

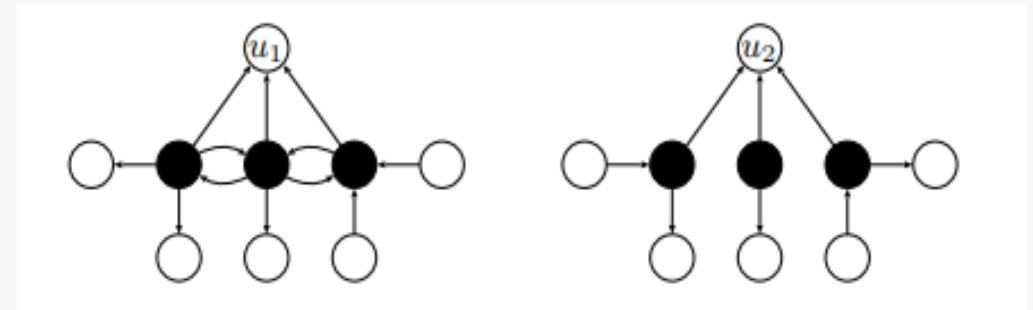
# Real-World Popularity Estimation from Community Structure of Followers on SNS

---

Shuheï Kobayashi, Keishi Tajima  
Kyoto University

## Does the number of followers accurately reflect the real-world popularity?

- The number of followers is a metric of popularity on SNS
- But followers on SNS are a sampling from real-world fans and are often biased
- Therefore, the number of followers does not necessarily directly reflect real-world popularity
- Can we better estimate real-world popularity by using the community structure of followers?



- Do different community structures reflect the target user's real-world popularity?
- Do SNS users with followers more distributed over the graph have more real-world popularity?

# PageRank

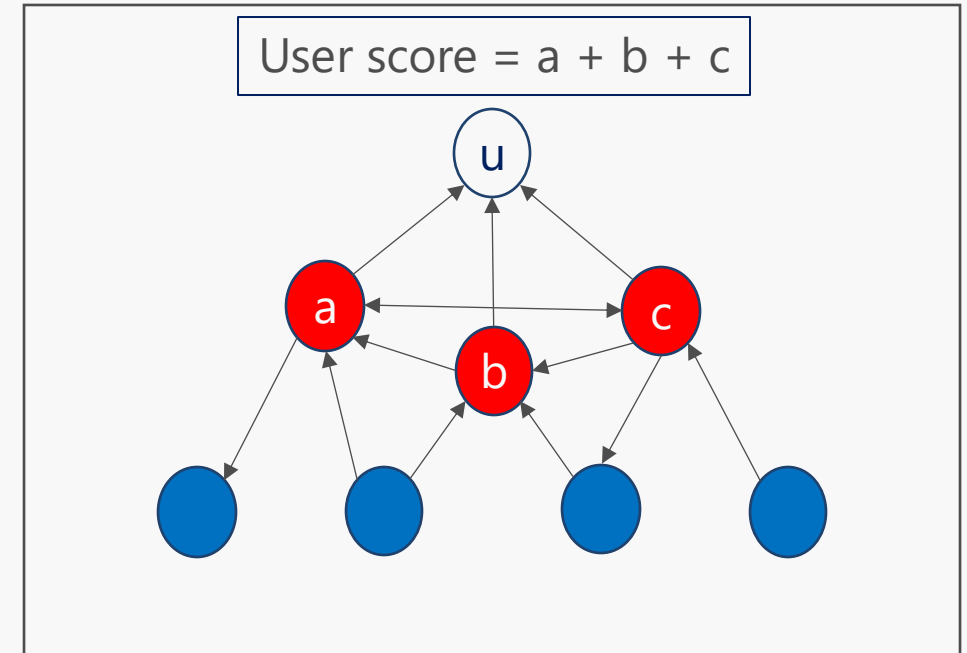
- A method for determining the value of a node in a network
- Need **a whole graph**



In our research, we use **only 2-hop graph**

# Calculate a score of each user

- Create *the follower-neighbor graph*
  - Retrieve a target user's ID, followers' IDs, and IDs of followers/friends of each follower
- Calculate the score of each follower using the method on the next page
- Sum up the scores of all the followers, and the result is the metric for estimating real-world popularity
  - The higher the score, the higher the popularity



