Community Interaction Optimization on Twitter for People with Mood Disorders

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Resume

Yuichi Okada

- Ph.D. student in Informatics
    - Optimization Algorithms
    - Software Development
    - Research on SNS(Twitter)

- President of a tutoring school in Japan
- Freelance programmer

Agenda

- Outline of our study and previous works
- Overview of the current study
- Details of the Proposed System
- Computational Experiments and Result
- Limitation and Future work

Introduction

Purpose: Optimize Interactions of Twitter Users

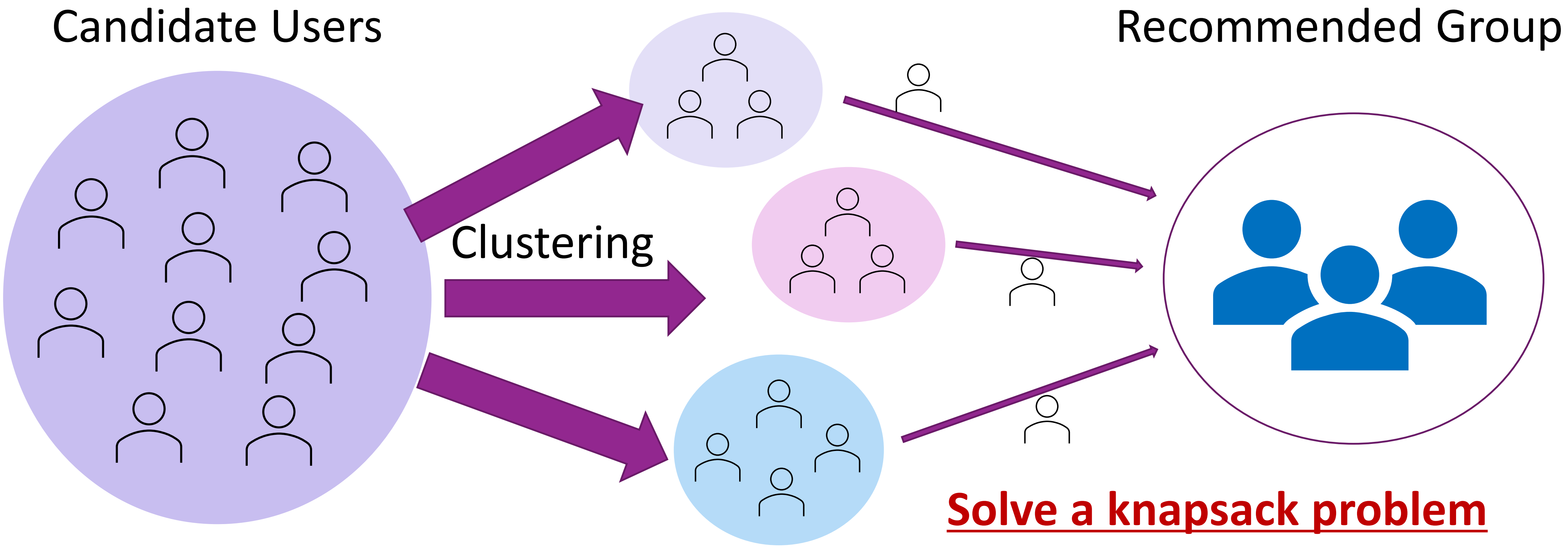
- Maximize users' benefits (e.g. knowledge, encouragement, relief)
- Reduce the negative impact on users

Challenging: Solving Combinatorial Problem

- Quantification of user information and tweets
- Mathematical programming model using the knapsack problem

