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Location Service Based on Newsfeed

K.Prathiba1, A.Petrisia2
1PG Student, 2Associate Professor
1, 2, Department of MCA, Dhanalakshmi Srinivasan College of Engineering and Technology

Abstract:

A location-aware news feed (LANF) system generates news feeds for a mobile user based on her spatial preference and non-spatial preference. We argue that diversity is a very important feature for location-aware news feeds because it helps users discover new places and activities. The newsfeed scheduler works with the other two functions to generate news feeds for a mobile user at her current and predicted locations with the best overall quality. To ensure that Mobi Feed can scale up to a larger number of messages, we design heuristic news feed scheduler. In this paper, we propose D-Mobi Feed a new LANF system enables a user to specify the minimum number of message categories for the messages in a news feed. In D-Mobi Feed, our objective is to efficiently schedule news feeds for a mobile user at her 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 achieve this objective, we formulate the problem into two parts, namely, a decision problem and an optimization problem. For the decision problem, we provide an exact solution by modelling it as a maximum flow problem and proving its correctness.

Keywords — **Location-aware news feed, Mobi Feed, D-Mobi Feed.**

1. INTRODUCTION

A location-aware news feed system enables mobile users to share geo-tagged user-generated messages, e.g., a user can receive nearby messages that are the most relevant to her. In this paper, we present MobiFeed that is a framework designed for scheduling news feeds for mobile users. 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 her current and predicted locations with the best overall quality. To ensure that MobiFeed can scale up to a larger number of messages, we design heuristic news feed scheduler.

A news feed is a common functionality of existing locationawaresocial network systems. It enables mobile users topost geo-tagged messages and receive nearby user-generatedmessages, e.g., "Alice can receive 4 messages that are themost relevant to her among the messages within 1 km fromher location every 10 seconds". Since a location-aware socialnetwork system usually possesses a huge number of messages,there are many messages in a querying user's vicinity.Coupled with user mobility, a key challenge for the locationawarenews feed system is how to efficiently schedule the kmost relevant messages for a user and display them on theuser's mobile device.

Although location-aware news feed andsocial network systems have attracted a lot of attention fromdifferent research communities, none of these applicationshas focused on how to schedule news feeds for mobile users.The state-of-the-artresearch prototype of a location-awarenews feed system is Geo Feed.

In contrast to GeoFeed,MobiFeed focuses on challenges in providing location awarenews feeds for mobile users. We design a location-awarenews feed scheduler that works with our location predictionand message relevance measure functions to provide newsfeeds for mobile users. In

this paper, we present MobiFeed that is a locationawarenews feed framework designed for social network systemsto schedule news feeds for mobile users.

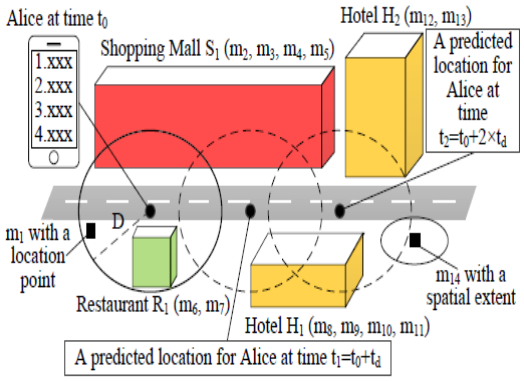


Fig1. Location-aware news feed Scheduling

Fig1 depictsan application scenario or a venue as its geo-location. Alice can also issue alocation-aware news feed query to retrieve the k most relevantmessages within her specified range distance D fromher location. MobiFeed consists of three key functions: locationprediction, relevance measure, and news feed scheduler.Given a user u's location u:location at the current time t0, u's required minimum message display time td, u's specifiedrange distance D, u's requested number of messagesper news feed, and a look-ahead steps n, the location predictionfunction estimates n future locations for u at timest1 = t0 + td, t2 = t0 + 2 × td, . . . , and tn = t0 + n × td, therelevance measure function calculates the relevance score ofeach candidate message with a geo-location intersecting anyu's query region and the news feedscheduler generates news feeds from the candidate messagesfor u's query regions at t0, t1, ….. , tn with the best total relevancescore.