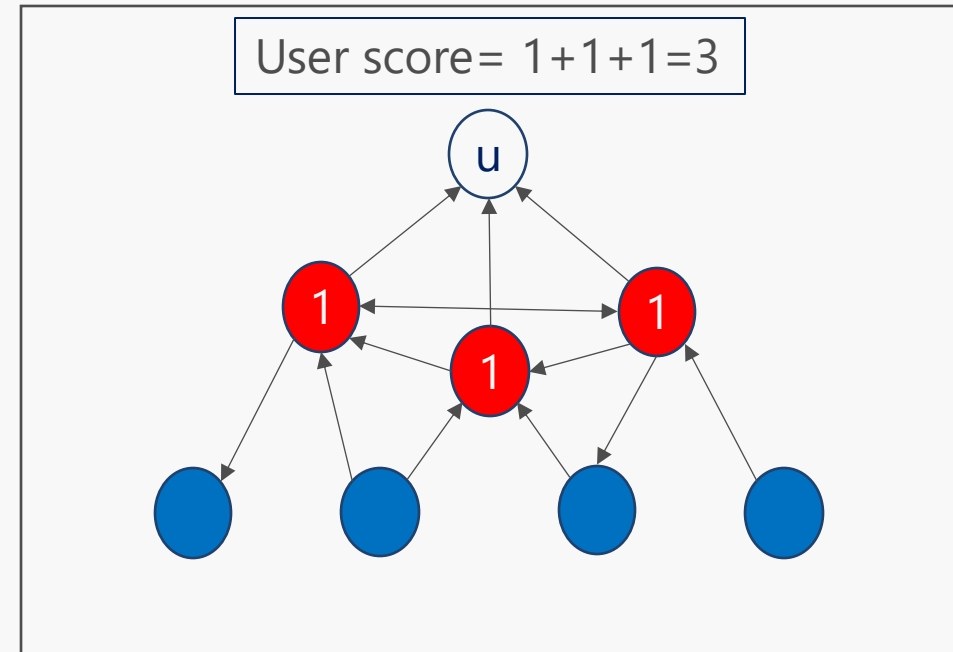
u is a target user,  
red nodes are followers, and  
blue nodes are friends/followers of each follower  
a, b, c is each follower's score

# Scoring the followers by the proposed method

- $Score = \frac{\log_2(\# \text{ of blue nodes adjacent to red nodes} + 2)}{\log_2(\# \text{ of red nodes adjacent to red nodes} + 2)}$
- **The more the number of adjacent red nodes, the smaller the score**
  - Followers from a same community (e.g. real friends) score lower
  - Smaller distribution when there are many adjacent red nodes
- **The more the number of adjacent blue nodes, the larger the score**
  - The more connections, the higher the score
  - More adjacent blue nodes are more valuable because followers are more likely to be influential or belong to various communities
- **The above score is calculated for each follower, and then summed up to obtain the target user's score**