The basis of our system

Obtain optimal interactions using the knapsack problem



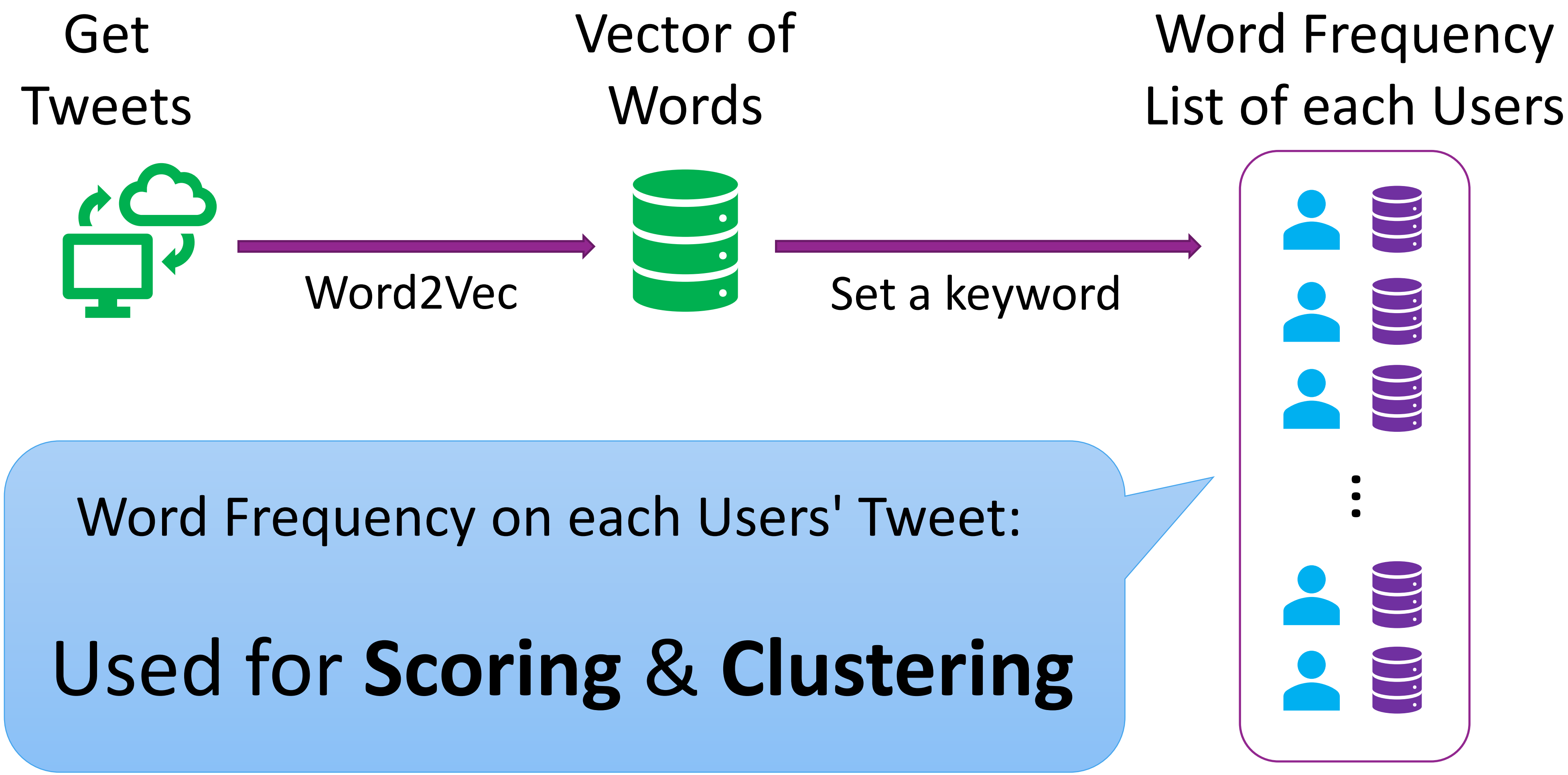
The previous work

Optimal Community-Generation Methods for Acquiring Extensive Knowledge on Twitter.

