Designing an Interactive Map of Musical Culture and a Digital Humanity App

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Abstract. An array of elements such as history, culture, music and delicacy can easily attract travelers' attention. In this paper, we attempt to design a mobile and visual search platform to help tourists understand these elements easily. Our target area is Dadaocheng, which is a well-known destination in Taiwan. We focus on local shops and design customized signboards for their digital marketing, cultural and creativity value-adding services. In addition, these signboards can serve as user's search target. The platform of our design provides search engine services with a monitoring mechanism at the server. Each query image is captured by mobile phone's camera, and search results on time and accuracy are recorded on the monitoring platform. This research focuses on the performance of visual search accuracy under ordinary circumstances. The overall process can be completed in one second. Current experimental results indicate that recognition rate can reach 88 percent.

1 Introduction

Over the past ten years, many cutting-edge technologies are coming up and have changed people's life. People are capable of get benefits with modern intelligent systems. The concept of Internet of Things (IoT) is getting mature in most existing companies. They are eager to propose a variety of protocols, domains, application and Web services, are expected to connect people to an advanced convenient life environments.

Mobile tourists are one example that combines the features and benefit from that. Moreover, it is more profitable and obvious for mobile tourists whom they travel around the world with mobile devices.

Before the trip, they can use either mobile devices or computer to collect the associated destination information, fight tickets and housing reservation.

On tour, people who are capable of ubiquitously querying anything via web search, or even sharing real-time multimedia in social network.

And after the trip, they are likely to review photos using cloud-based service platform.

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Now, a great diversity of Web approaches we can make use of. In spite of that, rather than powerful but complex tools, mobile tourists may prefer to use simple and user-friendly tools while on tour. Therefore, it is the objective of this paper to design a simple but effective mobile search way for mobile tourists. We incorporate content-based image retrieval into our mobile applications, trying to propose an easy and intuitive approach to query the targets which they are interested in.

The digital generation's acceptance of technology, particularly that of younger groups, has been increasing. Although society is aging, elderly people can communicate with younger people by learning to use digital technology. This was the impetus for this study. Based on the concept of digital natives, this study was intended to assist students in understanding the roles digital technology play in various fields in modern society, through a university course.

The core value of this course is to train 'digital natives' to think and design for 'digital immigrants', so that their applications and designs could actually 'empower' inexperienced users and let them enjoy the convenience of technology as well. Specifically, this course was first designed for the graduate students who took the course. In addition to participating in in-class discussions, the students, guided by the teacher, also visited a research area.

This course was intended to assist the students in creating a deeper link to the field through a series of design and thinking units, observation, question discovery, design and planning, method design. Therefore when the students develop actual mobile services in the future, their design consideration can be broader and more complete from a macro-view, thus benefiting and empowering experienced and also new users of digital applications and technologies (Fig. 1).

Fig. 1. Digital humanity App Core Value

2 Related Works

Digital technology has not only rendered daily life more convenient, and contributed to the improvement of several social issues, including medical care problems. For instance, Wu et al. [1] modified the technology acceptance model (TAM) and expanded it to design a mobile medical healthcare system (MHS). The result showed that with the effect of mobile technology on medical diagnoses is positive. Also, as more and more information environment structures being implemented, cloud computing and ubiquitous computing have made mobile medical healthcare even more easy and applicable.

Doukas et al. [2] developed a medical healthcare application on Android platform, with which under a stable Internet environment, that allows users to synchronize personal health condition and check on their basic health records through smart devices. Bourouis et al. [3] combined smart phone devices with a physiologic sensor, and designed a remote monitoring system that makes sure the safety of lone elders.

In dealing with daily issues for autistic children in school, Mintz et al. [4] designed an application that helps discovering problems they might encounter. The authors also try to find the causes and offer assistance with newer technology designs.

In hopes of improving learning for challenged individuals, Brown et al. [5] developed an Android location-based service (LBS) mobile game and performed follow-up evaluations and tests.

The increasing popularity of social networks has increased the attention focused on the combination of location-based service (LBS) and social networks. A part of LBS studies focused on certain groups of people. For example, Ferris et al. [6] designed a value-added service for passengers who take buses in Seattle, in hopes of improving the mass transportation issues of the city. Also, increasing attention has also been focused on LBS applications in specific cities, institutions, or regions. Ratti [7] collected information and data in Milan with the LBS design for future research regarding the city's planning and development. Karamshuk et al. [8] demonstrated how to find spots for new retail store with the help of LBS. According to the aforementioned and implementations, mobile value-added services combining mobile technology, social network, and LBS have been applied in various fields.

To boost tourism industry, some official organization will produce OR Some tourist organization have developed mobile traveling applications to introduce destinations. On behalf of the Malta Tourism Authority (Boiano, Bowen, and Gaia [9]), they distributed an iPhone app for promotion of the Maltese Cultural Heritage. Chen et al. [10] combined concept of service design in course lecturing, and encouraged students to develop their own mobile travel application which specific to YiLan county of Taiwan.

In 2011, Ji et al. [11] devised a large-scale landmark image search system that introduces the famous cities around the world, such as Beijing, New York, Florence and Singapore. Similar content-based image retrieval technique as Ji et al. [11], Nodari et al. [12] proposed a mobile visual search application to classify the objects of interests in fashion domain.

3 The Proposed Architecture

To let mobile tourists understand the scenery places effectively and effortlessly, this proposed system architecture aims to integrate content-based image retrieval into mobile application. We manage to focus on tourism industry in Taiwan so that Dadaocheng is our target place at this moment. Dadaocheng contains historical, cultural and delicacy scenic spots and it is a vital area with commercial vitality in Taipei City. Derived from Huang and Chen [13], we extend the system from desktop version to a mobile application. Figure 2 illustrates the proposed architecture.

