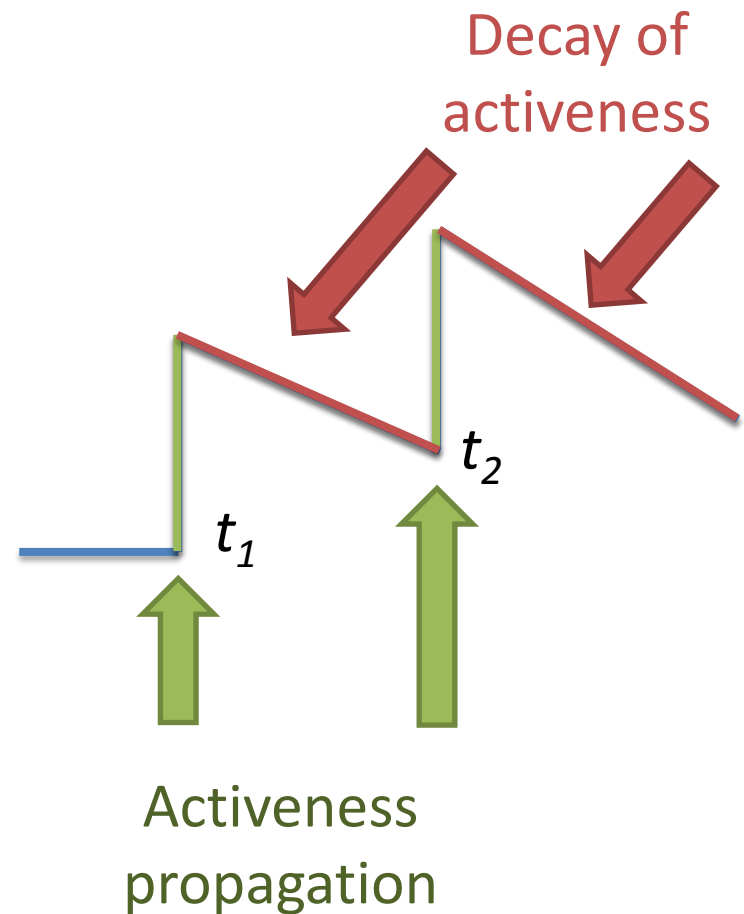
User interest = **Activeness** = Action rate