Designing a scalable and effective news feed scheduler has several key challenges. A message has a lifetime with respect to a user's movement. A message can be a candidate message for several consecutive or non-consecutive news feeds. The minimum display time periods of these news feeds constitute the message's lifetime. The scheduler should select at most k candidate messages for a news feed within their lifetime intervals such that the overall quality of a user's news feeds is maximized. The relevance of a message to a user is highly dynamic. Since we consider the distance between a message and a user as one of the factors in the relevance measure, the relevance of a message could vary for a user at different locations. A user prefers to have the most relevant message at the top of a result list. The relevance of a message displayed on a screen should be weighted by its position. For example, the highest weight is given to the message displayed at the top on the screen. The online scheduler should be efficient such that it could scale up to a large number of messages.

The contributions of this paper are summarized as follows:

- We design the location prediction function based on the path prediction algorithm and combine the vector space model with spatial and non-spatial factors to define the relevance measure function.
- We incorporate location prediction to the process of location-aware news feed generation, thus formulating a novel n-look-ahead news feed scheduling framework to improve the overall quality of multiple news feeds for moving users.
- We propose heuristic n-look-ahead news feed scheduler for the sake of efficiency. Moreover, we present an optimal scheduler by finding the maximum weight matching in a weighted bipartite graph; we also provide correctness proof and complexity analysis for our optimal scheduler.
- We evaluate the performance of MobiFeed through extensive experiments based on a real location-aware social network data set and a real road map. We also study the scalability of MobiFeed using a synthetic data set. Experiment results show that MobiFeed usually obtains a relevance score two times higher than GeoFeed, and it can scale up to a large number of geo-tagged messages.

2. RELATED WORKS

In [1] the paper presents the Geo Feed system, a location-aware news feed system that provides a new platform for its users to get spatially related message updates from either their friends or favorite news sources. Geo Feed distinguishes itself from all existing news feed systems in that it takes into account the spatial extents of messages and user locations when deciding upon the selected news feed. Geo Feed is equipped with three different approaches for delivering the news feed to its users, namely, spatial pull, spatial push, and shared push. Then, the main challenge of Geo Feed is to decide on when to use each of these three approaches to which users. Geo Feed is equipped with a smart decision model that decides about using these approaches in a way that minimizes the system overhead for delivering the location-aware news feed, and guarantees a certain response time for each user to obtain the requested location-aware news feed. Experimental results, based on real and synthetic data, show that Geo Feed outperforms existing news feed systems in terms of response time and maintenance cost.

In [2] this paper we present GeoSocialDB; a holistic system providing three location-based social networking services, namely, location-based news feed, location-based news ranking, and location-based recommendation. In GeoSocialDB, we aim to implement these services as query operators inside a database engine to optimize the query processing performance. Within the GeoSocialDB framework, we discuss research challenges and directions towards the realization of scalable and practical query processing for location-based social networking services. In general, we discuss the challenges in designing location- and/or rank-aware query operators, materializing query answers, supporting continuous query processing, and providing privacy-aware query processing for our three location-based social networking services.

In [3]an automotive application, movement-path prediction enables the delivery of predictive and relevant services to drivers, e.g., reporting traffic conditions and gas stations along the route ahead. Path prediction also enables better results of predictive range queries and reduces the location update frequency in vehicle tracking while preserving accuracy. Existing moving-object location prediction techniques in spatial-network settings largely target short-term prediction that does not extend beyond the next road junction. To go beyond short-term prediction, we formulate a network mobility model that offers a concise representation of mobility statistics extracted from massive collections of historical object trajectories. The model aims to capture the turning patterns at junctions and the travel speeds on road segments at the level of individual objects. Based on the mobility model, we present a maximum likelihood and a greedy algorithm for predicting the travel path of an object. We also present a novel and efficientserver-side indexing scheme that supports predictive range queries on the mobility statistics of the objects. Empirical studies with real data suggest that our proposals are effective and efficient.

