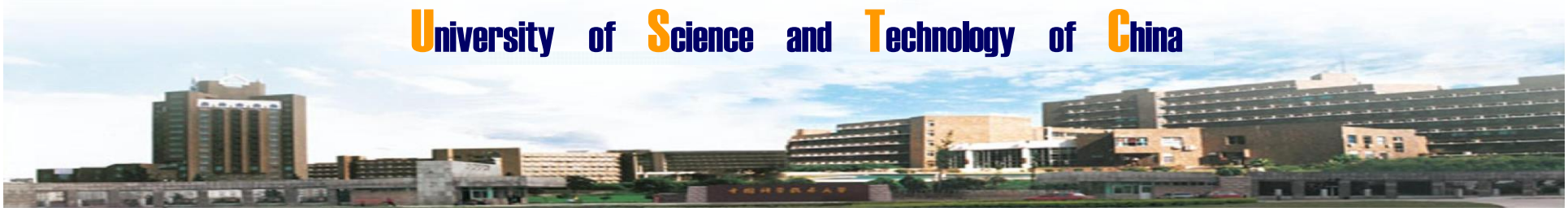
中国科学技术大学
University of Science and Technology of China

Exploring the Choice under Conflict for Social Event Participation

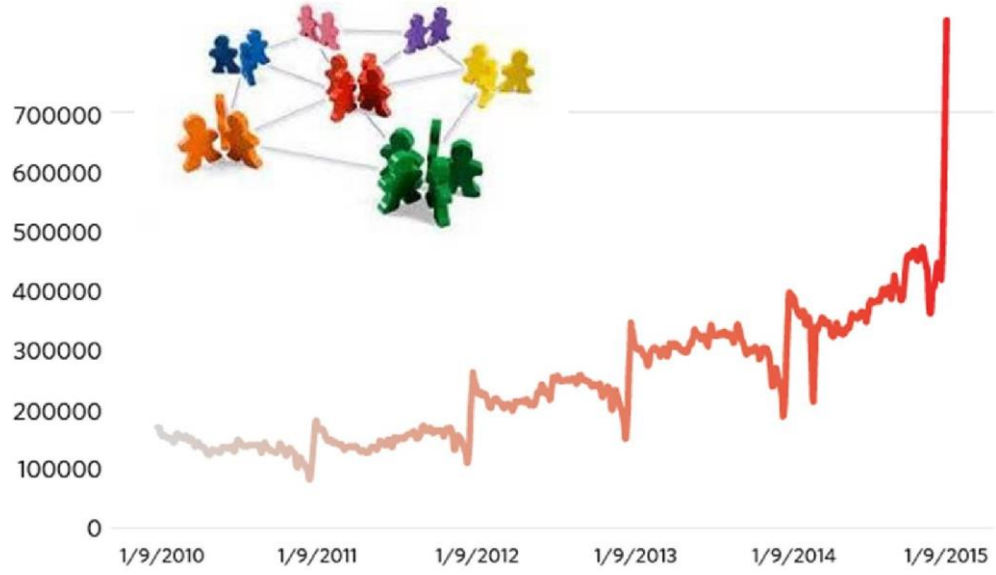
Xiangyu Zhao, Tong Xu, Qi Liu, Hao Guo

University of Science and Technology of China



Background

- Offline social events emerge, which connect cyber and physical social network.
- New challenges raise to draw events plan and predict attendance.

