IMPROVED FRIEND RECOMMENDATION SYSTEM FOR SOCIAL NETWORKING SITE THROUGH FP-GROWTH AND ANT COLONY OPTIMIZATION ALGORITHM

[1]Usman Bukar Usman, [2]Umar Tijjani Ali, [3]Ibrahim Abba, [4]Mohammed Shettima,

[5] Muhammad Baballe Ahmad,

[1,2,3,4] Department of Computer Science, Mai Idris Alooma polytechnic Geidam Yobe state Nigeria,
[5] Department of Computer Engineering Technology [C.E.T], Kano State Polytechnic Nigeria,

***Abstract**: Recommender systems have established to be of high-quality useful resource in dealing with the issue of information overload by using enhancing the person experience through best recommendations, with the speedy improvement of clever metropolis services, social network plays a higher role in giant areas with smart technology. Social Networking allow customers to create keywords such as tags in social tagging system to describe sources that are of activity to them, assisting to organize and share these assets with different users in the network, friend advice is important and inevitable in social network. however, many recommendation techniques of social networks are not necessarily steady with user's interests. in order to avoid the randomness and unreliability of friend recommendation in social community we proposed improved friend recommendation system for social networking website thru FP-growth and ant colony optimization algorithm, the outcomes of our test are weighted to adjusted for a higher accurate result, which ultimately forms recommendation lists for the target users. Finally, the experimental results on the Delicious dataset for friend suggestion show that the effectiveness and achieved accurate outcomes and a strong recommendation.*

Keywords: Social networking, FP-Growth, Friends Recommendation, Ant Colony Optimization, social tagging system

I. INTRODUCTION

With the rapid evolution of smart city service, social network has been another important platform for users to build and maintain relationships [24] In the last few years, the social Network site (SNS) has been increasing in both size and services. SNS has proven to have an enormous impact on its users and the Users of SNS can search for information without having to meet with others to get an idea of certain item [19]. SNS, allow users to create keywords such as tags in social tagging system to describe resources that are of interest to them, helping to organize and share these resources with other users in the network [6]. [2] sees Social tagging systems such as delicious.com are web-based social networking site that allow users to freely choose keywords called tags to label web resources in order to share or use them later. The popularity of STS is getting higher day with the aid of day due to the fact of the friendliness introduced in the sites and technological development. the social relationship is also a key component to be considered to make the buddy recommendation extra Reasonable [22]. Friend suggestion is an important recommender software in social networking. recommender system makes guidelines based totally on rating evaluate texts, and social networks [20]. Major social networking web sites such as Twitter, Facebook, and delicious.com are all successful of recommending pals to individuals. However, most of these websites use easy buddy advice algorithms such as similarity, popularity, or "friend's friends are friends", which are in-built but reflect on consideration on a few of the features of the social network. With the enlarge of e-commerce, recommendations structures have been of awesome interest, this is due to the possibility of increasing income acquired from successful hints [15]. Friend suggestion systems efficiently improve the user's social experience [25]. Friendship may also be an indispensable district of a human's life. Making friends can be very straightforward however making buddies with our pastimes can be an exhausting task. Many men have lots of buddies and have their very own set of interests. They're differing from individual to person. Many social networks provide a buddy suggestion gadget for making friends. To recommend perfect friends for quite a number of users, buddy recommendation algorithms are in urgent want [21]. The buddy advice machine aiding their customers in varied selection-making processes, like a geographical vicinity where the unit of size lives, as activity what music to pay attention to or what news to browse. Friend recommendation machine ought to be valuable suggests that for the online users to signify with the information overburden and have come returned to a minimum of one among the principal durable and frequent system in processing [1]. friend recommendation is to endorse applicants among which the goal user can choose as his/her friends [4]. The most challenging part of designing a recommendation device for a social community is the privacy issue of the users. With the ever-increasing net crimes and identification theft, people are turning into greater and more cautious in sharing their private information.

every other undertaking with existing social networking offerings is how to advise a exact pal to a user. Most of them be counted on pre-existing user relationships to choose friend candidates. For example, Facebook depends on a social link analysis amongst these who already share frequent friends and recommends symmetrical users as practicable pals [12]. On another hand, social tagging systems might also have some difficulties, Unsupervised comment incorporates with an great range of tag redundancy and tag ambiguity, which capacity that tags may have very comparable meanings, Redundant tags and tag ambiguity can abate the performance of the friend recommendation algorithms in social tagging systems, it is very challenging to knowledge pastime of the user who tags a little or affords a little assessment [17]. Applying the FP-Growth algorithm in the first segment to prepare the person things to do will get to the bottom of the tag ambiguity trouble and also enhance the first-rate of the resulting reality format and performance [7].

