HelPal: A System for Mobile Crowd Service

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Abstract

We design and implement a general location based system HelPal for mobile users to provide and enjoy instant service, which is called mobile crowd service. In this demo, we introduce a mobile crowd service system featured with several novel techniques. We sketch the system architecture and illustrate scenarios via several cases. Demonstration shows the user-friendly search interface for users to conveniently find skilled and qualified nearby service providers.

1 Introduction

Popularity of mobile devices makes the location based services a compelling paradigm. Users carrying with mobile devices can travel from places to places to collect various multimedia data, accomplish different tasks and provide qualified services. Mobile users are able to volunteer as providers of specific services and in the meanwhile to search these services. Sometimes we submit certain queries, but cannot get satisfied results from the traditional search engine, such as *get me a cab*, *fix my computer*, and *I need a house cleaner right now*. From these queries, what we expect is some people who can provide specific services with domain skills. In reality, people with skills like taxi driving, computer fixing and house cleaning are just around us. It is necessary to connect these mobile users so that they can help each other with specific services.

In the contrary to location based services, the results of mobile crowd service are mobile users rather than static objects, e.g., restaurants or houses. Prevail of crowdsourcing motivates us to better utilize the power of grassroots. Until now, mobile crowdsourcing focuses on how to gather a collection of users to solve a macro project and it does not pay attention on the speciality of users. There are some web sites that help with the identification of trades people, e.g., Craigslist. Mobile crowd service is not only a more mobile, fuzzy-matching service but an end-to-end model with instant message module, enabling efficiency and timeliness. Our system targets the increasing population of online mobile users, e.g., smartphone users, and enables such users to provide location-based services to each other. More specifically, on one hand, the system allows users to register as service volunteers, or micro-service providers. On the other hand, the system allows users to search available nearby relevant services provided by these volunteers.

Different from the existing systems, HelPal collects and organizes mobile users with their domain skills and updated locations by our client application and provides user-friendly interface for users to conveniently find the skilled and qualified people (turks) around to meet their needs. The system features with two major aspects, 1) Individual service with domain skills and 2) Mobile and instant response. However, to implement such a mobile crowd service platform is not easy. The challenges lie in Efficiency and Effectiveness.

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2 System Overview

The architecture is mainly built based on indexing, matching and recommendation techniques to fulfill the efficiency and effectiveness. In this section, we sketch our system via three core components, user management, service matcher and task recommendation. Incentive mechanism, reputation management and privacy protection are also concerned but skipped in this paper.

2.1 User Management - Mobile Spatial Textual Objects Indexing

Definition1: Spatial-Textual Object. A spatial-textual object is represented with a triple $o = \langle \psi, l, t \rangle$, where $o.\psi$ is the set of skills, $o.l$ is the latitude and longitude of the turk's location and $o.t$ is the last positioned time.

In this demo, there are two main challenges to handle users: 1) both spatial and textual information should be concerned. 2) the mobility of the users makes it difficult to construct and update the index for efficiency. We present a new hybrid indexing for the mobile spatial textual objects, called BIG-tree. The indexes are based on quadtree with sorted inverted lists and stored in *IndexDB*. And we propose an improved threshold algorithm with lazy refinement and prior termination to efficiently process the Top-k query over a large number of mobile spatial textual objects based on the index.

2.2 Service Matcher - Temporal Spatial Textual Objects Matching

Definition2: Temporal Spatial-Textual Query. A service query $q = \langle \psi, l, t \rangle$, where $q.\psi$ is the set of query keywords, $q.l$ is the query location and $q.t$ is the query time.

The temporal spatial-keyword score of a spatial-textual object o at time t is defined as follows,

$$S(q, o) = [\alpha S_l(q.l, o.l) + (1-\alpha) S_\psi(q.\psi, o.\psi)] S_t(q.t, o.t) \quad (1)$$

where $S_l(q.l, o.l)$ is the *spatial proximity score* of distance between query q and object o, $S_\psi(q.\psi, o.\psi)$ indicates *the text relevance* between q and object o, and $S_t(q.t, o.t) = \lambda^{-(q.t-o.t)}$ is the time recency. To measure the text relevance, we propose catalog matching with distant supervision to overcome the mismatch problem which is only based on keywords. We use Freebase as the distant supervision and model the expertise of each user as a catalog tree.

2.3 Task Recommendation - Context-aware Recommender with Explicit Ratings

Content based matching is an accurate matching, which may miss some potential qualified turks. Besides, turks sometimes cannot update their skills timely or accurately. *Context-aware recommender system (CARS)* deals with modeling and predicting user tastes and preferences by incorporating available contextual information into the recommendation process as additional categories of data. These long-term preferences and tastes are usually expressed as ratings and are modeled as the function of not only items and users, but also of the context. In other words, ratings are defined with the rating function as

$$R : User \times Turk \times Context \rightarrow Rating \quad (2)$$

where *User* and *Turk* are the domains of users and turks respectively, *Rating* is the domain of ratings, i.e., the satisfaction of users for the service of turks. *Context* specifies the contextual information associated with the application, which are time, location and domain skills information in our model.

3 Demonstration

A brief demonstration of HelPal can be found at https://youtu.be/fjGurUo4UbU. The main components consist of **Service query**, **Service notification**, **Service message**, and **Profile panel**. HelPal is designed to connect the world-wide available human service to form an elastic and on-demand service pool. For demonstration, we need a laptop to run the server and a mobile device (e.g., iPhone) to run the application. Both the server and client side need wireless network access.