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SCHEDULING NEWS FEED SYSTEM BASED ON LOCATION AND DIVERSITY AWARENESS FOR MOBILE USERS

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ABSTRACT

A location aware news feed (LANF) system enables mobile users to share geo-tagged user generated messages, i.e., a user can receive nearby messages that are most relevant to them. The LANF system generates news feeds for a mobile user based on their spatial preference (i.e., user's current location and future locations) and non-spatial preference (i.e., user interest). Existing system simply send the most relevant geo-tagged messages to their users and the major limitation of such an existing approach is that, a news feed may contain messages related to the same location (i.e., point-of-interest) or the same category of locations (e.g., food, entertainment or sport). In this paper D-MobiFeed is used which states that the diversity is a very important feature for location-aware news feeds because it helps users to discover new places and activities. D-MobiFeed is a framework designed for scheduling news feeds for mobile users. D-MobiFeed consists of three key functions location prediction, relevance measure, and news feed scheduler. The location prediction function is designed to predict a mobile user's locations based on an existing path prediction algorithm. The relevance measure function is implemented by combining the vector space model with non-spatial and spatial factors to determine the relevance of a message to a user. The news feed scheduler works with the other two functions to generate news feeds for a mobile user at their current and predicted locations with the best quality. D-MobiFeed, a new LANF system enables a user to specify the minimum number of message categories (h) for the messages in a news feed. In D-MobiFeed, the objective is to efficiently schedule news feeds for a mobile user at their current and predicted locations, such that each news feed contains messages belonging to at least h different categories, and their total relevance to the user is maximized. To ensure that D-MobiFeed can scale up to a larger number of messages, a heuristic news feed scheduler is designed. The performance of MobiFeed is evaluated through extensive experiments using a real road map and a real social network data set. Experimental results show that D-MobiFeed obtains a relevance score two times higher than the state-of-the-art approach, and it can scale up to a large number of geo-tagged messages. D-MobiFeed with the location prediction method effectively improves the relevance, diversity, and efficiency of news feeds.

Key Words—Location-aware news feeds, diversity constraint, online scheduling, location-based services, user mobility

1. INTRODUCTION

With the advance of wireless communications and the ubiquity of GPS-equipped smartphones, social network applications have become more prevalent and location- aware, as widely known as location-based social networks (LBSNs) (e.g., Facebook). A news feed is a common functionality of existing LBSNs. It enables mobile users to post geo-tagged messages and receive nearby user-generated messages as news feeds at anytime, anywhere.

For example, "Bob can receive a news feed with 3 messages that are most relevant to him among the messages within 1 km from his location every 10 seconds". Figure 1a depicts an application scenario.

The geo-location of a message could be a point (e.g., m4), a circular region (e.g., m5), or the spatial region of a venue (e.g., m6 and m7 are spatially associated with restaurant R1).

Besides, geo-tagged messages can be categorized by their underlying venues; for instance, m6 and m7 are posted from users at restaurant R1, so they are intuitively categorized to a "restaurant" category.

In the previous work, the state-of-the-art location- aware news feed system schedules news feeds for mobile users. In this, the relevance of a message m to Bob is measured by both the content similarity between m and Bob's submitted messages (i.e., a non-spatial factor) and the distance between m and Bob (i.e., a spatial factor). It is motivated by the fact that, if the news feeds are only computed based on a user's location at the query time (i.e., it does not consider the user's future locations, e.g., GeoFeed), the total relevance of news feeds are not optimized. For example, in Fig. 1a, there are 11 messages (i.e., m1 to m11) with their geo-location intersecting Bob's query regions (i.e., circular regions in Fig. 1a) at time t0, t1, and/or t2.
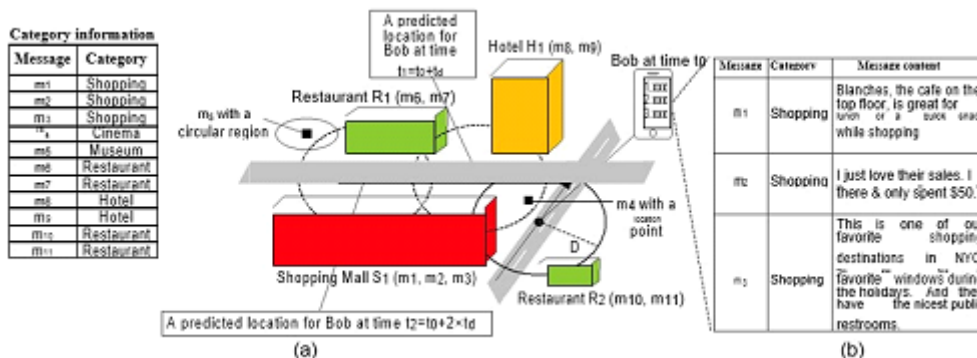

