
Relational Learning via Latent Social Dimensions



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and



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Social Networking Advertizing

Recent Boom of Social Media

VS

“In 2008, 57% of all users of social networks clicked on an ad and only 11% of those clicks lead to a purchase”

Reality:

- **Limited user profile information**
- **Readily available Social Network**

Core Problem:

- **How to utilize Social Network information to help predict user preference or potential behavior?**

Advertisers Face Hurdles on Social Networking Sites

By RANDALL STROSS
Published: December 13, 2008

FOR some time, [Procter & Gamble](#), the world's largest advertiser, has been dipping its big toes into the vast pool of [Facebook](#), now the world's largest social network. I recently knocked on the doors of both companies to hear how the experiment was going. Neither was inclined to say much.

[Enlarge This Image](#)



The "America's Favorite Stains" campaign, offered on Facebook by Procter & Gamble, asks for members' ideas. It recently displayed 18 submissions.

not ignored entirely.”

When advertisers invite members to come to pages dedicated to their products, they can attract visitors only by investing in expensive creative material or old-fashioned promotions like prize contests.

Independent experts on Web advertising have been watching, however, and what they see is a myriad of difficulties in making brand advertising work on social networking sites. Members of social networks want to spend time with friends, not brands.

When major brands place banner advertisements on the side of a member's home page, they pay inexpensive prices, but the ads receive little attention. Seth Goldstein, co-founder of SocialMedia Networks, an online advertising company, wrote on his Facebook blog that a banner ad “is universally disregarded as irrelevant if it's

- E-MAIL
- SEND TO PHONE
- PRINT
- SINGLE PAGE
- REPRINTS
- SHARE

Problem Formulation

- User Preference or Behavior can be represented by labels (+/-)
 - Whether or not clicking on an ad
 - Whether or not interested in certain topics
 - Subscribed to certain political views
 - Like/Dislike a product

 - **Given:**
 - A social network (i.e., connectivity information)
 - Some actors with identified labels

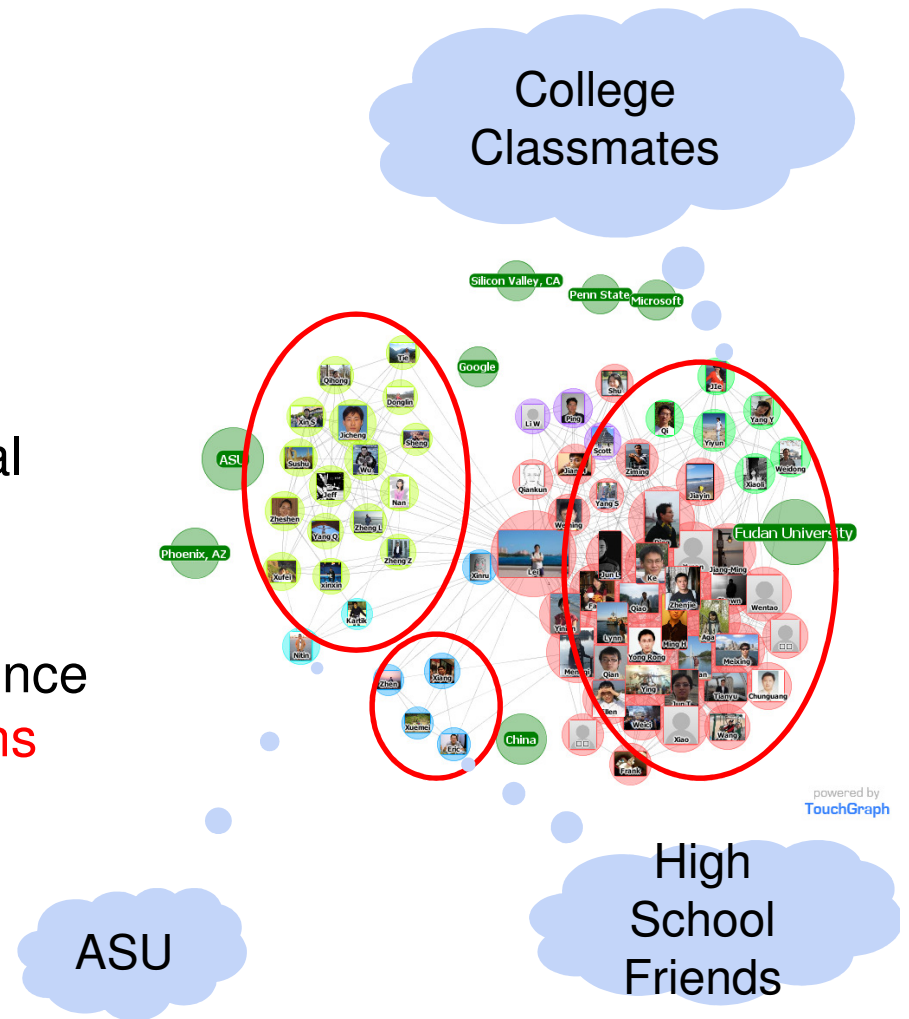
 - **Output:**
 - Labels of other actors within the same network
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Collective Inference