In order to alleviate the tag redundancy and tag ambiguity on friend recommendation, we suggest an improved friend recommendation system for social networking sites through FP-growth and ant colony optimization algorithm.

II. RELATED WORK

Due to the latest development of social networks, social networking sites (SNS) have the funds for new ways for customers to connect and share interests. Users can choose to their friends in SNS to share non-public emotions and use recommendations of pals before buying a product, house rant, movies, school courses, etc. Thus, pal advice has grown to be a critical section of social existence and a warm lookup topic in current years. Several researchers made enormous efforts at growing strategies for friends' recommendation in the social networking systems. [12] proposed an approach for friend advice based on a hybrid of SimRank and Ant colony optimization, whereas [7] proposed their technique for a suggestion of pals based on user's behaviors. [17] endorse a Friend Recommendation algorithm via User Similarity Graph (FRUG) in social tagging systems, FRUG recommends prospective buddies for customers with similar hobby by way of the similarity plan based on interest. FP-Growth algorithm in the first phase to classify the user things to do will resolve the tag ambiguity problem and also improve the first-rate of the ensuing fact sketch and performance [7].

The recommender device is a device that precisely predicts the users' tastes as nicely as expand their horizon about the accessible products or gadgets [5]. Recommender systems are extensively used in our lifestyles for mechanically recommending gadgets associated to our preference. The main goal of the recommender system is to filter the unwanted information based on users' preference that helps users to find interested items [26]. An advice machine is a subset of information filtering systems that seeks to predict the "preference" or "rating" a user would provide to an item [27]. principal recommender systems approaches are widely classified into five, namely, content-based filtering, collaborative filtering (CF), hybrid approach, and knowledge-based recommender structures [5]. Content-Based Filtering Content-based filtering (CB) considers how do the gadgets A1 and B1 relate to each different similarity between two items can be calculated using a range of methods like Jaccard similarity, Pearson, and Cosine similarity [5]. Our proposed lookup work has developed a new approach to suggest friends in a social tagging system, the method considers implicit information (user activities on the social tagging system) to enhance the matching pal suggestion system in social tagging. The buddy suggestion process, in a majority of social networks recommending pals based on specific data (social graphs) like pals of friends; buddies of friends on social graphs, can more often than not recommend people you may additionally already be aware of [17].

III. PROPOSED MODEL

In this work, the FP-Growth and Ant colony algorithm is applied to giant facts sets to discover the frequent itemset. We first load the sample of archives from the transaction database that suits into memory. FP-Growth Algorithm begins as follows. A preliminary population is created consisting of randomly generated transactions. Each transaction can be represented by means of a string of bits. Our proposed FP-Growth and ACO based totally method for finding general itemset many times transform the populace with the aid of executing, the whole approach of the algorithm: First step: Calculate the widely wide-spread between any two nodes using the FP-Growth algorithm in accordance to the relationship and behaviours between the members. The Second step: take the results of the first

step as the input of ant colony optimization, and then calculate the optimal buddy advocated order through iteration. The detailed algorithm is described below:

Step 1: Start

Step 2: Load a sample of records from the database that fits in the memory.

Step 3: Apply FP-Growth algorithm to find the frequent item sets with the minimum support. Suppose A is set of the frequent item set generated by FP-Growth algorithm.

Step 4: Set Z= 0 where Z is the output set, which contains the association rule.

Step 5: Input the termination condition of FP-ACO.