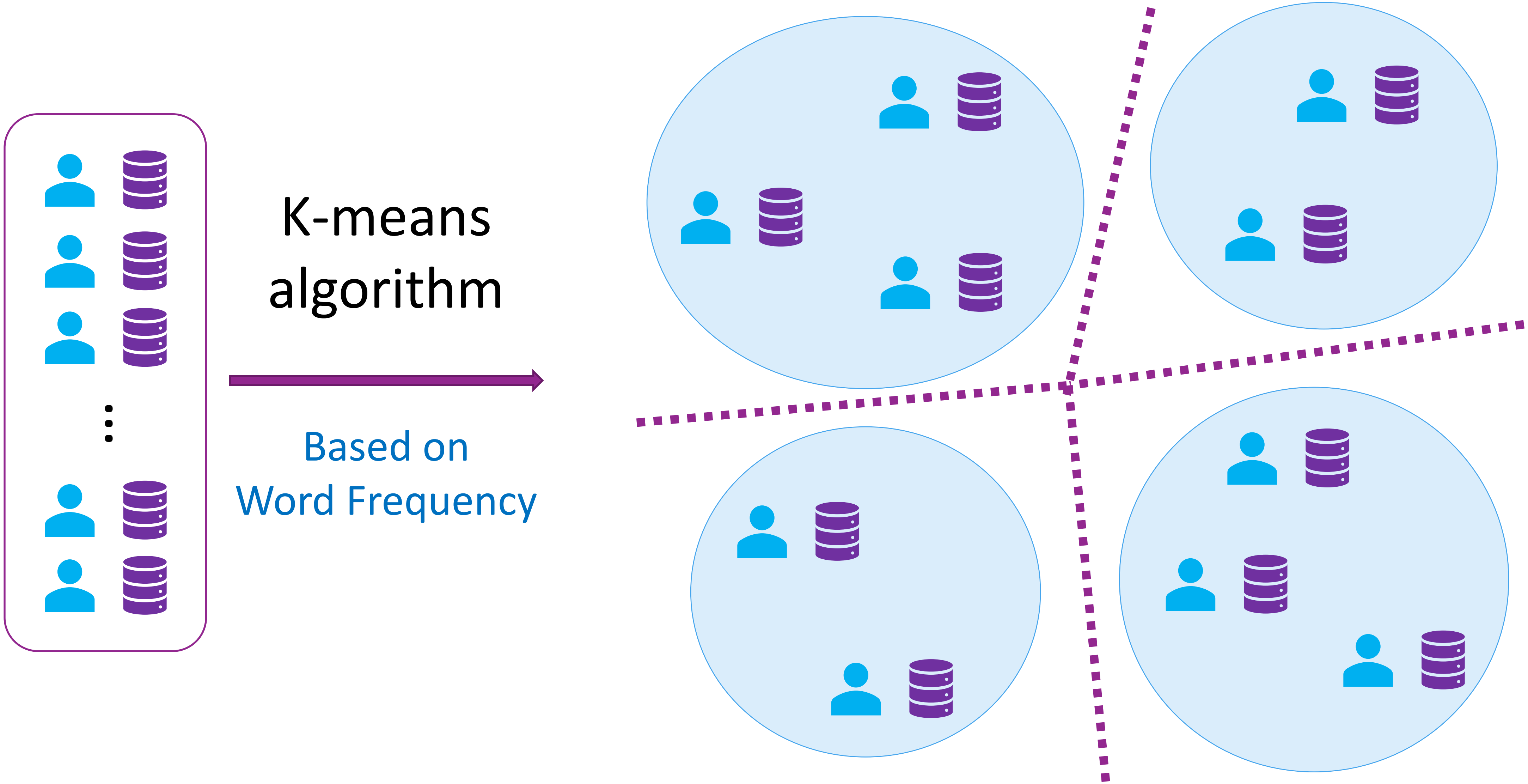
- Optimized the volume and the spread of knowledge
- Verified the effectiveness of our method

Yuichi Okada, Naoya Ito, and Tomoko Yonezawa.
International Conference on Human-Computer Interaction. Springer, Cham, 2021.