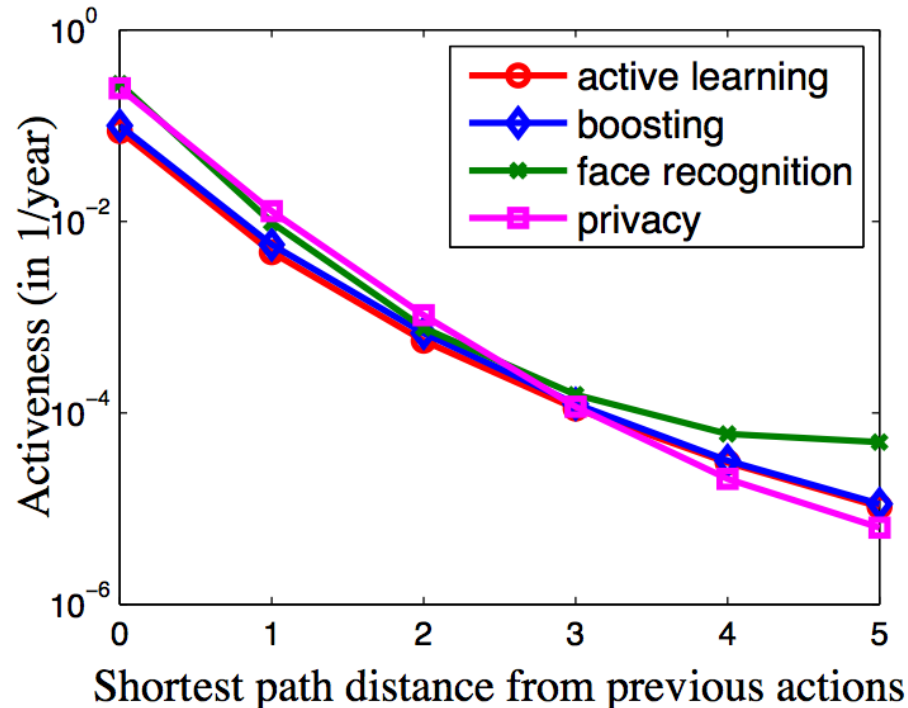
Activeness = user interest



Activeness of v



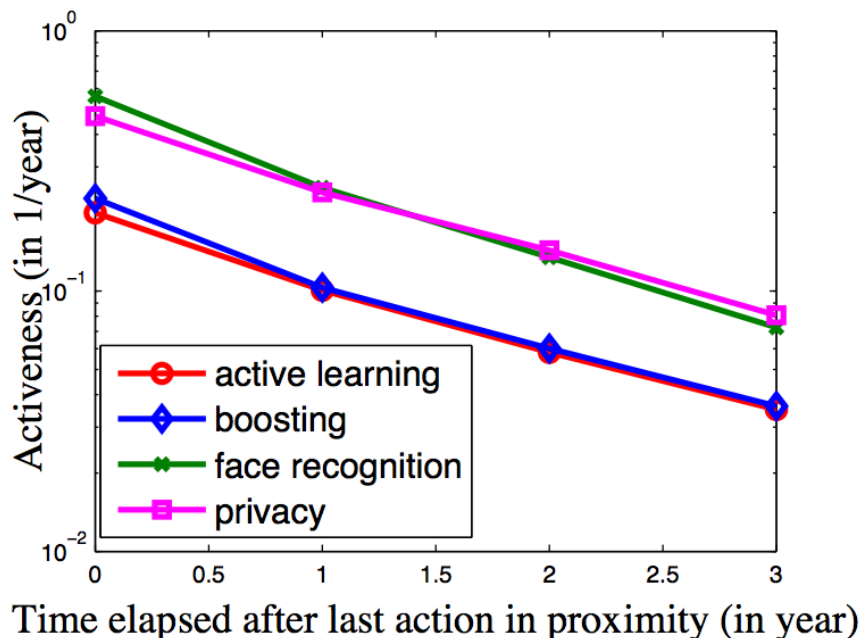
Activeness Propagation



Activeness exponentially decreases as the distance increases:

$$\lim_{t \rightarrow t_a +} r_v(t) = \lim_{t \rightarrow t_a -} r_v(t) + \alpha \cdot \exp(-b \cdot \text{dist}(u, v))$$

Decay of activeness

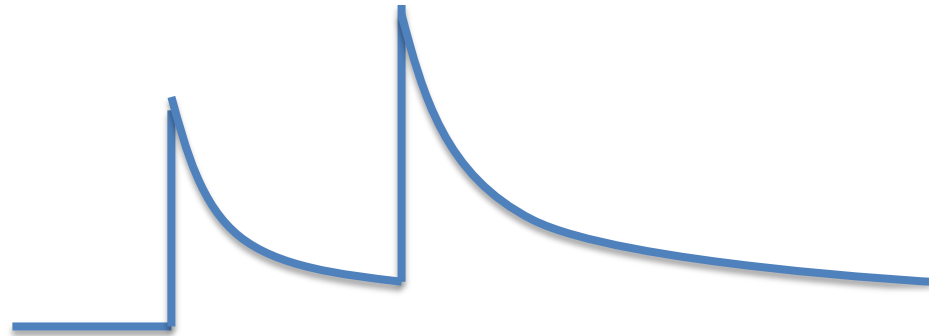


Activeness exponentially decreases as time progresses:

$$r_v(t) = r_v(t_0)e^{-(t-t_0)/\tau}$$

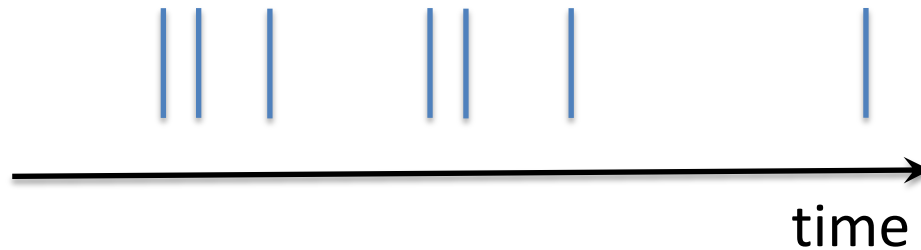
Activeness = action rate

Activeness of v

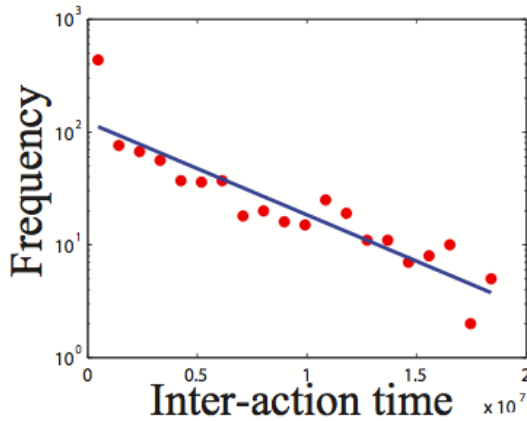


Action Generating Process

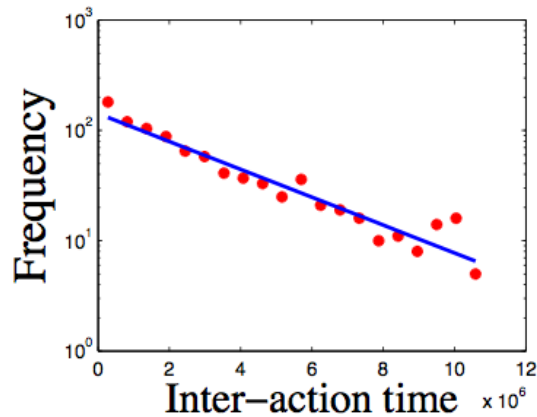
Actions of v



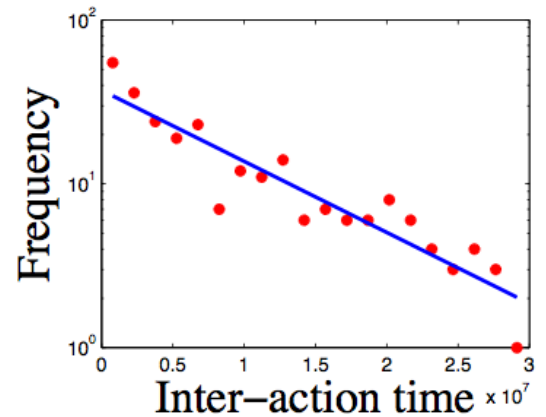
Action Generating Process



(a) Apple



(b) Android



(c) HTML5

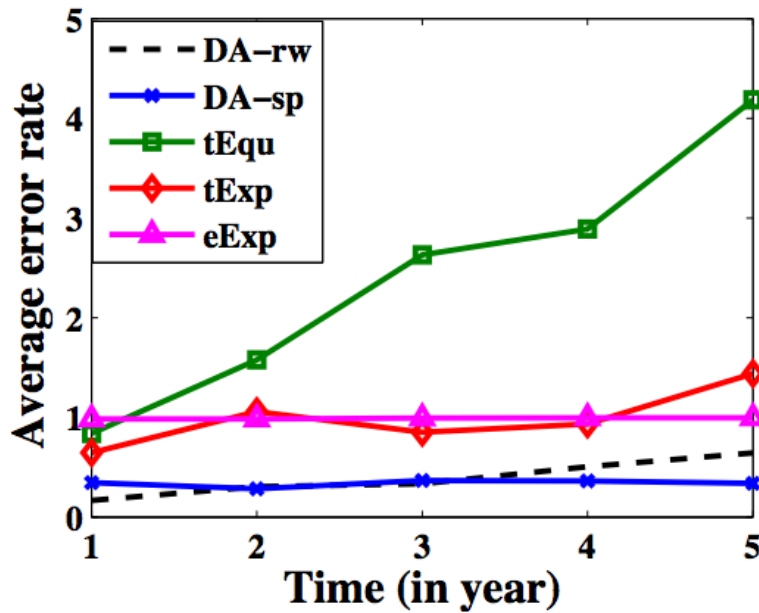
Actions are generated from activeness by a non-homogeneous Poisson process.

Experiment

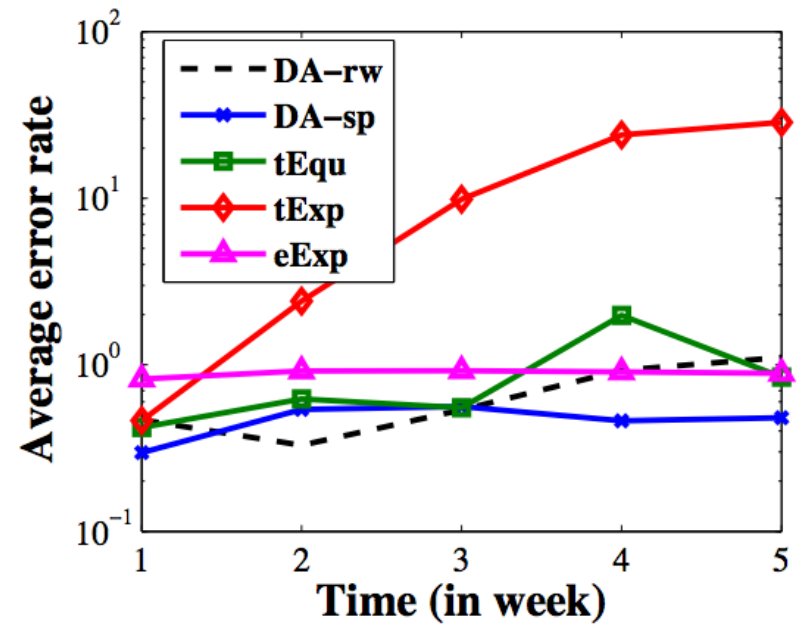
- Datasets
 - DBLP
 - Twitter
- Baselines
 - Three variants of the IC model with the propagation delay.
 - eExp
 - tExp
 - tEqu

