

YummyKarachi: Using Real-Time Tweets for Restaurant Recommendations in an Unsafe Location

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Abstract. In this paper the YummyKarachi system is presented; it is a combined restaurant and safe routes recommender system for an unsafe city such as Karachi. YummyKarachi utilizes a hybrid model combining service recommendations with route recommendations in a map-based user interface. It utilizes tweets arriving in real-time to search for danger zones within the city, and it generates restaurant recommendations while taking into account security conditions of the city.

1 Introduction

Recently Karachi was declared as the most dangerous megacity of the world by the US Foreign Policy Magazine⁵, and rightly so as the city has often been struck by extreme incidents of shootings and blasts over recent years. The nature of dangers in this metropolis of Pakistan is peculiar in that danger in one part of the city does not affect other parts of the city due to the huge size and population of the city. In this scenario, citizens are often confronted with the problem of finding out the security conditions of various zones within the city, and this is particularly the case when planning how to reach restaurants⁶. Currently the citizens of Karachi rely on local news services and sms technology to receive updates about a particular location, and to be informed on the overall security situation of the city. However, these solutions do not provide updates in real-time and hence, they cannot be relied upon.

⁵ http://www.foreignpolicy.com/articles/2013/09/03/cooking_in_karachi_meth_pakistan?page=0,0

⁶ Note that this does not imply insensitivity on the part of citizens of Karachi but a necessary outcome of the huge size of the metropolis.

As a solution we propose YummyKarachi, which is a restaurant recommendation system that provides recommendations of interesting places to eat/drink while taking into account the security situation of the entire city. The proposed system processes tweets arriving in real-time to discover the dangerous zones of the city. Furthermore, the system implements a novel approach that utilizes various rating levels for the restaurant recommendation problem.

2 Related Work

Tourism serves as a primary application area when it comes to mobile environments, and an increasing number of mobile services have been proposed to aid the traveller before, during and after the travel [7]. In this context, the information overload problem tends to make it more and more difficult for travellers to find the right information that is needed to complete a particular task (e.g., choosing a movie, or planning a trip); hence, mobile recommendation systems offer information filtering and decision-making support in such situations [5]. The tasks supported by mobile recommendation systems involve tourist recommendations including service recommendations (i.e., restaurants, transportation services etc.) [1, 4], route recommendations [6], and information recommendation [3]. Within YummyKarachi, we propose a hybrid model that combines service recommendations with route recommendations in a map-based user interface. Recently, the focus of route recommendation services has moved towards the suggestion of safe routes, and as an example Kim et al. propose to use the sentiment expressed in tweets for determining the crime hotspots thereby recommending routes that exclude the crime areas [2]. Similar to Kim et al., we propose the use of tweets for detection of danger zones in a city, but instead of utilizing sentiments we use explicit “*alert terms*” extracted from tweets.

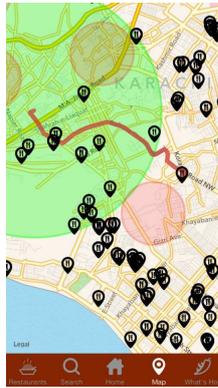


Fig. 1: A Snapshot of Map-Based UI Depicting Danger Zones

3 Methodology and System Overview

YummyKarachi includes a back-end tweet processing module that scans tweets for detecting what we call *alert terms*. These *alert terms* are extracted by mining tweets related to terror incidents. To the aim of defining a base of “alert terms” we have first used the Twitter search API to search for tweets related to “Karachi”; note that we search for tweets with hashtag #khialerts since citizen journalists and social media activists use it for reporting about events in Karachi. This step has then been followed by a manual annotation of tweets relating to a danger event such as a shooting incident or bomb blast with the annotation marking whether or not the tweet is relevant to the event⁷. We have then used the tweets marked as relevant to extract *alert terms* by asking the annotators to provide the strongest term indicative of a danger, and the terms chosen by all three annotators have been used as *alert terms*. A similar methodology is followed for terms indicating a traffic blockage. Unlike the approach in [2], YummyKarachi does not rely on geo-tagged tweets⁸; instead its tweet-processing module makes use of the Twitter API to fetch tweets with hashtag #khialerts along with tweets issued by security analysts and journalists of Karachi, while finally scanning fetched tweets for names of Karachi zones extracted from Wikipedia. Corresponding to each zone a danger level is computed by counting the number of tweets in which any of the *alert terms* occur. The danger zones are then shown in a map-based user interface with varying levels of intensity of the red color (see Figure 1). At the same time, YummyKarachi also shows the zones with heavy traffic, and this feature is included to further facilitate the citizens of Karachi. Finally, YummyKarachi recommends a navigation path to the user’s recommended restaurants by taking into account the danger zones i.e., it recommends the routes with no danger zones or with the minimum amount of danger zones.

The recommendation module of YummyKarachi introduces a novel three-level rating module to produce restaurant recommendations. We adopt a standard collaborative filtering methodology and we apply the matrix factorization module of singular value decomposition to produce restaurant recommendations. However, the user-item ratings are combined on three levels based on the following user preferences: i) cuisine, ii) food item, and iii) restaurants. We use a linear combination for the user similarity scores generated from each of the above three ratings. The categories and food items available in each restaurant are obtained by crawling the menus of these restaurants that are available on food portal web sites. This offers the opportunity to take into account user preferences on a multi-granular level. As an example, consider a group of users who express preference for the cuisine type “Italian” and the food items of “pizza” and “pasta”; a user who expresses ratings similar to this group is likely to be recommended a restaurant that serves authentic Italian cuisine thereby leading to a higher user satisfaction.

⁷ A total of three annotators were used.

⁸ This is done due to the scarce amount of geo-tagged tweets available.

4 Preliminary Evaluations

The demonstration video for YummyKarachi is available at <http://bit.ly/1seBXLJ>. We performed a set of preliminary evaluations for YummyKarachi, where we asked 10 users to utilize the application for restaurant recommendations. Our evaluation questionnaire required the users to express their level of satisfaction with the danger zones shown by YummyKarachi along with their level of satisfaction with the generated recommendations and likert scales from 1 to 5 were used for the survey. We asked the users to rate the satisfaction level of danger zones with respect to the truth value of the information which we asked them to verify through news sites. The mean likert scale values for level of satisfaction with the danger zones is 4.2 while for generated recommendations it is 3.9. This reflects that generally users consider YummyKarachi as a useful source of information for planning their restaurant trips.

5 Future Directions

As a future work we aim to incorporate within YummyKarachi the ability to predict likely zones that may become dangerous in the near-future. We aim to do this through incorporation of a predictive text mining module within YummyKarachi. Furthermore, we plan to extend the YummyKarachi framework to recommendations of other location types in order to enable citizens of Karachi to plan all their travels in a safe manner.

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