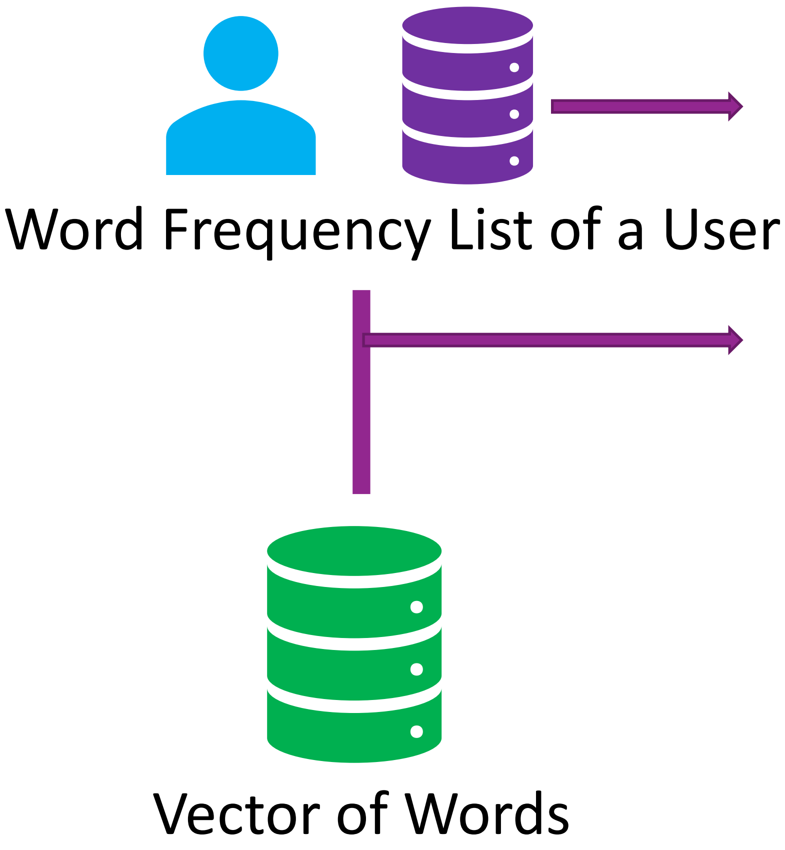
Define a feature of each users(Prev. work)



Clustering users (Prev. work)



Scoring the knowledge volume (Prev. work)



f_k: Frequency of word[k]

s_k: Similarity Value of word[k]

$$Score = \sum_{k=1}^{n} s_k \cdot \log(f_k + 1)$$

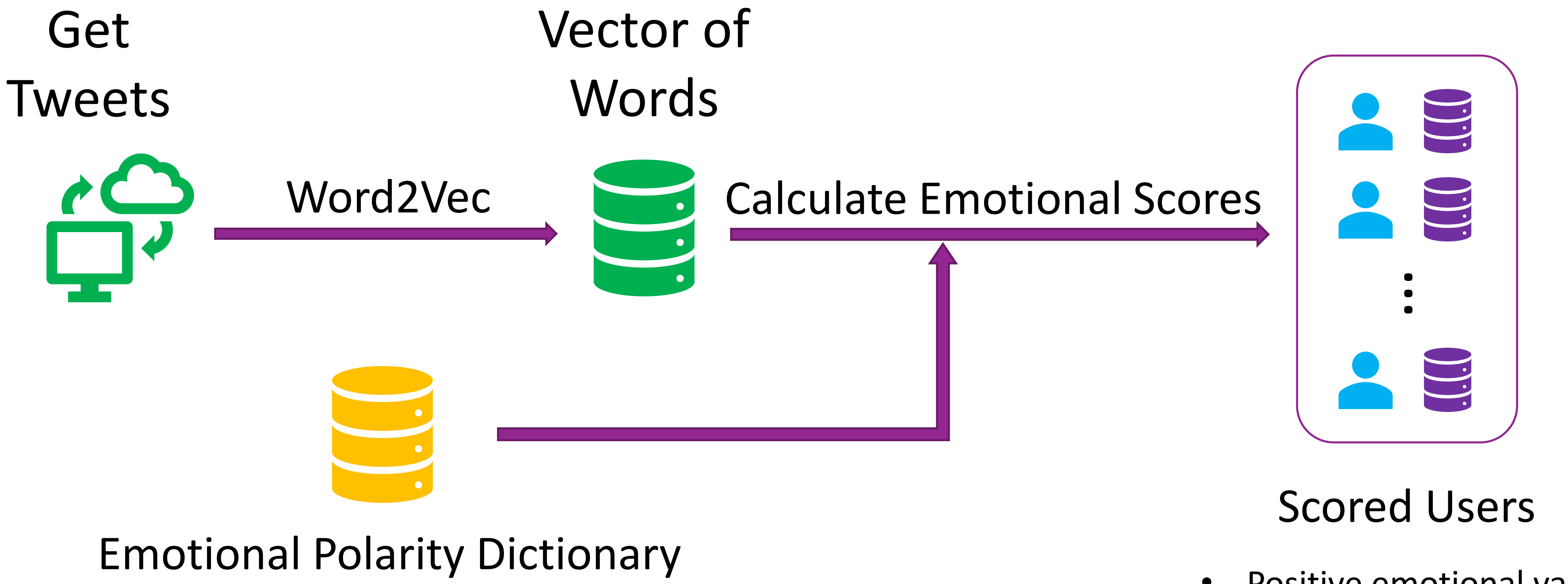
(n: size of the word frequency list)