Fig. 1: (a) An application scenario. (b) The news feed at t0 generated by MobiFeed.

(a) Distribution of news feeds with different numbers of categories (k=5)

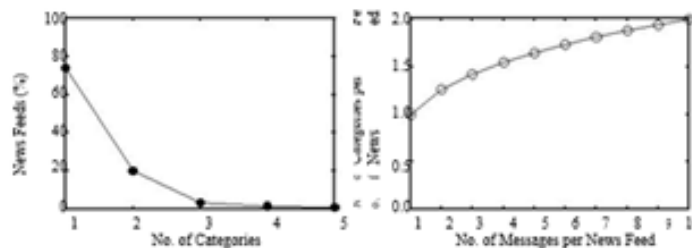(b) The number of categories in news feeds with various k

Fig. 2: Diversity of news feeds generated by MobiFeed.

Assume mi is more relevant to Bob than mj if i < j, and the number of messages per news feed (i.e., k) is 3. GeoFeed returns (m1, m2, m3) at t0, (m4, m6, m7) at t1, and (m5) at t2. To improve the relevance of news feeds, given Bob's current location at t0, MobiFeed predicts two future locations for him at t1 and t2, and schedules news feeds by considering all three query regions at the same time, which results in a better solution with (m1, m2, m3), (m 4, m8, m9), and (m 5, m6, m7) at

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t0, t1 and t2, respectively. Thus, MobiFeed aims at maximizing the total relevance of news feeds by utilizing a location prediction technique.

Unfortunately, relevance alone is unable to capture the broader aspects of user satisfaction. Although users expect to receive messages that are highly relevant to their interests, they may prefer a location-aware news feed with a certain level of diversity (i.e., the messages in a news feed belong to a certain number of categories). In conventional web search or recommender systems, topic diversification is a key method to improve user satisfaction. This work considers a mobile environment that makes our location- and diversity-aware news feed system unique and more challenging. With the geographical distance between a message and a mobile user in a relevance measure model, the relevance of a message to a mobile user is changing as the user is moving. Such a dynamic environment gives us an opportunity to employ location prediction technique to improve the quality of news feeds and the system efficiency.

Existing diversification problems focus on retrieving an individual list of items with a certain level of diversity. In contrast, with location prediction techniques, the main aim is at improving the quality of news feeds by scheduling multiple location- and diversity-aware news feeds for mobile users simultaneously.

To show the limitation in our previous model MobiFeed, we have conducted experiments to investigate the diversity of its news feeds generated for mobile users. Experimental results show that, when k = 5, over 75% news feeds contain messages belonging to one category and about 20% of news feeds are related to two categories; over 95% of news feeds are related to only one or two categories, as depicted in Figure 2a. Even if k is increased to 10, the diversity of the news feeds generated by MobiFeed is still very low (i.e., the average number of categories is two), as shown in Figure 2b.

To the best of our knowledge, this is the first study to incorporate both relevance and diversity for scheduling location-aware news feeds for mobile users in LBSNs.

2. RELATED WORK

In this section, the state-of-the-art techniques in location-aware news feed systems and existing diversity models in recommender systems and web search systems is highlighted.