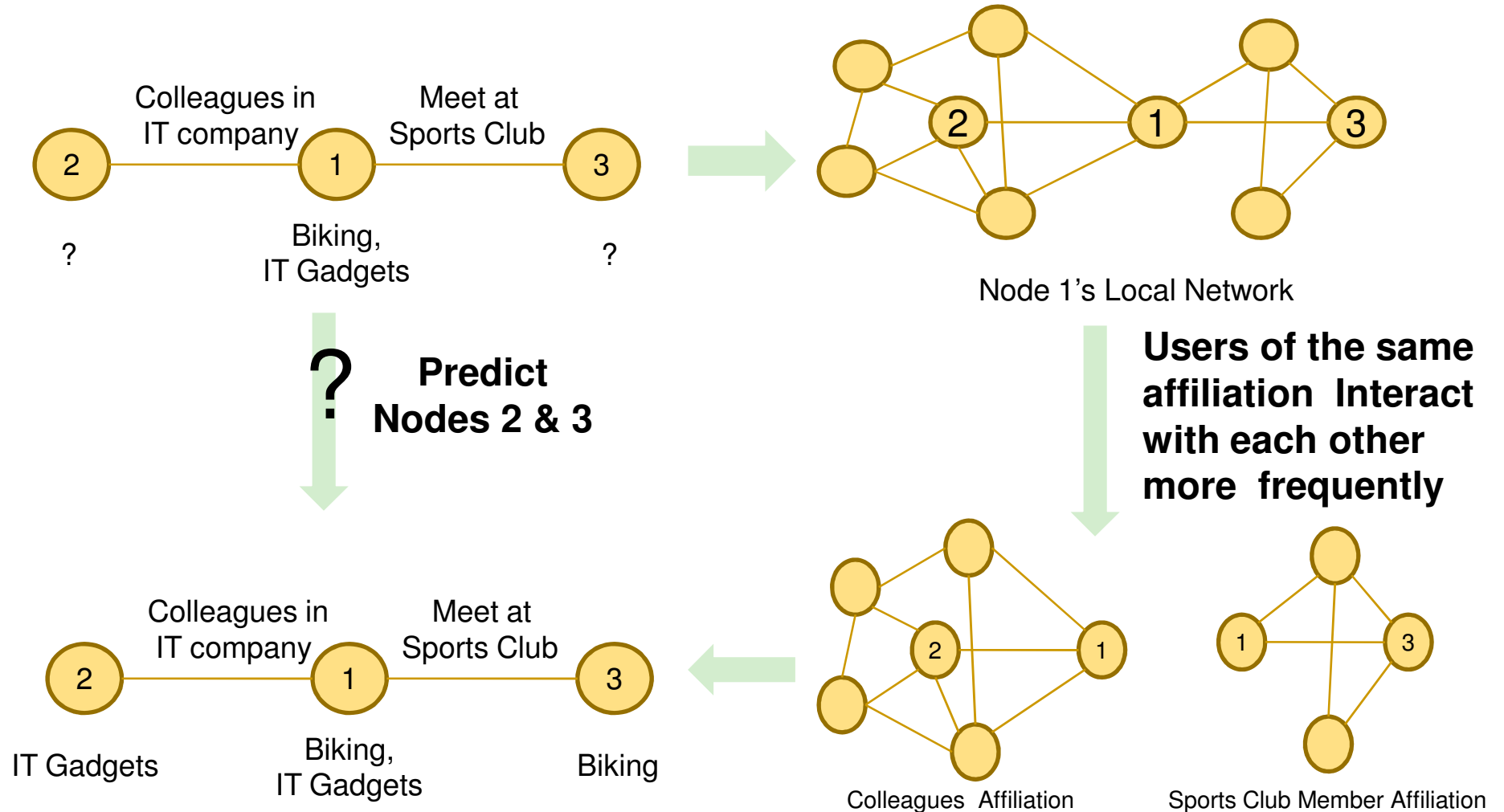
- Markov Assumption
 - Label of one node depend on that of its neighbors
 - Training
 - Build a relational model based on labels of neighbors
 - Prediction --- **Collective inference**
 - Predict the labels of one node while fixing labels of neighbors
 - Iterate until convergence
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Heterogeneous Relations