The current work: **mental effect**

Optimizing SNS connection
based on **psychological characteristics**

- Especially for the people with mood disorders
- The method defines the variables
  - Positivity Users based on SNS comments
  - Mood Disorder Level

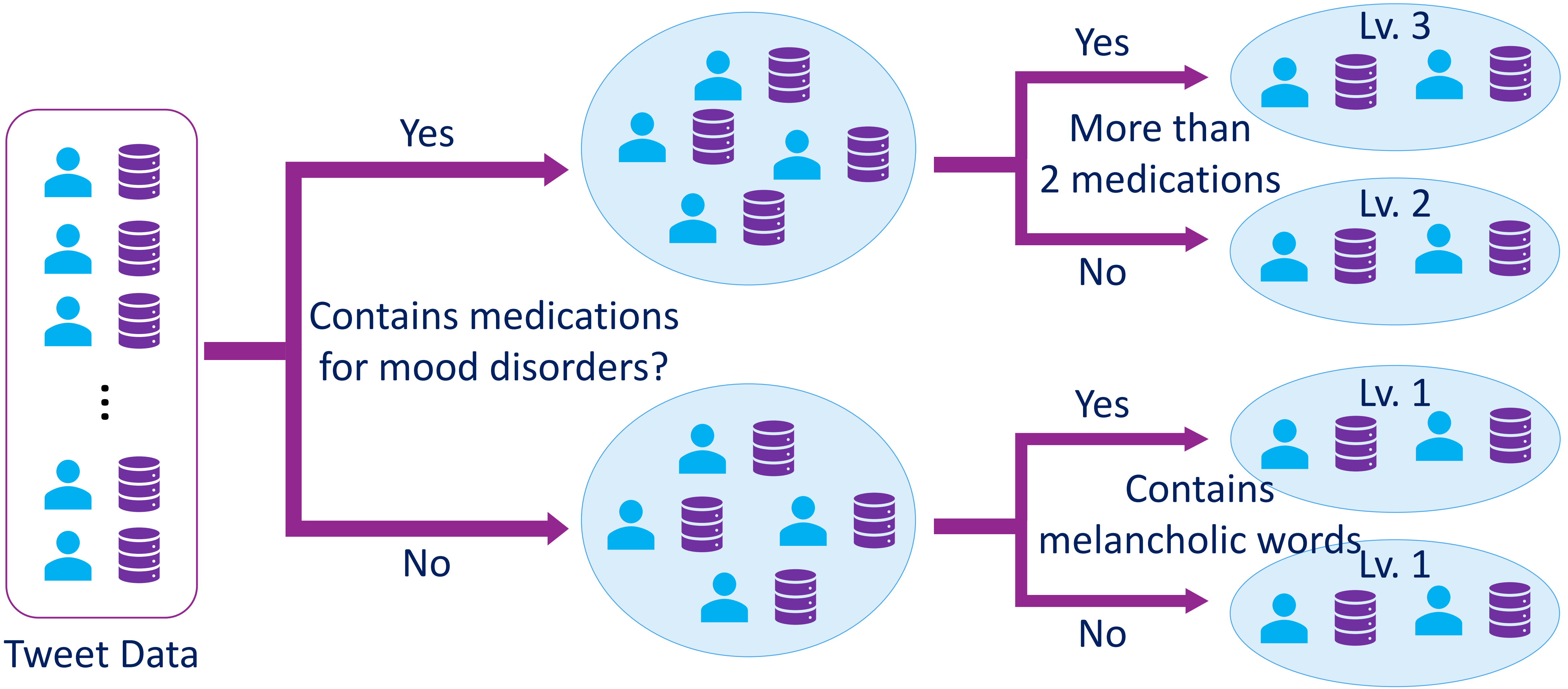
Define a feature of each users(Cur. work)