Step 6: Step 2 Path construction In the Tth cycle, for ant k which is located in node I, it selects the next node according to the following route probability.

$$P_m(i,j)=\begin{cases}\dfrac{\left[\tau_{(i,j)}\right]^{\alpha}\cdot\left[\eta_{(i,j)}\right]^{\beta}}{\sum_{k\in S_m(i)}\left[\tau_{(i,j)}\right]^{\alpha}\cdot\left[\eta_{(i,j)}\right]^{\beta}} & if\ \ j\in S_m(i)\\ 0 & otherwise\end{cases} \qquad \text{eq. 1}$$

where

$\tau_{(i,j)}$: the intensity measure of the pheromone deposited by each ant on the path (i,j). The intensity changes during the run of the program.

α : the intensity control parameter.

$\eta_{(i,j)}$: the visibility measure of the quality of the path (i,j). This visibility, which remains constant during the run of the program, is determined by $\eta_{(i,j)}=1/l_{(ij)}$, where $l_{(ij)}$ is the cost of move from session i to the session j.

β : the visibility control parameter.

$S_m(i)$: the set of sessions that remain to be observed by ant m positioned at session i.

Equation 1 shows that the quality of the path (i,j) is proportional to its shortness and to the highest amount of pheromone deposited on it (i.e., the selection probability is proportional to path quality).

Step 7: Pheromone update Pheromone update involves two aspects, one is pheromone evaporation, the other is updating which is the reflection of ants' search experience.

Step 8: The new cycle Empty all the ants' taboo table, and put all ants randomly on n nodes, repeat steps, after reaching the maximum number of times M, then end the cycle.

Step 9: Solve the optimal solution Compare the length of saved M path:

12 min , min ,..., min m L L L, and find the minimum value minL, which is the global optimum, and the corresponding node order is the optimal recommended order.

IV. Friend Recommendation by Mining User Activities Graph

The user Activities layout based on user hobby is built via users' activity which is described in the above-described Algorithm. The nodes in graphs signify users, and the edges in graphs represent the similarity between the user's activities. An example of the interest-based person Activities design is depicted in Fig. 1.

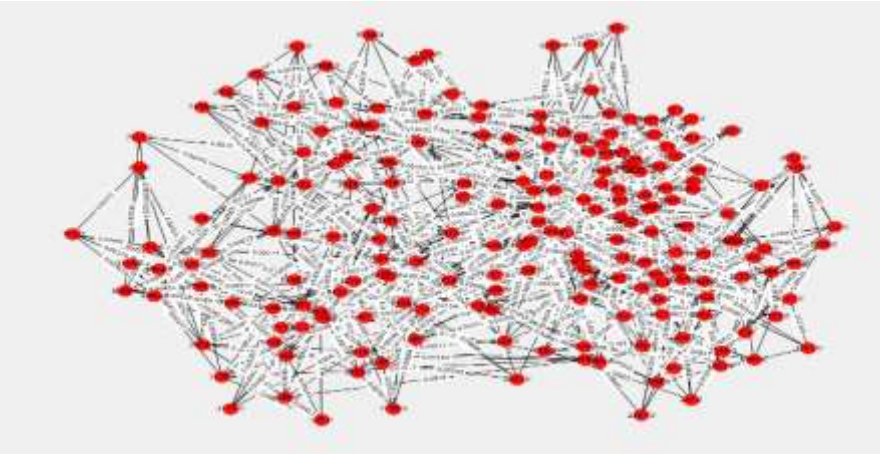

Fig. 1 An example of user activities graph based on interest

V. Experimental Evaluation

A. DATASETS

Our proposed model friend's recommendation algorithm on the Delicious dataset which is the most popular social tagging resource. hetrec2011-delicious-2k is a Delicious dataset which is published at the workshop of HetRec2011 [3]. and it's available can be downloaded from the internet site of the crew lens. The dataset consists of 1867 whole wide variety of users, 53388 tags, and 69226 resources. There are 437593 instances of consumer annotation and; an average of 234.383 tags annotated by means of a person and an average of 6.321 annotated tags per resource. Furthermore, it consists of 7668 bi-directional person relations and averaged 8.236 buddies per user. The formal definition of a social tagging gadget and of a buddy recommender machine is described by using [11] A social tagging gadget can be defined as a tuple Q ={U, R, T, A, C}, where: U, R, A, C and T are sets of users, resources, ternary relation between the units of users, the relation between the users and tags; moreover [28] described shape of social tagging as follow: there are U = {u1, u2,……., un} is a set of 'n' users. T= {t1, t2,……,tl} is a set of tags interpreted by using users to describe resources. R= {r1, r2,……,rn} is the set of 'n' useful resource items tagged with the aid of users.