3. EXISTING SYSTEM

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 commonfunctionality 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.

In MobiFeed, a spatial grid structureis used to index all geo-tagged messages. Given a user u's query, a range query is issued to the grid index to retrieve the geo-tagged messages, which are not generated by u, associated with a location point, a spatial extent, or a venue region intersecting the query region.

After a mobile user u issues a location-awarenews feed query to MobiFeed, MobiFeed calls the *locationprediction* function to return n future locations for u. Its scheduler then finds a set of candidate messages for each of $n + 1$ locations and calls the *relevance measure* function to filter out all candidate messages that do not belong to any

top-δcategories and determine the relevance of each remaining candidate message to u. The scheduler finally returns news feed for each location such that the total relevance score is maximized.

Our heuristic scheduling algorithm consists of two main steps.

Step 1. Candidate message step. Given u's query at time $t0$, the *location prediction* function predicts n locations for u at times $t1, t2, \ldots, tn$, where $ti = t0 + u.td \times i$ and $u, td$is u's specified message minimum display time. For each of n+1 locations, a range query with a circular region centered at the location with a radius of $u.D$ is issued to retrieve the messages intersecting the query region as a set of candidate messages $CandidateMsgi$ ($0 \leq i \leq n$). Then, the *relevancemeasure* function filters out all messages that do not belongto any topδcategories from each $CandidateMsgi$. For each remaining candidate message m, a relevance score for m, i.e., $relevanceScore(u;m)$, is calculated to indicate the relevance of m to u. Finally, the messages in each $CandidateMsgi$ are sorted by their relevance score in non-increasing order. To break ties, precedence will be given to a message with a more recent post time.

Step 2. Online scheduling step. As depicted in the running example some candidate messages are included in multiple sets of candidate messages. For example, $m1$ is included in $CandidateMsg0$, $CandidateMsg1$ and $CandidateMsg2$, so $m1$ can be scheduled to one of these query regions or none. This step aims at scheduling at most $k \times (n + 1)$ candidate messages to the $n + 1$ query regions such that the total relevance score of these query regions is maximized. The input of this step is $n + 1$ sets of sorted candidate messages for $n + 1$ query regions. For each query region qi, we calculate a score for its candidate message mj with the highest relevance score by $relevanceScore(u,mj) \times displayWeight(j,k)$ where u is the querying user and k is the highest available position in qi's result list. The message with the highest score, denoted as $BestMsg$, is selected. $BestMsg$ is assigned to the query region giving the highest score, and it is no longer a candidate message for any query region. To break a tie, $BestMsg$ is assigned to the query region where the firstmessage in its candidate message set has the smallest relevance score. The reason is that other query regions have a higher chance to put a message with a larger relevance score to the same slot in the result list. Candidate messages are repeatedly selected to appropriate query regions until each query region has k messages or its candidate message set becomes empty. Whenever k messages have been assigned to a query region, its corresponding candidate message set is discarded. The computed $n + 1$ news feeds are sent to u. u's mobile device immediately displays the first news feed, i.e., the query region at $t0$, and then displays each of the remaining news feeds one by one for every td.

4. PROPOSED WORK

A framework MobiFeed that is designed to schedule news feeds for mobile users.MobiFeed takes the limitations of mobile devices and the user 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 contain messages related to the same category and thus it impede users to discover new places and activities. In conventional web search/recommender systems, topic diversification is a key method to improve user satisfaction.

4.1 Architecture Diagram

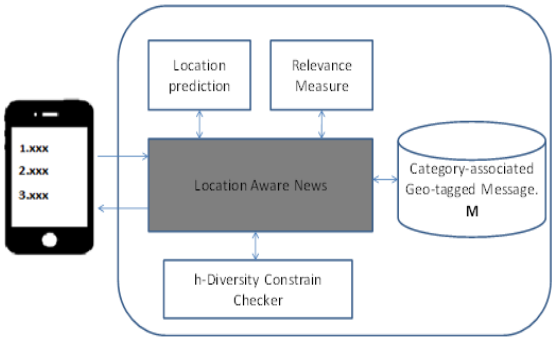


Fig 2. Architecture of Location-aware news

The information from the mobile device is transferred as the input to location-aware news. Depends upon the information the location is predicted and the relevance measure is calculated. The category associated geo-tagged message M is

used with the information that the message is tagged or not. After this, the h-Diversity Constrain Checker is used to check the information status and it is transmitted to the mobile device.