http://www.lr.pi.titech.ac.jp/~takamura/pndic_en.html

- Positive emotional value
- Negative emotional value

Classification of mood disorder levels(Cur. work)



Scoring users' emotional polarity(Cur. work)

$$Pos(k, m) = \frac{pos_k}{neg_k}\{1.0 + \alpha(n_k - m)\}$$

Our Tentative Emotional Score

- k: index of user
- pos_k: positive value of $user_k$
- neg_k: negative value of $user_k$
- n_k: mood disorder level of $user_k$
- m: mood disorder level of the target user
- α: positive constant

Construct a knapsack problem

maximize

$$\sum_{i \in N} Pos(x_i, m)$$

subject to

$$g_j(x) = \sum_{i \in N} g_1(x_i) \leq b_j \qquad j = \{1,2\}$$

$$g_1(x_k) = \begin{cases} 1, member\ selected\ in\ Group\ k \\ 0, nobody\ selected \end{cases}$$

$$g_2(x_k) = days\ per\ tweet\ of\ user\ x_k$$

Computational experiment

How does the optimal interaction change depending on the features of the user?

- Compared between users who tweet frequently(heavy users) and those who do not(casual users)
- Simulated users with the highest level of mood disorder as the target
- 500 users each for each level of mood disorder, for a total of 2000 users

Result

Heavy Users

n-users	Lv.0	Lv.1	Lv.2	Lv.3
20	0.00%	10.00%	10.00%	80.00%
40	0.00%	5.00%	20.00%	75.00%
60	0.00%	5.00%	28.33%	66.67%
80	0.00%	3.75%	37.50%	58.75%

Casual Users

n-users	Lv.0	Lv.1	Lv.2	Lv.3
20	5.00%	10.00%	35.00%	50.00%
40	5.00%	20.00%	37.50%	37.50%
60	8.33%	30.00%	31.67%	30.00%
80	7.14%	31.43%	31.43%	30.00%

- Heavy users prefer to interact with users with higher mood disorder levels than casual users.
- A similar trend was observed when the α (the weight of the difference in mood disorder levels) was varied.

Discussions

- **In case of interactions with heavy users**

  Do users with high levels of mood disorders prefer to have interactions with users who have similar levels to them?

- **In case of interactions with casual users**

  When having interactions with casual users, is it less influenced by mood disorder level?

- **Are these estimations likely to be correct?**

  Careful consideration needs to be given to whether issues exist in how the data is generated and the hypotheses formulated.

Limitations

- **Classification of Mood Disorder Levels**

  More accurate classification should be conducted based on the content of profiles and tweets rather than the value of emotional polarity.

- **Evaluation of emotional polarity**

  Emotional polarity data should be generated for Twitter-specific abbreviations and new words.

- **Justification of Hypothesis**

  Does the difference in mood disorder levels between users affect the optimality of interactions?

Future Works

Can the proposed method have a positive impact on the quality of communication?

- Large-scale investigation of actual data
- Methods for evaluating users' emotional features