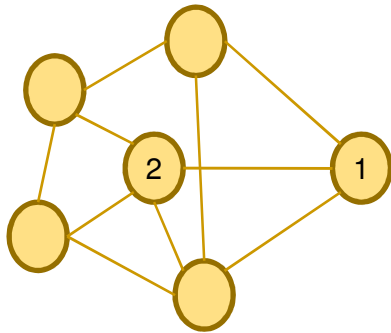
- Connections in a social network are heterogeneous
- Connection type information in social media is not always available
- Direct application of collective inference to social media **treats all connections equivalently**



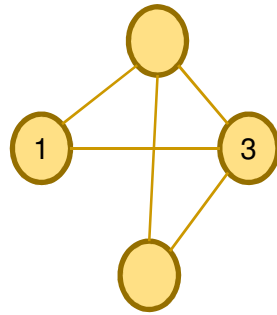
Extracting Actor Affiliations



Social Dimensions



Affiliation 1

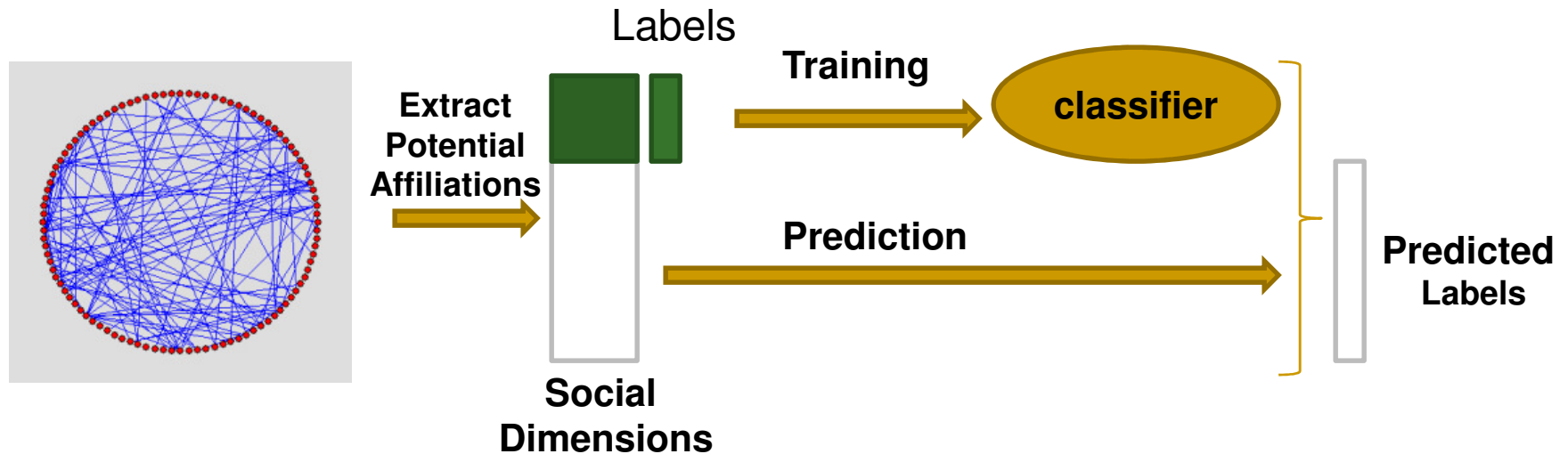


Affiliation 2

Actor	Affiliation 1	Affiliation 2
1	1	1
2	1	0
3	0	1
...