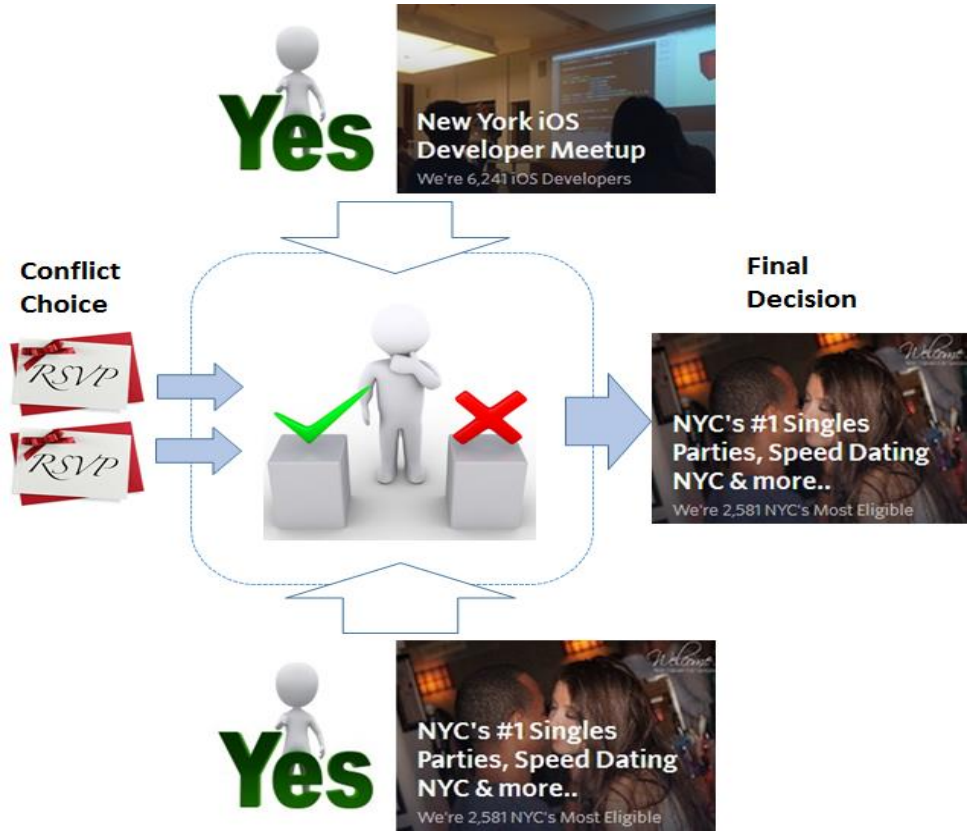


Prior Arts

- Traditional techniques tend to summarize users' historic participation.
  - Basic Assumption: Attendance may indicate preference, higher frequency may lead to more significant interest.
- However, they may fail to describe the various motivations of users.
  - User’s real preference may be concealed in different motivations.
  - ***Attendance may not directly affect preference.***

Motivation 1 – Conflicting Choices

- Final decisions among conflicting invitations may better reflect users' real preference.



Motivation 2 – Choice Utility

- Various motivations may exist within decision- making process.
  - Social interaction
  - Event topics
  - Cost factors
    - financial cost
    - distance

CCT – Problem Statement

- Basic Assumption
  - The contrast between pairwise events' choice utility could reveal the actual preference of users.

$$h(P_{u,e_n} - P_{u,e_y})$$

- Choice Utility for rejected event
- Choice Utility for attended event

CCT – Choice Utility

- Choice Utility are determined by three factors
  - content-based utility
  - social-based utility
  - cost-based utility

$$P_{u,e_k} = C_{u,e_k} \cdot S_{u,e_k} \cdot D_{u,e_k}$$

CCT – Choice Utility

- Content-based utility

$$C_{u,e_k} = cosine(\mathbf{t_u}, \mathbf{a_k}) = \frac{\mathbf{t_u} \bullet \mathbf{a_k}}{\|\mathbf{t_u}\| \|\mathbf{a_k}\|}$$

