Modeling Dynamic Multi-Topic Discussions in Online Forums

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Abstract

[illegible]

Introduction

[illegible] *online forums* or *message boards* [illegible] *comments* or *posts* [illegible] *sports* [illegible] *board* or *community* [illegible] *topic* [illegible]

[illegible]

Overview

[illegible]

Intuitions

... *peer-influence* ... *self-preference* ...

... *the information is flowing from early posters (users who post) to late posters.* ... *topics* ...

... *time lapse factor* ...

... *Random Walks* ... *topics* ...

Problem Formulation

...

Data Input

- **Thread Document:** ... D ... $d \in D$ ... *thread document* ...
- **Reply Link:** ... R_{ij} ... u_i ... u_j ... d. ... C_i^d ... u_i ...

... d ... *thread root* ...

Data Output

- **Influential Network:** ... $G = (\ , E)$ ... $| = n$ ... E ... $n \times n$ ... $v_i \in$ ... u_i ... $e_{ij} \in E$ ... u_i ... u_j ... $\mathbf{W}$ ... $n \times n$ ... w_{ij} ... e_{ij} ... *peer-influence* ...
- **Topic-level Influential Network:** Cons ... $G^z = (\ , E^z)$ ... z ... 999 ... DA ... B ... C ... 9 ... Corr spon ... v_i^z e_{ij}^z w_{ij}^z $\mathbf{W}^z$ ... z ...
- **User Preference:** ... $\mathbf{y} = [y_1, \cdots, y_n]^\top$ ... *self-preference* ... *peer-influence* ... Corr spon ... $\mathbf{y}^z$ ... z ...
- **ParticipationRank:** ... 4 ... 9 ... 4 ...

n s n n Br n n 99 n u_j o o s u_i o o n n s ss on s u_j r p s u_i n s s p pos n or on o s ro u_i o u_j s p o r q n o s u_i r p u_j s R^d_{ij} n r o n d n n n w_{ij} o n r **W** sso o n n n or G s

$$w_{ij} = \sum_{d\in D} R^d_{ij}$$

w_{ij} r pr s n s s r n o n n o u_i o u_j n op on o op r ns on pro r **S** r n n r n o on G n n s

$$S = \ D^{-1}W + (1- \ )N$$

r **D** s on r (i,i) n q s o s o i ro o **W** ro s o **W** r s o ro r p n o s ro s n **N** s r n s q o n Eqn n n pr s pro o r ns on o n n no n pro $1-$ o p n o n no on r p n or r n o B n ro n r $(1- \ )$**N** ns r r ns on r **S** rr n r p G s ron onn r ns on pro s r pr s n *peer-influence* o s s n n o n op ons o op n ons *self-preference* or n p o o n s pos s u_i o n s n r spons o n o s rs n r o s C^d_i n r o n d n n o s pr n or $y = [y_1, \cdots, y_n]^\top$ s

$$y_i = \sum_{d\in D} C^d_i$$

nor or $q = [q_1, \cdots, q_n]^\top$ s n

$$q_i = y_i \ \ \sum_{i=1}^{n} y_i \qquad 4$$

s on r s pro s r on o r n o r p on n **p** o no s n o n r p r n o o n q on

$$p_{(t+1)} = \ S^\top p_{(t)} + (1- \ )q$$

r $p_{(t)}$ s r p on n or n t r on n on ro s n o *peer-influence* n *self-preference* n s s s n o o s o p rson n n 4 n orr spon s o pro o n o s s r s 99 r $p_{(t)}$ on o p^* s n p^* or $p_{(t+1)}$ n $p_{(t)}$

$$p^* = \ S^\top p^* + (1- \ )q$$

Fo o n so r s ps n n o n

$$p^* = (1- \ )(I - \ S^\top)^{-1}q$$

r **I** s n r n s s os or o o p r p on n s r s por n n n n ss o s n p r p on o s ss on o n op or r s o op rr no s n n or n p rsp o n or on o