4.2 Location Aware news feed

The location-aware news feed services, in two main areas. They are traditional news feed systems and location-aware social networks.

Traditional News feed systems. Most of existing news feed systems work in a similar way to publich/subscribe services which use a push approach to fan out the message notices to all their users. However, such systems are not applicable to address the location-aware news feed, as they do not consider the spatial relevance of each message, and using the push approach does not scale up for large number of publishers and subscribers as it is the case for social networks. For commercial systems, our only knowledge is about the Feeding Frenzy system which we consider as our closest work and compare with it. The main idea of Feeding Frenzy is to build a cost model for deciding upon using the pull or push approaches as means for retrieving the news feed for a registered user. The only way to use the Feeding Frenzy system for the location-aware news feed problem is to attach a wrapper around it to filter any spatially irrelevant message from the users' news feed. However, that would be very inefficient as the spatial filter is applied as an afterthought solution. Our proposed system, GeoFeed, distinguishes itself from Feeding Frenzy in that it is built with the location-awarenessfunctionality in mind. Thus, the query evaluation methods, the cost model, and decision model take into account the spatial aspect of each posted message along with the location of each user.

Location-aware social networks. Existing commercial location-based social networks fall in two categories, as summarized. The first category includes that they consider the location information of the message issuer as just an additional tag attached with the message. Then, a system user will get the same news feed regardless of the user location. The second category includes to having the location tags, they also give their users the ability to issue range queries to view the whereabouts of their friends. GeoFeed distinguishes itself from all these commercial products in two main aspects:

(1) GeoFeed gives its users the ability to set the spatial validity range of each posted message., and hence give control to the message issuer to decide who should get the posted information. For example, the weather service provider may decide a tornado warning is relevant to followers located only in a certain area.

(2) Unlike all existing systems that are built mainly to be used by mobile devices, GeoFeed offers a more flexible way for the users to share their geo-tagged messages. Users of GeoFeed can access their account in the same way they use Facebook, yet, they will retrieve more relevant location-aware news feed than that of Facebook users.

4.3 Diversity Constraints

The objective of diversity constraints is to provide a systematic way to compare the performance of these diversity constraints. To achieve this goal, we first propose a canonical form for these diversity constraints, and show how to transform these diversity constraints into the canonical form. With the canonical form, all of these diversity constraints are in the form of an upper-bound constraint, and their respective bounds all fall into the same range. On the lowest end of the range of the bounds, these diversity constraints all restrict the feasible region of the portfolio optimization problem to exactly one point corresponding to the equally-weighted value. On the highest end of the range of the bounds, these diversity constraints all become redundant. By using the same value for the upper bound of these diversity constraints in the canonical form, a systematically comparison among them can be achieved.

4.4 Online Scheduling

The online recommendation part provides a user with a list of venues, considering the user's preferences, current location, and social opinions from the selected local experts, detailed in the following two components:

Preference-aware candidate selection. This component selects a set of local experts who visited the venues within a user's recommendation range R

and have a high expertise in the categories preferred by the user. A preference-aware candidate selection algorithm is designed to properly choose these local experts from different categories according to a user's different preference weights in her WCH. Meanwhile, this algorithm improves the efficiency of our approach significantly while maintaining the effectiveness, making our system really location-aware. **Locationrating calculation.** This component first computes the similarity between each selected local expert and the user using a similarity function based on their WCHs. The calculated similarity score is further fed into a CF-based model to infer the rating that the user would give to an unvisited candidate venue. Later, the venues with relative high predict ratings are returned as the location recommendations.

4.5 Location Based Services

A location-based service (LBS) is a software application for a IP-capable mobile device that requires knowledge about where the mobile device is located. Location-based services can be query-based and provide the end user with useful information such as ATM or they can be push-based and deliver coupons or other marketing information to customers who are in a specific geographical area.