Location-aware news feed systems. Most existing news feed systems only provide publish/subscribe services that simply forward messages to subscribed users. Bao et al injected the location-awareness into a news feed system, which enables a message to be associated with a spatial extent to control where users can receive it. A framework MobiFeed that is designed to schedule news feeds for mobile users has been proposed.

MobiFeed takes the limitations of mobile devices and the user's preferences into account, and schedules the most relevant geo-tagged messages to mobile users. Unfortunately, MobiFeed has a major limitation that only considers the relevance of messages to users, so a news feed may contain messages related to the same category; and thus it would impede users to discover new places and activities.

In conventional web search/recommender systems, topic diversification is a key method to improve user satisfaction. To address this limitation D-MobiFeed framework allows users to specify their required levels of diversity of news feeds in terms of the number of message categories (i.e., the h-diversity constraint). D-MobiFeed aims at maximizing the total relevance of news feeds and satisfying the condition that each news feed contains messages belonging to at least h categories.

l-diversity principle for privacy-preserving data publishing. The l-diversity principle is proposed for privacy-preserving data publishing. Basically, this principle is used to generalize non-sensitive attributes (e.g., zip codes 13053 and 13068 are generalized to "130**" and ages 28, 29, and 21 are generalized to "< 30") in a class of records such that the sensitive attribute contains at least l different values, in order to protect the privacy of published data.

The entropy l-diversity is further used to defend against the homogeneity problem without

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considering the role of background knowledge, i.e., entropy increases as frequencies of sensitive attributes become more uniform.

This work focus on a different problem because D- MobiFeed aims to maximize the relevance of news feeds for mobile users while news feeds satisfy the h-diversity constraint (i.e., the messages in each news feed belong to at least h categories).

Diversity-aware recommender systems. In MobiFeed, the only metric used to evaluate its quality as a recommender system is the relevance of messages to users (i.e., accuracy). However, it is argued in that, developing recommender systems with accuracy as the single goal has many drawbacks, and the recommender community should move beyond the conventional accuracy metrics.

One promising direction that has drawn recent interest is to diversify the recommendation lists. Ziegler et al proposed an intra-list similarity metric to measure the overall diversity of a recommendation list, where thesimilarity between products is derived from their taxonomy-based categorization.

The authors employed a heuristic algorithm to increase the diversity of a recommendation list, and their user study results show that in spite of the loss in accuracy, users still prefer the recommended items with larger extent of diversity. Zhang et al addressed the diversification problem as the joint optimization of two objective functions (i.e., the relevance and diversity of a recommendation list), which is solved by using binary quadratic programming algorithms.

Diversity-aware web search systems. The process of web search systems differs from that of recommender systems since it involves an explicit user query (i.e., keywords). The query, how-ever, is also ambiguous and has more than one interpretation.

One possible way to address this problem is to produce a set of diversified results that cover different interpretations of the target query. Specifically, the search result diversification

approaches in the literature can be classified as either implicit or explicit.

Implicit approaches assume that similar documents will cover similar aspects of a query. Their basic idea is to iteratively select documents which are similar to the query but different to the already selected ones in terms of vocabulary or divergence in language models.

Explicit approaches, on the other hand, model aspects of a query in an explicit approach.

For example, Agrawal et al assumed that there exists a classification taxonomy over queries and documents to represent user intentions, and they proposed a diversification function that maximizes the probability of finding at least one relevant document in the top-k positions.

Similarly, Carterette and Chandar modeled the aspects of a query as topics extracted from the top ranked documents, and they designed a probabilistic method to maximize the coverage of the retrieved documents.

The above-mentioned diversity-aware recommender systems and web search systems focus on retrieving an individual list of items with a certain level of diversity, in order to improve user satisfaction.

This work focus on a mobile environment, where mobile users are moving in a road network. The problem is unique and more challenging as D-MobiFeed considers the geographical distance factor between messages and mobile users in the relevance measure model, and thus, the relevance of messages to users could be changing as they are moving.