Topic-specific Topic Flow Model

n s s s on n o op sp op F o o F or op s ss ons n r r s s r o s n op s n s s s ons o o n o on n or r n o n op s s s p r p on p ns o s ss on r n An p r p or o op s o po s no n s n spor s s p or s rs n n n n or s sso o n n op s s ss on r o n s pro s r o r n op s s r o n d n s n o op ss $z \in Z = \{z_1, \cdots, z_T\}$ pro $P(z|d)$ n s $P(z|d)$ o r pr s n s r n o op o r r n o z or os s rs o o n n s ss on o d r or n op z n n p n n orr spon n n n n or n s o n r p n r **W** or n n r ons n s rs n Eqn n o n W^z orr spon n o z s o o s

$$w^z_{ij} = \sum_{d\in D} P(z|d)R^d_{ij}$$

Corr spon n p s pr n or **y** n Eqn o o n y^z sso o z s o o s

$$y^z_i = \sum_{d\in D} P(z|d)C^d_i \qquad 9$$

o p ons o S^z q^z n p^*_z n s o n s pp n Eqn 4 n r sp r on n n o o s s n ors or r s on s r s s r p z on s r s o r p on n $\{p^*_z\}_{z\in Z}$ o s r n n ss o s o p r p n s ss on o n op z

o n o r s s n $= 1$ n n pro s o n op s n o n $\{P(z|d)\}_{z\in Z}$ n or s r on op sp op F o o r s o B s op F o o o n n op s op n D r A o on DA B n or n s n n o or op o n or o s no o n pro o ro s n n n n p o nn 999 s s s p

Time-sensitive Topic-specific Topic Flow Model

n s s s on propos s ns op sp op F o o F n orpor n *time lapse factor* or op s ss ons

s s pr n s o op s n o r n r For p n n s s o n oor spor s op n s s n r r n rn n s s or r p ss on n n oor spor s s s s p r p on p ns o op s r n n r o s on r ons o r r on o s s rr n or r ors s n on s os r n s r oo n or or n n o on s p r p on or r r n o on o n n ro ps or n r or n r sso o n op z W^z n Eqn s

$$w^z_{ij} = \sum_{d\in D} \exp(- \ \cdot \Delta t_d)P(z|d)R^d_{ij}$$

r $\Delta t_{\mathbf{d}}$ r pr s n s o ps ro n
n o r d s os n o rr n
or or pr on n s or n p r r
r s o q s r s op on ors n
o r s r pr r n or $\mathbf{y^z}$ n
Eqn 9 s

$$y_{\mathbf{i}}^{\mathbf{z}} = \sum_{\mathbf{d} \in \mathbf{D}} \exp(- \cdot \Delta t_{\mathbf{d}}) P(z|d) C_{\mathbf{i}}^{\mathbf{d}}$$

o p ons o $\mathbf{S^z}$ $\mathbf{q^z}$ n $\mathbf{p_z^*}$ n n r s s
s ss n o s s on
o n $= 0$ s s ns o r s
o op sp op F o o

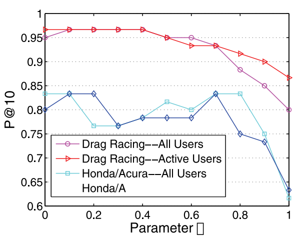
Experimental Results

n s s on rs s r s o o r s s
n pr s n pp r sn sp n or or ons rrs o r s 4 9 4 o r propos op s ss on o s
n n or on o on pro s r s 4 D n o o
n ro r pp r o r n
s *Timestamp* *User Name* *User ID* *Replied User Name*
n *Message Text* 9 4 r s n o o n s
ross on *all users* s n o r n s ro p 4 D s 4 4 o A

s o r p on n $\mathbf{p}_*$

[illegible] = 0.01 [illegible]

[illegible]	[illegible]	Dr[illegible] n		[illegible]on A[illegible]r	
		A[illegible]	A[illegible]	A[illegible]	A[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	B[illegible]F	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]F	**0.960**	**0.960**	[illegible]	[illegible]
	[illegible]F	**0.960**	**0.960**	**0.940**	**0.940**
A[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	B[illegible]F	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]F	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]F	**0.643**	**0.736**	**0.576**	**0.652**



Related Work

o s o o r no no pr o s s s s s
ons r pro o o n n
op s ss ons n on n or s sp ro p r
sp o n or on o o r r r o n s
o os r or r n s s on

Online Forums

n s o on n or s o s s on pp ons
s s q s on ns r s r s Con n
on s s r o Cro n 9 n n
r r s r ors n n s s n r n
o n s D n r nn r on B on n
B n s 9 s no r n r n
s 99o ss r s s n r s s o s no o n s 4 s ors os 4 o s p r 4 r 4 r 4 n