

4.6 Askers as Answerers and Vice Verse

Unlike traditional Question Answering site, by design the MoboQ users generally just play the Asker role. We found of the 29,487 answers, 2051 MoboQ registered users (5.8%) contribute 4731 responses (16%). This observation might also arise because the users typically are able to answer the questions about the locations that they are familiar with. When the number of questions is relatively small, the users might hardly ever see a question that they could answer. As a comparison, 27% of the Yahoo! Answers users have ever provided a single response [12].

Surprisingly, even if 22,882 Weibo strangers have answered at least one question, less than 0.5% of them joined MoboQ afterwards. Every question contains two URL links to MoboQ site. One link is the asker's page and the other is the question's detail. However, we tracked very few incoming accesses from those links. After receiving answers, 6,206 thank you messages were sent by askers (i.e., 21% of the answers received a thank-you message that also contains an implicit invitation to join the community). This result might be indicate that the strangers could be willing to help by sending a simple reply sentence within Weibo, but clicking an additional URL to leave for another site might be too costly or risky for them.

5. DISCUSSION

In this section we focus on the implications of the analysis of the usage data and discuss the findings.

5.1 Privacy

The privacy issue has been widely discussed ever since the birth of social media, and the stranger Q&A feature of MoboQ pushes further on social media users' understanding of on-line privacy. In [30], the authors propose a number of guidelines for creating a location-sharing service. In [31], the authors discuss how a socially driven sharing (e.g., the location-based service Foursquare) is fundamentally different from purpose-driven sharing (e.g., Google Maps).

In MoboQ we define several fundamental rules for protecting a user's private information, for example, the collected data that are used to predict user's location must be publicly shared by the user himself/herself. However, we had the concerns that a Weibo user's understanding of the service might be different from the actual model that is used by the site, for example, users might not be aware that their check-in message is publicly posted. Therefore we maintain our attention on any user feedback that is useful for analyzing how much of an issue this concern is for the MoboQ system. Overall, based on the feedback data, there were only two answerers who complained that the sudden question was annoying to them and that is violated their privacy. However, we do not have the data on whether users have marked the question messages as spam in Weibo. From the community management point of view, it is also important to guarantee that all of the questions are real and sincere. Spam questions should be strictly filtered out before being sent to social media users; thus, a comprehensive monitoring system should be established in the next stage.

5.2 Additional Quality Control Method

As explained in the previous section, there is no explicit quality control method that is implemented in the current version of MoboQ. However, we observed people who were not at the location or did not understand the MoboQ service rather than malicious users who generated a large number of irrelevant answers. We believe that the push-based question assignment

mechanism also helped to reduce the possibility of having malicious answerers because all of the answerers were selected by the algorithms and thus spammers had less opportunity to insert themselves into the process.

To further improve the answer quality, additional components might be included. In the future we are interested in building classifiers that could detect extremely bad answers, and filter out obviously useless messages and spam messages using Natural Language Processing technologies.

5.3 Augmenting MoboQ through Social Media Mining

Systems such as Social Telescope [29] collect location-related information via Social Network Mining. Although many questions that are asked in MoboQ could not be satisfied through such an implicit way of collecting a review, such an approach could significantly enhance the response time for the party of the queries. When introducing a human into the loop, one of the drawbacks is that humans increase the time-cost of the whole process. Hence, data mining in the social media could potentially augment the weakness of MoboQ.

Therefore, we consider a combined Social Network Mining approach, which presents the results to an asker as reference data; this approach could be another interesting future direction. Simultaneously, we would consider adding a new feature of "report" into MoboQ, with which the user can "report" what activities are occurring at his current position and share these interesting stories with the community. By accomplishing these changes, the system could generate a "potential answers pool" before anyone is actually asking a question, which could be used as a reference for the potential askers.

5.4 Trust and Incentives

When discussing the stranger-sourcing concept, many people would first think of what incentive to provide to the answerers; however, we found that perhaps a more important question is how to build trust between strangers via the Internet. In MoboQ, a point system and a simple overall leaderboard are implemented to motivate community members to answer questions, but neither of these approaches appears to be effective because few MoboQ users contributed answers. However, the Weibo users (to whom we can hardly provide any strong incentives) actively responded to the requests. We believe that this result might demonstrate that once the strangers consider that the message is coming from a real person who is in trouble, they would very likely offer their help. However, without further study, we cannot provide a conclusion as to which factor might drive such altruistic activity.

Nevertheless, we designed the system as openly as possible to support online trust between strangers: non-registered strangers can easily verify the asker's profile and history, as well as the MoboQ's introduction information. All of the messages between MoboQ and Weibo are sent in public channels rather than private messaging, to allow all of the information to be open to everyone. Furthermore, the Weibo user's effort to help the asker is minimized to the task of simply replying to the tweet.