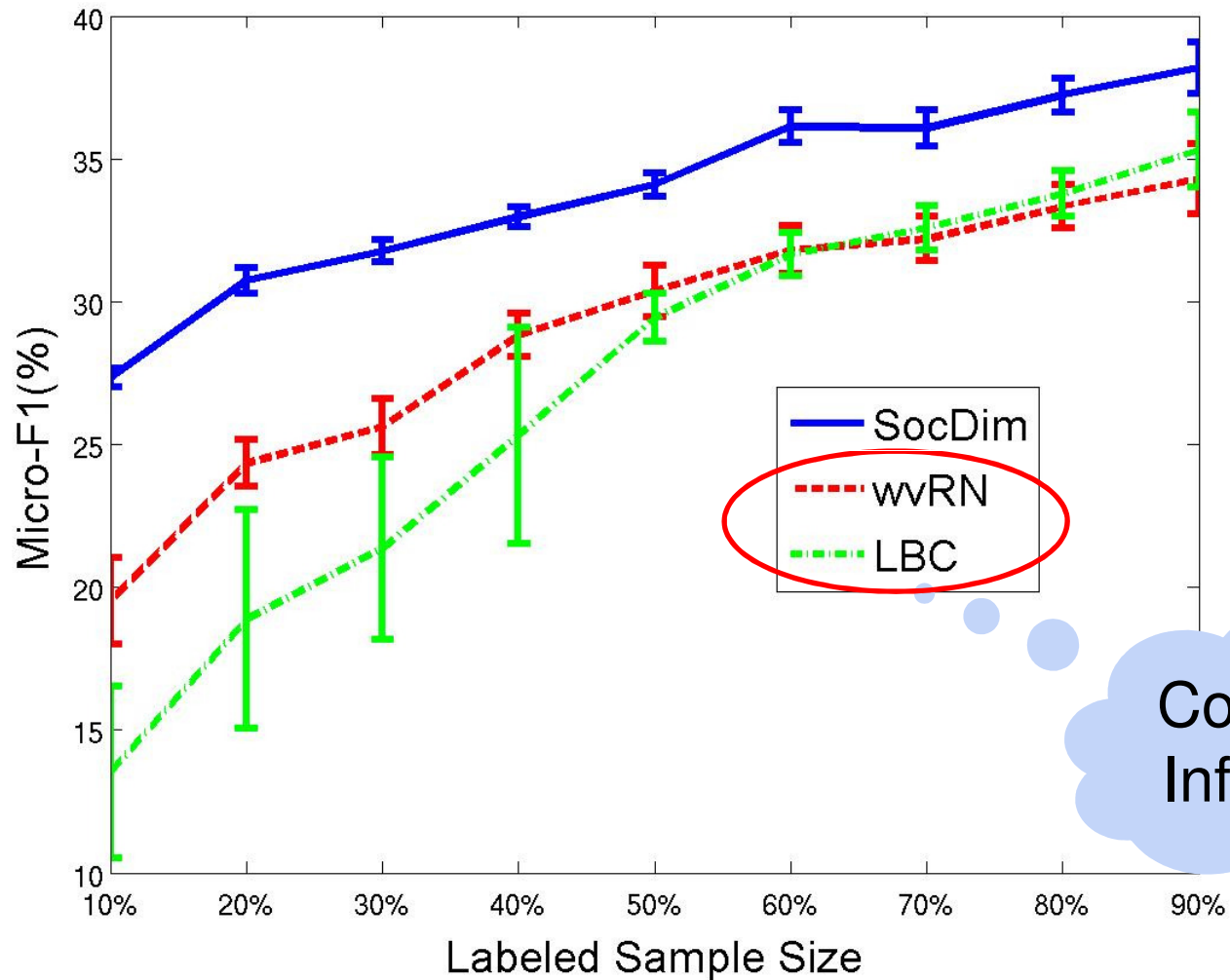
- Affiliations of actors are represented as **social dimensions**
- Each Dimension represents one potential affiliation
- Social dimensions capture prominent interaction patterns presented in the network