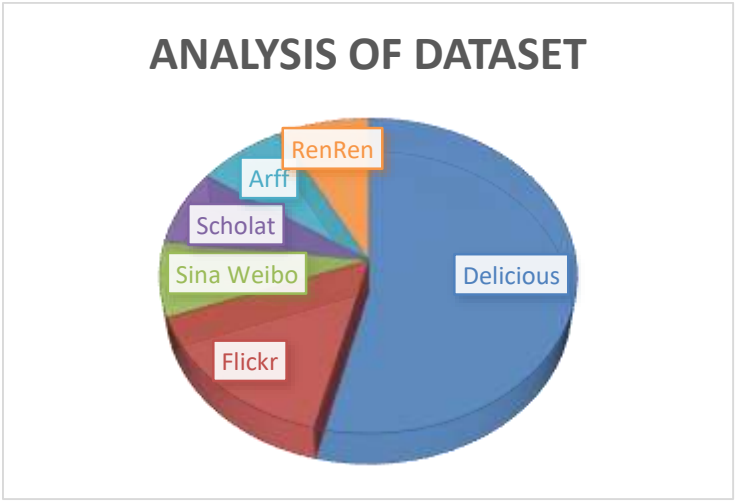

Fig. 2 Most commonly used dataset

Delicious dataset is the most popular dataset in used for empirical evaluation in previous research works [2]; [11]; [17]; [28];[29]; [30];[14]. based on that we choice delicious data as our experiment.

B. **PERFORMANCE MATRICS**

To measure the performance of our proposed model with Delicious dataset, we will use the three most widely used evaluation metrics in recommender systems: precision, F-measure and recall to evaluate the quality of our technique, for each the target user and we adopted the formula from [17]; [2].

$$Precision = \frac{\sum_{u \in U} |R(u) \cap T(u)|}{\sum_{u \in U} |R(u)|} \quad \text{eqn. 1}$$

Recall is formula is defined as following:

$$Recall = \frac{\sum_{u \in U} |R(u) \cap T(u)|}{\sum_{u \in U} |T(u)|} \quad \text{eqn. 2}$$

F-measure is defined as following:

$$F1 = 2 \times \frac{PRECISION \times RECALL}{PRECISION + RECALL} \quad \text{eqn. 3}$$

In the above equation, U stands for a set of all customers in the dataset. T(u) is the list of friends in the dataset. R(u) is the list of potential friends who endorsed to person u with the aid of the proposed algorithm. In the above equation, U stands for a set of all users in the dataset. T(u) is the listing of friends in the dataset. R(u) is the list of practicable pals who recommended to user u by way of the proposed algorithm.

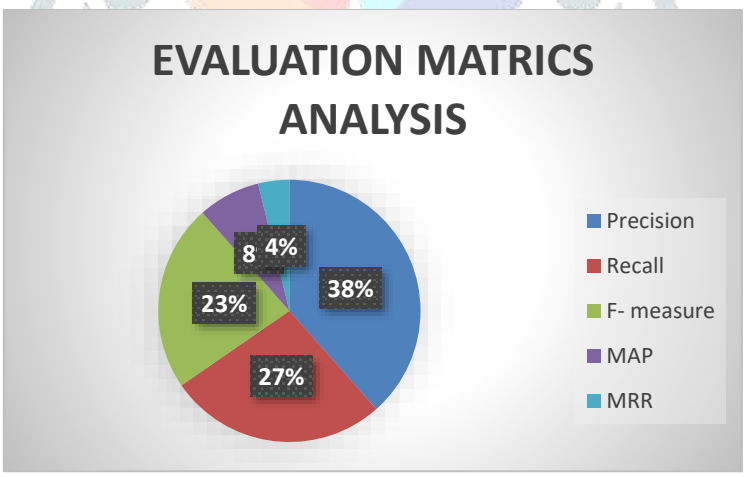

Fig 3

In the above equation, U stands for a set of all users in the dataset. T(u) is the listing of friends in the dataset. R(u) is the list of possible friends who recommended to consumer u with the aid of the proposed algorithm. In the above equation, U stands for a set of all customers in the dataset. T(u) is the list of friends in the dataset. R(u) is the list of doable pals who endorsed to person u by means of the proposed algorithm.