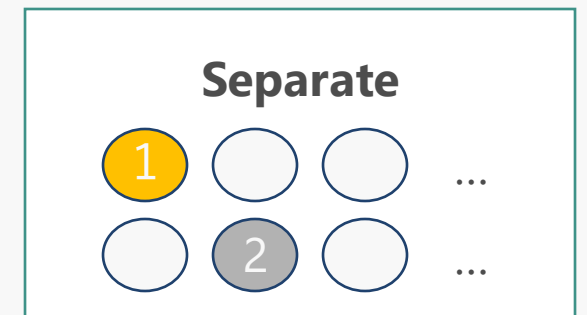
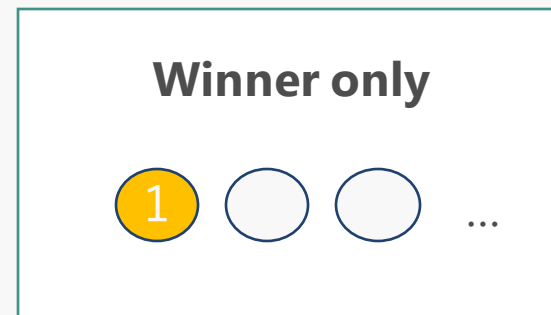
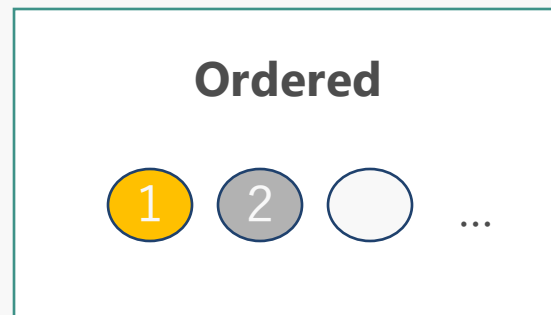
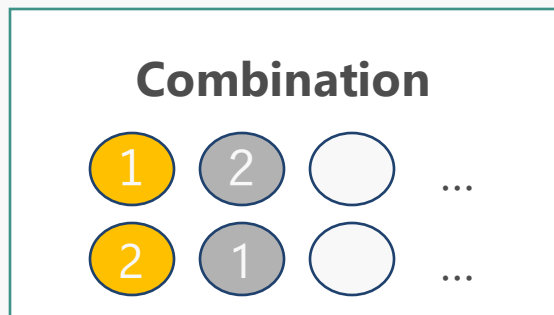
# Example of score calculation

- Each user's follower has two **red** adjacent nodes and two **blue** adjacent nodes
- Each follower's score is 1
  - Each follower's score =  $\frac{\log_2(2+2)}{\log_2(2+2)} = 1$
- Therefore, the score of this target user is 3
  - User score =  $1 + 1 + 1 = 3$



# Predicting Ms/Mr University Competitions Standings

- Predicting the winner and the runners-up of nine competitions
- Compare the accuracy of proposed methods and the method using the number of followers
- Four evaluation metrics



## Calculate the score of each target user

- Use Twitter and Instagram
- Construct the follower-neighbor graph on Twitter and calculate the score
- Instagram scores are estimated from Twitter scores



# Obtain twitter graph only

- Although it is desirable to obtain the follower structure for both Twitter and Instagram, the Instagram follower structure is difficult to obtain due to restriction
- Instagram scores are estimated by converting scores obtained from Twitter
  - $Insta-score = Twitter-score \times \left(\frac{\# Instagram\ followers}{\# Twitter\ followers}\right) \times \left(\frac{0.106}{0.42}\right)$
  - 0.106 is the clustering coefficient of Twitter social graph (A. Java, 2007), 0.42 is that of Instagram social graph (L. Manikonda, 2014)
- Experiments with two patterns: Twitter+Instagram and Twitter only

# Example of score converting

- Estimate Instagram score

Twitter score	Instagram score	# Twi followers	# Ins followers
1,000	?	1,000	2,000

- Instagram score is 504

$$\text{Insta-score} = 1000 \times \left(\frac{2000}{1000}\right) \times \left(\frac{0.106}{0.42}\right) \approx 504$$

$$\text{Twi} + \text{Insta-score} = 1000 + 504 = 1504$$

## Twitter + Instagram

Accuracy	Combination	Ordered	Winner only	Separate
# Twi followers	3/9	1/9	6/9	7/18
# Ins followers	5/9	3/9	6/9	9/18
#Twi + Ins followers	5/9	3/9	7/9	10/18
Proposed method	4/9	2/9	6/9	8/18

- The number of total followers shows the best accuracy on Twitter+Instagram

## Twitter only

Accuracy	Combination	ordered	Winner only	separate
# Twi followers	3/9	1/9	6/9	7/18
Proposed Method	5/9	4/9	6/9	10/18

- Proposed method shows the best accuracy on Twitter only

## Follower structure may be used to estimate real-world popularity

- The proposed method shows a lower accuracy on Twitter+Instagram, but shows a higher accuracy on Twitter only
- If *the follower-neighbor graph* of the Instagram could be obtained, the proposed method could show higher accuracy on Twitter+Instagram
- The characteristics of the proposed method suggest that the more distributed the followers are, the higher the real-world popularity is, and the higher the value of the followers, the higher the real-world popularity.