Results

Coverage



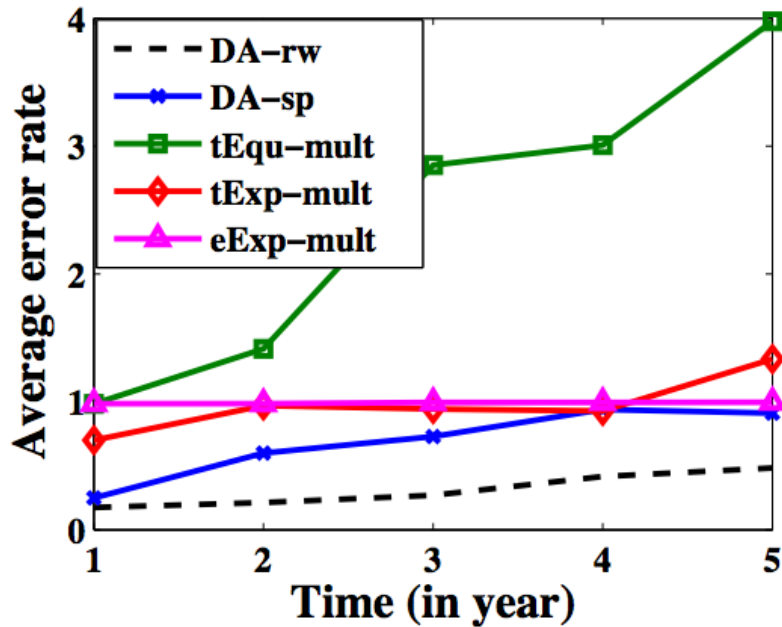
(a) DBLP



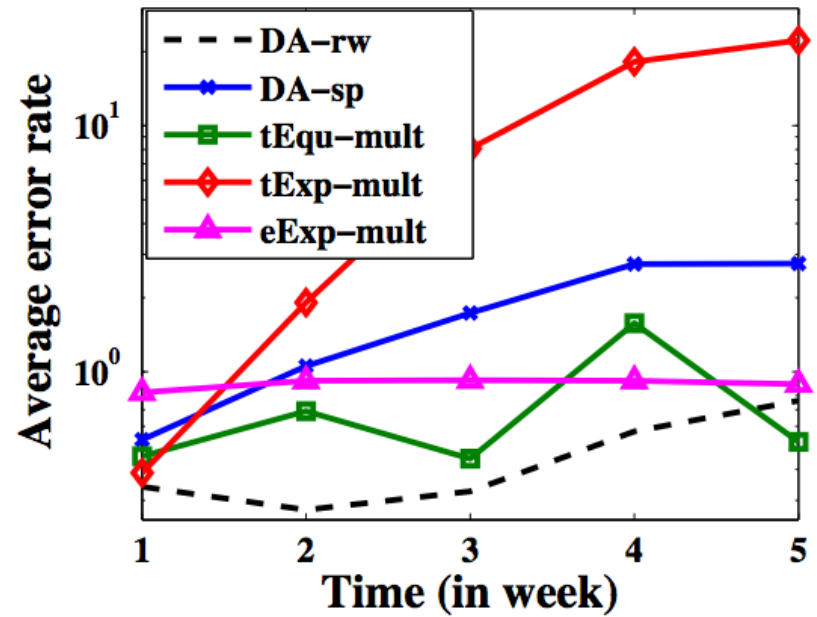
(b) Twitter

Results

Intensity



(a) DBLP



(b) Twitter

Results

Duration

	DBLP		Twitter	
	C-D	I-D	C-D	I-D
DA-rw	0.9	0.9	0.8	0.5
DA-sp	0.8	0.9	0.6	0.5
tEqu(-mult)	0.6	0.5	0.4	0.5
tExp(-mult)	0.8	0.9	0.6	0.7
eExp(-mult)	0.7	0.7	0.3	0.4

Conclusion

- Formalized the trend prediction problem with three characteristics of trends: coverage, intensity and duration.
- Proposed the Dynamic Activeness model for trends based on the novel concept of node activeness.

Thank you!