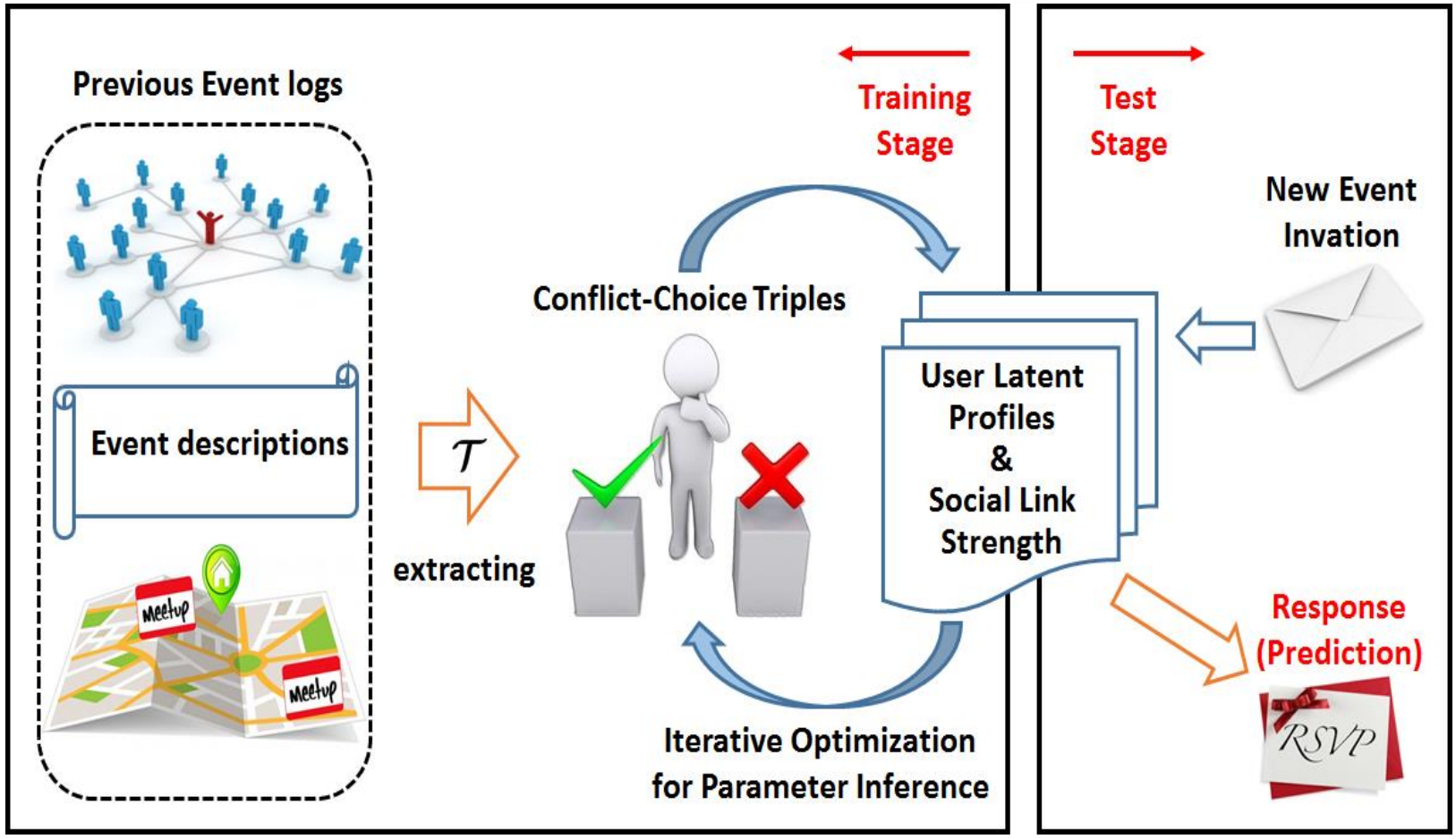
- Social-based utility

$$S_{u,e_k} = 1 - \prod_{v \in N_{u,k}} (1 - w_{vu})$$

- Cost-based utility

$$D_{u,e_k} = \frac{1}{|X_u|\sigma} \sum_{x \in X_u} K(\frac{y - x}{\sigma})$$

CCT – Two-stage Framework



CCT – Two-stage Framework

- Training Stage: Inferring the choice utility for each event of target user, as well as learning the connections strength and users' profile vector.
  - Minimizing the discriminant error.

$$\min_{w,\mathbf{t_u}} F(w, \mathbf{t_u}) = \sum_{r_i \in R_u} \sum_{e_y, e_n \in r_i} h(P_{u,e_n} - P_{u,e_y})$$

- Test Stage: Participation analysis on given social event and target user group.

Technical Solution

- Optimization Task
  - Gradient descent methods

$$\frac{\partial P_{u,e_k}}{\partial w_{vu}} = C_{u,e_k} \cdot \prod_{x \in N_{u,k}, x \neq v} (1 - w_{xu}) \cdot D_{u,e_k}$$

$$\frac{\partial P_{u,e_k}}{\partial t_u^m} = \frac{a_k^m \cdot \|\mathbf{t_u}\|^2 - t_u^m \cdot \mathbf{t_u} \bullet \mathbf{a_k}}{\|\mathbf{t_u}\|^3 \|\mathbf{a_k}\|} \cdot S_{u,e_k} \cdot D_{u,e_k}$$

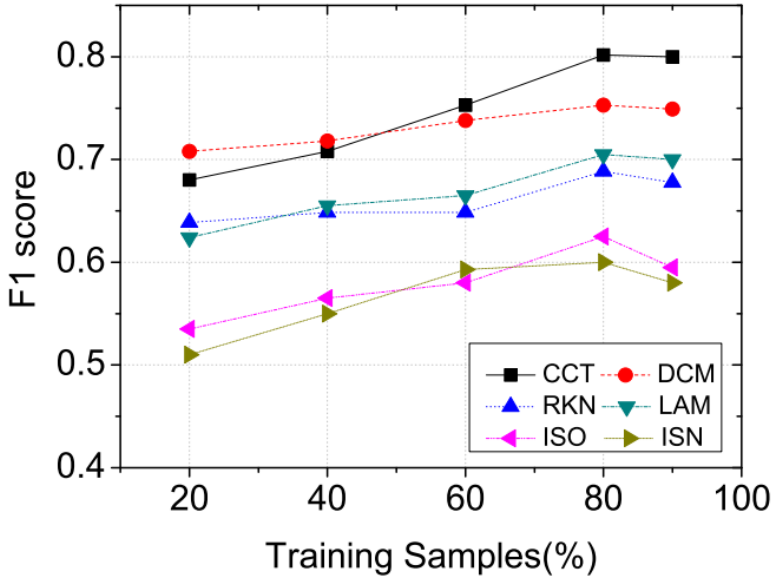
Experimental Results

- To verify the effectiveness, we perform extensive experiments on real-world data set extracted from official API of ***Meetup.com***.
- 625 user groups, 50,719 social events and 99,854 related users are analyzed in total.
- Several state-of-the-art techniques are compared as baselines, including Discrete Choice Model, RankNet, LambdaMART and Information Spreading model.