To strike a balance between efficiency and precision, client-server architecture is the approach we try to perform the mobile content-based image retrieval (CBIR) in this

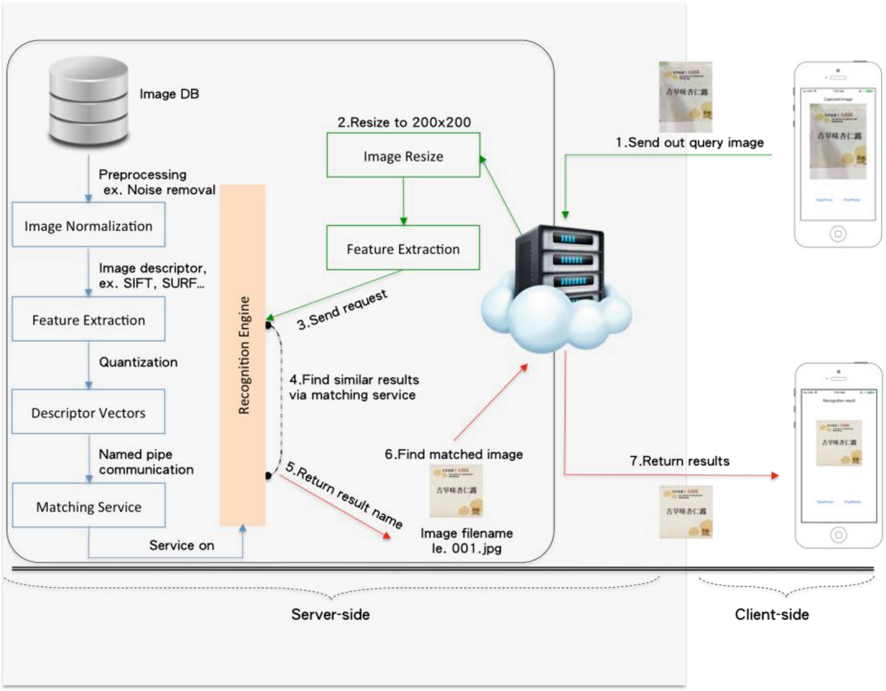

Fig. 2. System architecture

paper. First, image descriptors are extracted from an offline database using SIFT descriptor. For the communication between multiple processes, inter-process communication (IPC) is a practical approach for performing capabilities such as named pipe, shared memory, message queue and socket functions.

According to the analysis in Yu [14], the named pipe approach outperforms other IPC approaches in Internet connection and concurrent multiple query processes. Instead of server-side that processes the majority of complex computation, client-side plays a presentation role in the first and last step in this application. At this moment, we take mobile phone's embedded camera to achieve capture query images. Query image then will be normalized to 200×200 size and send it to the recognition engine for further processing. After query image is processed thoroughly, mobile device will automatically fetch the matching result via URL link and present it on the user interface. In terms of this proposed design, client-side can keep it simple in character of presentation part and keep off the electricity consumption from intensive computing.

4 Experimental Results

At present, we cooperated 207 local shops with our research. To promote local tourism, we design customized signboards for their digital marketing, cultural and creativity value-adding services. To attain a robust accuracy, we generate blur and brightness

samples to imitate the improper but normally happened in real life. In simple, we generate 10 more instances of blur cases and 30 instances of brightness case. In this experiment, a total of 8487 samples are employed from 207 local shops have been gathered. And we choose Apple iOS as our mobile platform. Without detailed destination information provided, the proposed mobile search application now is only responsible for sending the collected query image of the request to the server-side and presents the retrieved result.

To evaluate the performance of the proposed architecture, we have designed a monitoring mechanism at the server. It will be helpful that we keep track of the each query. We have collected each query image and recognized result, then logged each processing time as the image filename. Based on the filename, we can get that the overall process can be completed in one second. To ensure the accuracy is stable in preliminary experimental stage, we restrict relevant manager to verify the matching results manually by checking each corresponding checkbox.

In this experiment, a total of 8487 samples from Dadaocheng's local shops have been employed, and we randomly adopted 100 queries to evaluate the accuracy in real life. We found out that the 88 queries can be matched correctly. Some incorrect matches happened on over occluded or exposure cases.

5 Summary and Future Studies

We have proposed a mobile application to provide a timely visual search tool for mobile tourists. One of the purposes of this paper is trying to boost the local tourism industry. Hence, we initially focus on Dadaocheng district in Taiwan. Moreover, we put much emphasis on the establishment of system architecture, including client-server architecture and monitoring mechanism.

Specifically, we have first accomplished the entire process integrating mobile devices with visual search technique into our proposed architecture. Secondly, the overall image search process can be completed in one second. At last, all the activities will be logged on the monitoring system.

The preliminary results are promising, achieving 88% accuracy. For those incorrect cases, improve matching algorithm is a one way to tailor its accuracy but it may cost much more development time.

However, there are a few common traits of mobile devices we can refer to, such as overlay some visual hints on the user interface or utilize touch screen operation to reduce unnecessary recognition area. These UI methods are not only accelerating the development cycle, but also it is also a good manner to enhance the user experience from a user's point of view.

Currently, we already make sure that the proposed approach is feasible.

Future work certainly includes increasing more features of our services. Provide relevant travel information, for instances, viewing destination information, social network connections, augmented reality interaction or even integrate other embedded sensors.

Regarding to the monitoring mechanism, it is required to adopt database in the near future if we desire to track down the abundant data for further management.

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