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VI. EXPERIMENTAL RESULTS

Experimental outcomes are shown in Table 1. The performance measured in phrases of precision and recall. The wide variety of attainable friends encouraged to a user is 5 and 10 respectively.

Table 1: The results

	N=5			N=10		
	P	R	F1	P	R	F1
FRUG	**0.145581**	**0.110927**	**0.125906**	**0.110927**	**0.120442**	**0.115489**
Proposed model	**0.98690**	**0.744400**	**0.848666**	**0.968560**	**0.623430**	**0.758578**
FP-growth	**0.76123**	**0.68732**	**0.67318**	**0.65401**	**0.56743**	**0.60765**

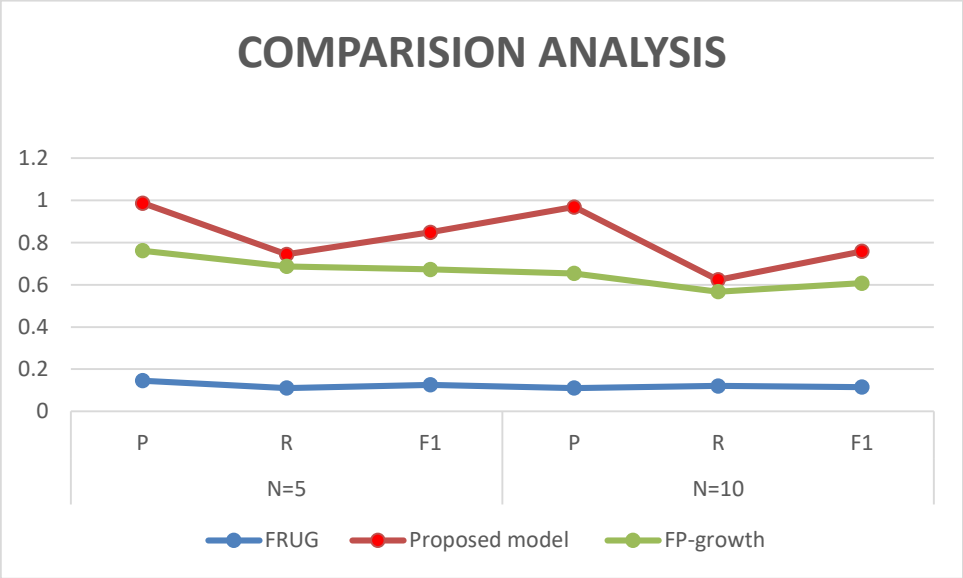

Fig 4

Note: Here, P stands for Precision in %, R stands for Recall in % and F represents F_1 metric.

Results in Tables 4 show that recommendations generated through our proposed model have significant enhancement as compared to **FRUG** values of N. where N is the number of potential friends recommended to one user. The following observations were made when the two approaches were tested for different values of N ranging from 1 to 10 as represented in Table 4 above.

VII. CONCLUSION

Our algorithm presents a new friend recommended answer for virtual neighborhood operators and primarily based on the user's online activities and optimization of buddies in a social tagging device the use of F.P boom Algorithm and ant colony optimization Algorithm The outcomes of our experiments on a Delicious dataset, the use of our model, precision, recall and F-measure are improved. The experimental outcomes exhibit the significant improvement of our proposed strategy when in contrast with the result of FRUG as well as the FP-growth based totally Algorithm. We have described a new recommendation system using FP-Growth Algorithm and ant colony optimization Algorithm thru which we performed accurate results and a robust recommendation.

VIII. FUTURE WORK

The organizing friend suggestion additionally requires extra advanced research into the methods to be used to price the recommendations in social tagging as a future task. Other future research ought to concentrate on the use of different features such as venue, user blood group, etc. Working with more than a few statistics mining algorithms, large-scale datasets such as Facebook and Twitter, and so forth and community detection in social tagging systems for friend recommendation is some other course for future research.

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