Experiments – Overall Results

Table 2. Overall performance of each approach.

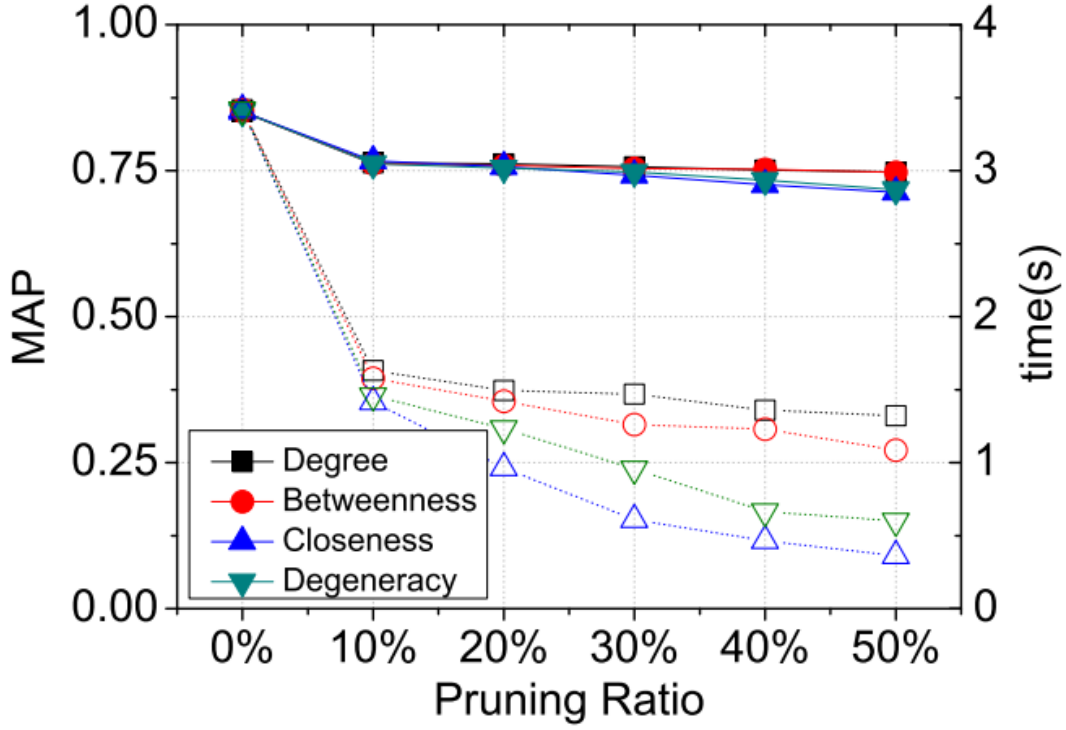
	CCT	DCM	RKN	LAM	ISO	ISN
MAP	**0.8513**	0.7683	0.8069	0.8299	0.6980	0.6699
Improvement(%)	-	10.788	5.5003	2.5826	21.968	27.066
P-Value	-	0.0000	0.0091	0.0387	0.0000	0.0000
F1 score	**0.8016**	0.7530	0.6885	0.7050	0.6249	0.5996
Improvement(%)	-	6.4542	17.873	15.130	29.859	35.283
P-Value	-	0.0000	0.0000	0.0000	0.0000	0.0000



- Significant margin occur compared with baselines, which validates the potential of our Conflicting Choice model in analyzing social event participation.

Experiments – Network Pruning

- Optimization task is a time-consuming process.
- Inactive neighbors are usually useless in the prediction process.



Discussion – Interesting Rules

	Sample A		Sample B		Sample C		Sample D	
precision	100%		100%		100%		55%	
Participation	Attend	Absent	Attend	Absent	Attend	Absent	Attend	Absent
Topic Sim.	0.388	0.193	0.351	0.407	0.702	0.766	0.791	0.818
Members	16.50	17.50	7.750	2.750	11.57	11.67	51.25	45.22
Distance	5.376	5.381	11.06	10.98	1.889	5.112	18.56	11.42

- Type of social-based influence
  - authority influence
  - group influence

Conclusion

- Final decisions among conflicting invitations would better reflect users' real preference.
- Effects of topic-based, social-based and cost-baesd utility should be highlighted during the event participation.
- It will be interesting to design more complicated scheme to describe the social-based utility, especially to extend the point-to-point interaction to the superimposed effect of multiple attenders or even little community.

Thanks!

zxy1105@mail.ustc.edu.cn