COMPETITIVE BIKE: COMPETITIVE ANALYSIS AND POPULARITY PREDICTION OF BIKE- SHARING APPS USING MULTI SOURCE DATA

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ABSTRACT

In recent years, bike-sharing systems have been widely deployed in many big cities, which provide an economical and healthy lifestyle. With the prevalence of bike-sharing systems, a lot of companies join the bike-sharing market, leading to increasingly fierce competition. To be competitive, bike-sharing companies and app developers need to make strategic decisions and predict the popularity of bike-sharing apps. However, existing works mostly focus on predicting the popularity of a single app, the popularity contest among different apps has not been explored yet. In this paper, we aim to forecast the popularity contest between Mobike and Ofo, two most popular bike-sharing apps in China. We develop CompetitiveBike, a system to predict the popularity contest among bike-sharing apps leveraging multi-source data. We extract two novel types of features: coarse-grained and fine-grained competitive features, and utilize Random Forest model to forecast the future competitiveness. In addition, we view mobile apps competition as a long-term event and generate the event storyline to enrich our competitive analysis. We collect data about two bike-sharing apps and two food ordering & delivery apps from 11 app stores and Sina Weibo, implement extensive experimental studies, and the results demonstrate the effectiveness and generality of our approach.

1. INTRODUCTION

IN recent years, shared transportation has grown tremendously, which provides us an economical and healthy lifestyle. Among the various forms of shared transportation, public bike-sharing systems [1], [2], [3] have been widely deployed in many metropolitan areas such as New York City in the US and Beijing in China. A bike-sharing system provides short-term bike rental service with many bicycle stations distributed in a city [4]. A user can rent a bike at a nearby bike station, and return it at another bike station near his/her destination. The worldwide prevalence of bike sharing systems has inspired lots of active research, addressing interesting topics such as bike demand prediction [5], [6], [7], [8], bike rebalancing optimization [4], [9] and bike lanes planning [10].

More recently, station-less bicycle-sharing systems are becoming the mainstream in many big cities in China such as Beijing and Shanghai. Mobike1 and Ofo2 are two most popular station-less bicycle-sharing systems. Unlike traditional public bike-sharing systems, station-less bike sharing systems

aim to solve "the last one mile" issue for users. Using the Mobike/Ofo mobile app, users can search and unlock nearby bikes from Mobike/Ofo. When users arrive at their destinations, they do not have to return the bikes to the designated bike station. Instead, they can park the bicycles at a location more convenient for them. Therefore, it is easier for users to rent and return bikes than traditional bike-sharing systems.

As bike-sharing apps become increasingly popular, a lot of companies join the market, leading to fierce competition. To thrive in this competitive market, it is vital for bike sharing companies and app developers to understand their competitors, and then make strategic decisions [11] for mobile app development and evolution [12], [13], [14]. Therefore, it is significant and necessary to predict and compare the future popularity of different bike-sharing apps.

With the rapid development of mobile social media, more and more users can contribute valuable data [15], [16], [17], [18], and data from multiple sources can bring multi-dimensional and rich information about bike-sharing apps. When users download and install a mobile app, they may submit user experience to the app store [19], [20], [21]. Specifically, users may upload their requirements (e.g. functional requirements), preferences (e.g. UI preferences) or sentiment (e.g. positive, negative) through reviews, as well as their satisfaction level through ratings. Therefore, the app store data can reflect users' online experience with the app. Online social media is another way to share the user experience of a mobile app. When users actually use the bike, they may share the ride experience on social media. Specifically, users may record the feeling of the ride, the advantages and disadvantages of the bike/system, or the comparison with other bikes/systems. Therefore, the micro blogging data can reflect users' offline experiences with experience will affect the popularity of the apps, thereby affecting their popularity contest outcome. Therefore, app store data and micro blogging data are complementary, and can describe a mobile app from different perspectives. In this paper, we study the problem of competitive analysis and popularity prediction of bike-sharing apps using both app store and micro blogging data.

To the best of our knowledge, the problem of predicting the competitiveness of mobile apps has not been well investigated in the literature. There are several challenging questions to be answered. First, how to forecast the popularity contest of bike-sharing apps? Second, how to extract effective features to characterize the contest of bike-sharing apps from multi-source data? Last, how to generate the event storyline to provide competitive analysis and present the results of the popularity contest of bike-sharing apps?

To answer these questions, we propose Competitive Bike, a system that predicts the outcomes of the popularity contest among bike-sharing apps leveraging app store data an micro blogging data, and then generates the event storyline of the contest. We first obtain app descriptive statistics and sentiment information from app store data, and descriptive statistics and comparative information from micro blogging data. Using these data, we extract both coarse-

grained and fine-grained competitive features, we then train a regression model to predict the outcomes of popularity contest. We finally generate the event storyline to provide competitive analysis and present the popularity contest.

