

Demo: Data Analysis and Visualization in Bike-Sharing Systems

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ABSTRACT

Public bike-sharing systems (BSS) are booming all around the world, providing a flexible trip mode for people in cities. However, the imbalance usage among stations is causing problems for both system operators and users. As a first step to address this challenge, a recent paper [1] has proposed a spatio-temporal bicycle mobility model based on historical bike-sharing data, and devised a traffic prediction mechanism on a per-station basis with sub-hour granularity. To better demonstrate the mobility model and prediction, we develop this data analysis and visualization system, not only presenting massive real-time prediction results but also serving as a platform for human mobility analysis.

Keywords

Bike-sharing system; Mobility modeling; Prediction; Visualization

1. INTRODUCTION

Due to the ever-changing usage patterns and the resulting uneven distribution of bicycles, there exists a strong demand for efficient bike re-balancing strategies in BSS. Inspired by traffic control from communication area [2], recent work [1] has proposed a flow-based mobility modeling and prediction approach for BSS, which lays a solid foundation for re-balancing designs. To better demonstrate the modeling and prediction results, we develop a novel data analysis and visualization system [3] based on Hangzhou public bike-sharing dataset. Unlike most of the existing bike-sharing visualizations, our system provides many functions for both public bike users and operators, aiming at mining valuable information behind the predicted data and historical data, and presenting that information with insightful and graceful visualization elements. Part of the system is based on BaiduMap API and ECharts.

First of all, the system is designed to demonstrate the massive data for both users and system operators. For mobile use, our system can serve as a public bike tour guide to help people track real-time stocks of nearby stations. Recommended routes with transit stations as well as the predicted distribution of available docks of the stations close to the destination will also be provided. To meet the operator's requirements, we display all stations on the map, with real-time stock information and predicted results in the near future. This way, the overall potential stock shortage situation can be early warned by highlighted markers.

Furthermore, our system is more than just the demonstration of real-time and predicted data. With massive historical data, over a whole year scale, stored in our back-end database, we are able to

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Figure 1: Bike-sharing visualization system.

perform comprehensive data analysis to mine valuable information. For example, heat map of stocks across stations, historical data curve of every single station, the flow pattern of the whole city based on the clustering results considering both locations and check in/out volume etc.

2. DEMONSTRATION

In our demo, we mainly show main functions of our system and how public bike users and operators can benefit from the visualization results from the following three scenarios.

- **Bike tour guide:** Our system provides valuable information with real-time and predicted data for users to plan a trip using a shared bike.
- **Real-time monitoring:** The operators can visualize the whole picture of the city with our system and easily find useful information (e.g., early-warning stations, abnormal stocks etc.).
- **Historical analysis:** Based on massive historical data, our system is also a powerful tool for in-depth data analysis. By showing historical data with different dimensions from multiple views, we are able to obtain interesting insights, such as human mobility patterns and station classifications.

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