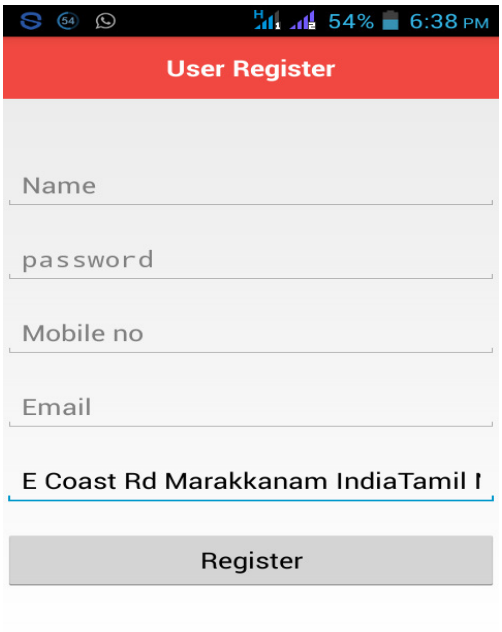
Advantages

- User satisfaction is improved with the help of topic diversification.
- This helps user discover new places and activities.
- Total location relevance to the user is maximised.

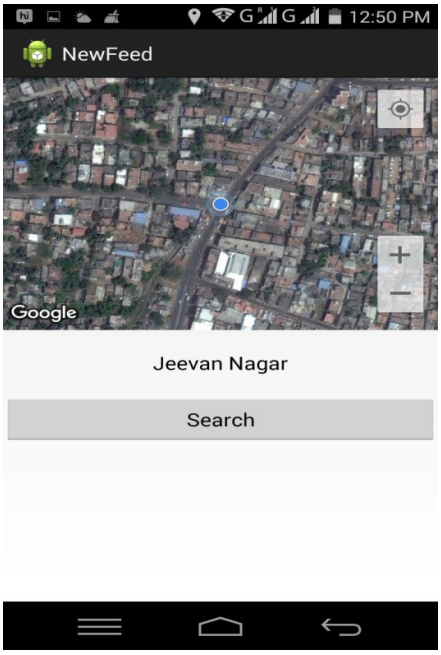
Disadvantages

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

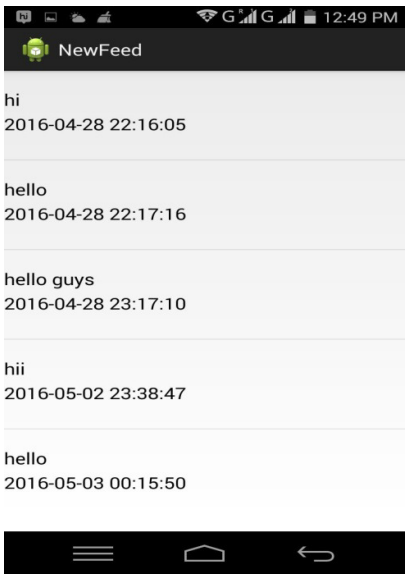
5. SIMULATION RESULTS



SCREEN SHOW THE USER REGISTER PAGE ON NEWS FEED



NEWS FEED FIND THE LOCATION ON MAP AND RELVANCE MEASURE



NEWS FEED SHOW THE CURRENT LOCATION AND TO GET THE VIOLENT MESSAGE ON LOCATION

6. CONCLUSION

The result of this experinment, we designed D-MobiFeed a location-aware news feed framework takes the relevance and diversity of news feeds into account when scheduling news feeds for moving user. It aims at maximizing the total relevance of generated newsfeed and satisfying the diversity constraint. We focus on two key problems inD-MobiFeed, namely, decision and optimization problems. The decision problem is modeled as a maximum flow problem and enables D-MobiFeed to decide whether it can fulfill the diversity constraint for a news feed. Experimental results based on a real social network data set crawled fromFoursquare and a real road network show that D-Mobi Feed can efficiently provide location- and diversity-aware news feeds when maintaining their high quality in terms of relevance.