In addition, D-MobiFeed has an opportunity to employ a location prediction technique to improve the quality of news feeds by scheduling multiple (i.e., n + 1, where n is a look-ahead step) location-and diversity- aware news feeds for mobile users simultaneously.

The main reason is that computing each news feed individually as in the web search or recommender systems will not maximize the total relevance of news feeds for a user.

In experimental results, which is as depicted, D- MobiFeed with n = 0 generating a news

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feed at a time performs worse than D-MobiFeed with n > 0 computing a set of n news feeds simultaneously, in terms of relevance, diversity, and efficiency.

3.   EXISTING SYSTEM EXISTING CONCEPT

- Existing LANF systems simply send the most relevant geo-tagged messages to their users. Unfortunately, the major limitation of such an existing approach is that, a news feed may contain messages related to the same location (i.e., point- of-interest) or the same category of locations (e.g., food, entertainment or sport).

- A news feed is a common functionality of existing LBSNs. It enables mobile users to post geo-tagged messages and receive nearby user-generated messages as news feeds at anytime, anywhere.

- The diversification problems focus on retrieving an individual list of items with a certain level of diversity.

DISADVANTAGES

- Unfortunately, relevance alone is unable to capture the broader aspects of user satisfaction.

- Although users expect to receive message that are highly relevant to their interests, they may prefer a location-aware news feed with a certain level of diversity.

4.   PROPOSED SYSTEM PROPOSED CONCEPT

- D-MobiFeed is used which states that the diversity is a very important feature for location-aware news feeds because it helps users to discover new places and activities.

- D-MobiFeed is a framework designed for scheduling news feeds for mobile users.

- The D-MobiFeed, a new LANF system enables a user to specify the minimum number of message categories (h) for the messages in a news feed.

- The main objective is to efficiently schedule news feeds for a mobile user at their current and predicted locations, such that each news feed contains messages belonging to at least h different categories, and their total relevance to the user is maximized.

- D-MobiFeed with the location prediction method effectively improves the relevance, diversity, and efficiency of news feeds.

ADVANTAGES

- User satisfaction is much improved with the help of diversification.

- D-MobiFeed helps user discover new places and activities.

- Total location relevance to the user is maximized.

5.   **SYSTEM ARCHITECTURE**

Figure 3 depicts the system architecture of D- MobiFeed, which is designed based on the framework.
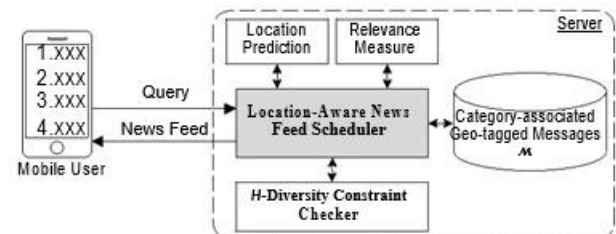

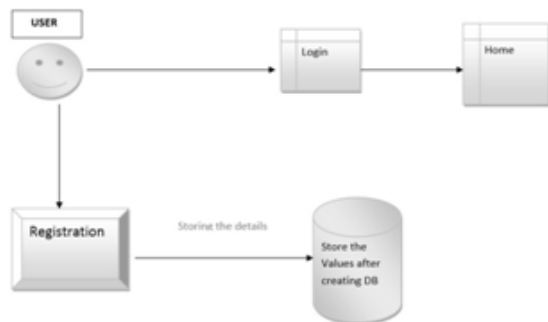Fig. 3: System Architecture of D-MobiFeed

6.   MODULE DESCRIPTION

The implementation of this study involves four modules. They are as follows:

- Login & Registration
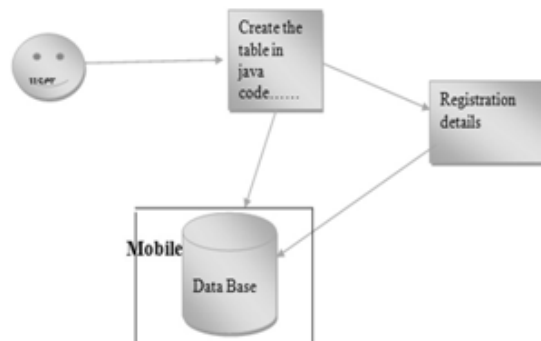
- Database Creation

- News Update

- Notification

LOGIN & REGISTRATION

In this module, design of login and signup screen has been done. The signup page contains details such as user Id, user name, password, confirm password, mobile number and Email Id of new user which should be stored in database. Login screen contains username and password. when the user login the app it should retrieve the data from the database and combine based on user input if its match user name, password to allow in the app otherwise it gives an alert and show a message to the user.
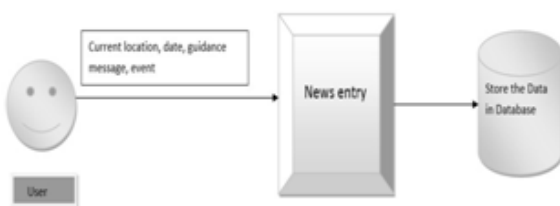
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DATABASE CREATION

Once the user creates the particular data for the application, the data will get stored into the database. User Id, user name, password, confirm password, mobile number and Email Id have been stored in MySQL database using php function and JSON (Java Script Object Notation). Generally android has its own inbuilt database named as SQLITE. But it cannot store the value in cloud.so only we use php and json for storing and retrieving the data in cloud using our Android application.
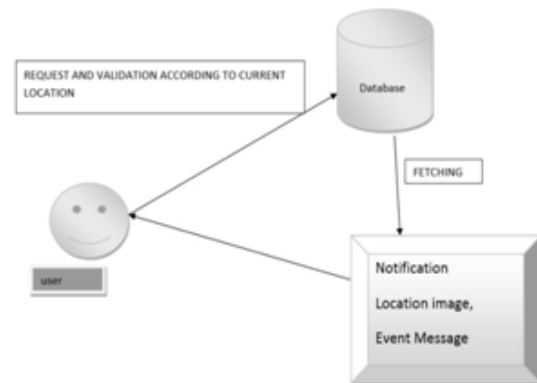

NEWS UPDATE

In this module, user can store the details of location image, message and event detail in MySQL database along with user details such as user id and user name.

NOTIFICATION

In this module, user can view the news details of their current location retrieved from MySQL database along with user details such as user id and user name.

7.   EXPERIMENTAL RESULTS

Experimental results based on a real social network data set crawled from Foursquare and a real road network show that D-MobiFeed can efficiently provide location- and diversity-aware news feeds when maintaining their high quality in terms of relevance.

8.   CONCLUSION

The result of this experiment designed D-MobiFeed, with the location prediction method effectively improves the relevance, diversity, and efficiency of news feeds. A location-aware news feed framework takes the relevance and diversity of news feeds into account when scheduling news feeds for moving users. D-MobiFeed users can specify the minimum number of categories in a news feed as an h-diversity constraint, and it aims at maximizing the total relevance of generated news feeds and satisfying the h-diversity constraint. Two key problems in D-MobiFeed has been focused namely, decision and optimization problems. The decision problem is modeled as a maximum flow problem and enable D-MobiFeed to decide whether it can fulfill the h-diversity constraint for a news feed. For the optimization problem, we design an efficient three-stage heuristic algorithm to maximize the total relevance of news feeds under the h-diversity constraint. D-MobiFeed can efficiently provide location- and diversity-aware

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news feeds when maintaining their high quality in terms of relevance.

9.   FUTURE WORK

Future direction is to measure the dissimilarity of pair- wise messages in terms of their category information and study a new multi-objective optimization problem of finding a set of news feeds, in which each news feed satisfies the h-diversity constraint and the dissimilarity of the messages in each news feed is maximized while maximizing the total relevance of a set of news feeds for mobile users.

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