2. EXISTING SYSTEM

- Recently, a significant effort has been spent on predicting popularity of mobile app [22], [23], [24], [25], [26], [27], [28]. Zhu et al. [22] proposed the Popularity-based Hidden Markov Model (PHMM) to model the popularity information of mobile apps, which can learn the sequences of heterogeneous popularity observations from mobile Apps. Wang et al. [23] proposed a hierarchical model to forecast the app downloads.
- Ghose et al. [24] estimated demand for mobile apps by using econometric model. Malmi et al. [25] found that there existed connection between app popularity and the past popularity of other apps from the same publisher. Finkelstein et al. [26] extracted a set of features from release notes available in app store, and found that there is a strong correlation between customer rating and the number of downloads. Garg et al. [27] inferred app downloads based on the rank of the app. Girardello et al. [28] presented AppAware, a platform for discovering mobile apps based on their current popularity.

DISADVANTAGES

- In the existing work, to the best of our knowledge, the problem of predicting the competitiveness of mobile apps has not been well investigated in the literature..
- There is no accurate result in analyzing Bike Micro blog data due to poor techniques.

3. PROPOSED SYSTEM

- The system proposes CompetitiveBike, a system that predicts the outcomes of the popularity contest among bike-sharing apps leveraging app store data and microblogging data, and then generates the event storyline of the contest. We first obtain app descriptive statistics and sentiment information from app store data, and descriptive statistics and comparative information from microblogging data. Using these data, we extract both coarse-grained and fine-grained competitive features, we then train a regression model to predict the outcomes of popularity contest. We finally generate the event storyline to provide competitive analysis and present the popularity contest. In summary, we make the following contributions.
- This work is the first to study the problem of competitive analysis and popularity contest of bike-sharing apps. We use two indicators for the comparison: competitive relationship to indicate which app is more popular; and competitive intensity to

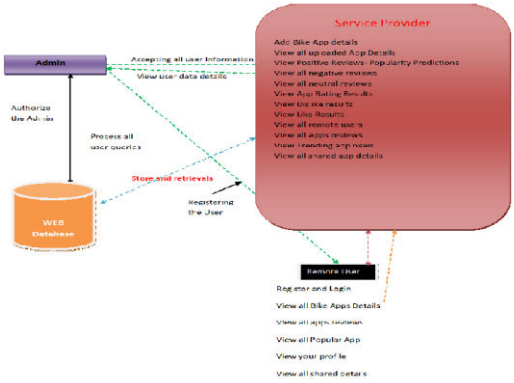
measure the popularity gap between the two apps/systems.

- ❖ To predict popularity contest, we extract features from different aspects including inherent descriptive information of apps, users' sentiment, and comparative opinions. With this information, we further extract two novel features: coarse-grained and fine-grained competitive features, and choose Random Forest algorithm for prediction.
- ❖ To provide competitive analysis, we utilize topic model to analyze the topics in competing apps, and apply the minimum-weight dominating algorithm to select representative microblogs. We also generate event storyline to present and visualize the popularity contest.

ADVANTAGES

- To thrive in the competitive market, it is vital for bike sharing companies and app developers to understand their competitors, and then make strategic decisions for mobile app development and evolution.
- Specifically, users may upload their requirements (e.g.functional requirements), preferences (e.g. UI preferences) or sentiment (e.g. positive, negative) through reviews, as well as their satisfaction level through ratings. Therefore, the app store data can reflect users' online experience with the app. Online social media is another way to share the user experience of a mobile app.

4. SYSTEM ARCHITECTURE



5.MODULES

Service Provider

In this module, the Service Provider has to login by using valid user name and password. After login successful he can do some operations such as Add Bike App details,View all uploaded App Details,View Positive Reviews- Popularity Predictions,View all negative reviews,View all neutral reviews,View App Rating Results,View Dislike results,View Like Results,View all remote users,View all Apps reviews,View Trending app news,View all shared app details.

View and Authorize Users

In this module, the admin can view the list of users who all registered. In this, the admin can view the user's details such as, user name, email, address and admin authorizes the users.

Remote User

In this module, there are n numbers of users are present. User should register before doing any operations. Once user registers, their details will be stored to the database. After registration successful, he has to login by using authorized user name and password. Once Login is successful user will do some operations like View all Bike Apps Details,View all apps reviews,View all Popular App,View your profile,View all shared details.

6. CONCLUSION

In this paper, we focus on the problem of competitive analysis and popularity prediction over Mobike and Ofo. We propose CompetitiveBike to predict the popularity contest between Mobike and Ofo leveraging app store data and microblogging data. Specifically, we first extract features from different perspectives including the inherent descriptive information of apps, users' sentiment, and comparative opinions. With this information, we further extract two sets of novel features: coarse-grained and fine-grained competitive features. Finally, we generate the event storyline to provide competitive analysis and present the popularity contest. We collect data about two bike-sharing apps and two food ordering & delivery apps from 11 mobile app stores and Sina Weibo, implement extensive experimental studies, and the results demonstrate the effectiveness and generality of our approach.

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