SocDim: Framework based on Social Dimensions



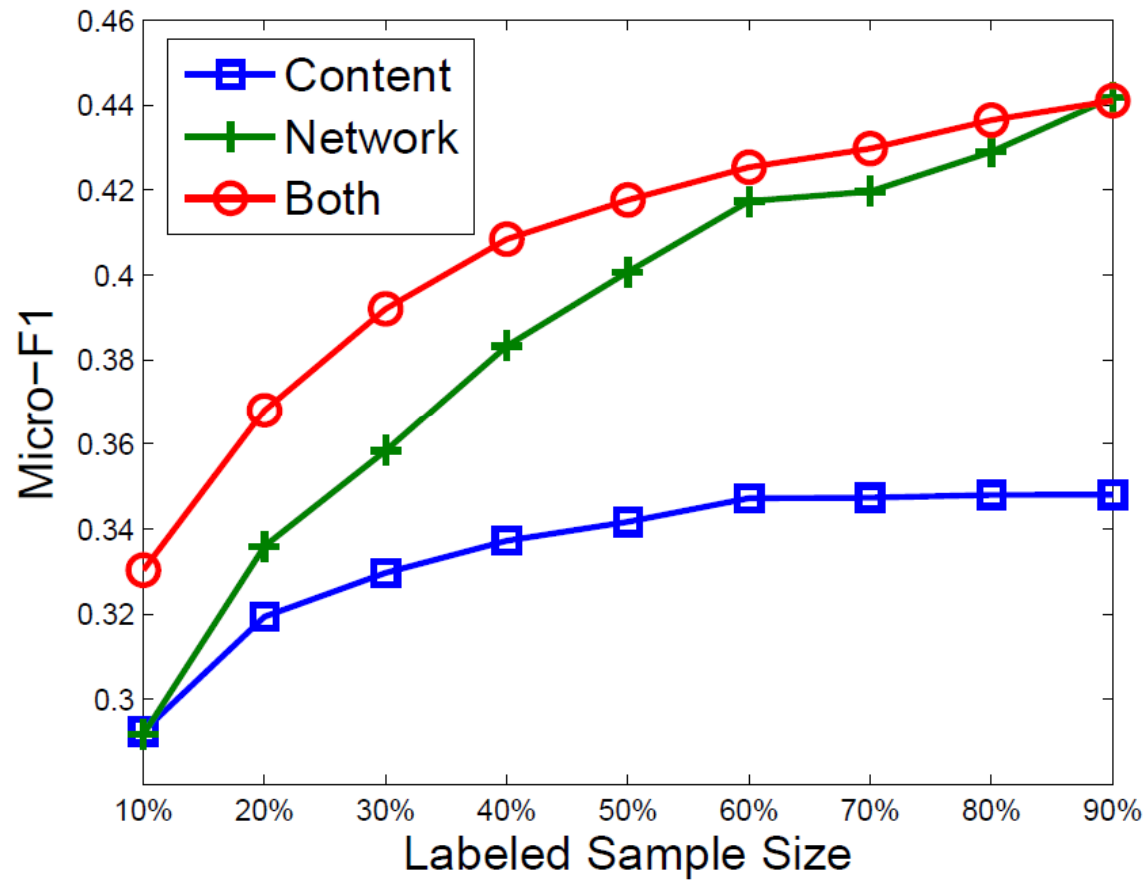
- Training:
 - Extract social dimensions to **represent potential affiliations of actors**
 - Any soft clustering methods is applicable (modularity maximization, graph Laplacian)
 - Build a classifier to **select those discriminative dimensions**
 - Any discriminative classifier is acceptable (SVM, Logistic Regression)
- Prediction:
 - Predict labels based on one actor's latent social dimensions
 - No collective inference is necessary

SocDim vs. Collective Inference



Collective Inference

Conjunction with Other Features

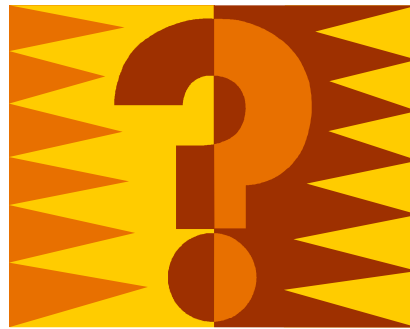


Summary

- Networks in social media are *heterogeneous*
 - SocDim proposes to extract social dimensions to capture potential affiliations of actors
 - SocDim converts networks into features that can be combined with other content and/or profile features
 - SocDim outperforms other representative relational learning methods, and no collective inference is necessary for SocDim
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- Please feel free to contact “Lei Tang”
 - Both data and code are publically available at Lei’s homepage
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