5.5 Support Region Oriented Questions

We found that such a location-based system should be able to search for a larger region instead of only a specific POI. Current MoboQ is designed for asking questions to very specific POIs, e.g., a shop, a restaurant, a bar, etc. One of the reasons for this is because current location-based sharing services users normally check-in at POIs rather than at regions.

However, we found that a MoboQ user often sets a whole area as a target location, and then asks a question about one specific place in that area. For example, if Dom Coffee is one shop in a large shopping mall called Nordstrom's, then many users might ask “#City, Nordstrom shopping mall# is Dom Coffee crowded right now?” rather than “#City, Dom Coffee# is it crowded over there”. This action is logical and is an understandable way of thinking; however, it adds new requirements when searching for appropriate answerer candidates. This type of query might suggest that in a future version of MoboQ, we should implement an additional semantic parser to retrieve possible POI names out from the question content, and consider these POIs to be another factor in the ranking algorithm.

5.6 User's Expectations and Demands

In traditional Q&A sites such as Yahoo! Answers, there is already a large database of questions and answers; thus, a user can search for the answers immediately. On the other hand, MoboQ attempts to solve real-time questions, which means that, even for the same question at the same location, the answer would most likely be different depending on the time and the context; thus the previous questions and answers are much less useful than in other Q&A services. As a result, compared to other Q&A sites, MoboQ does not have a particularly well-supported function to display and search historic questions and answers. However, such a design leaves a user almost nothing to do other than asking/answering questions and waiting. From the user's feedback, we received several suggestions about providing more intelligent questions and answers feed that contains only the locations that they are interested in, which implies that there would be a demand for browsing historical data.

We found that another core issue is that users have different expectations of the response time, with regard to the type of question or the context. However, MoboQ cannot guarantee the waiting time to users while adjusting these expectations. In the future, we believe that it could be very helpful to give an estimated waiting time for each question based on historical data. Additionally, a notification should be given when it is highly likely that the user's expectation for the response time would be higher than what the service could offer, for example, in the case of asking about a question to an uncommon location or at the midnight. An appropriate guide should be provided to suggest possible alternative tasks or choices.

6. Future Applications for Specific Scenarios

MoboQ is designed to be a common platform for supporting location-related real-time question answering. In our initial deployment we focused on a wide range of questions, but the results show that it is difficult for a new user to understand such a general-purpose application thus the user adoption is slow. We believe that it is important to repurpose our general infrastructure to support a more focused applications that are difficult to be implemented by traditional methods. Nonetheless, from the asker's usage data and the classifications, we can see the potential of narrowing down the usage scenario and building ubiquitous computing applications for more specific purposes on top of the MoboQ platform. Moreover, it is reasonable to assume that such applications' performances could be better than the current MoboQ system if the ranking algorithm and the data sources can be adjusted for the specific application domain.

The most successful applications built on top of the MoboQ would need to have the following properties:

- Utilize information that cannot be collected via traditional sensor technologies;
- Be able to tolerate a reasonable delay (e.g., 5 minutes to half an hour), because human sensors cannot provide a response as fast as machine sensors;
- Location and time-sensitivity should be required components of the solution; and
- The problem targeted is difficult for existing social search systems to solve.

With the guidelines and the question classification results in mind, we can at least foresee the following potential applications directions:

6.1.1 Tourism Information

Visitors might want to obtain get immediate support from local residents, e.g., recommendations for restaurants, advises for transportation, questions about directions, and weather condition. This possibility is different from existing users' reviews and local information search services such as Yelp or Dianping because people can have asynchronous conversation with another people to ask information with certain requirements and to obtain specific answers for their demands. For example “how cold is Beijing, what should I wear, is a jacket enough” instead of having a number for the temperature, or “is there a café suitable for business meeting” instead of checking comments on Yelp to find out the answer.

6.1.2 Emergency Management Information

A stranger-source system could also be used for information collection during emergency situations, such as detecting the current state of a given location after a natural disaster. During natural disasters, such as earthquake, it is common for the telephone voice network to be destroyed or inoperative. Some of the authors witnessed the situation that occurred at the nearest major cities to the epicenters of the 2011 Tohoku Ms9.0 earthquake: the telephone network was completely down after the first shock waves, but the Internet connection survived, although the speed was slow. During the important first 24 hours, many people relied on social networks to report, communicate and receive the latest news. Previous researches [27, 9, 11, 7] studied how to utilize Twitter feeds to real-timely detect crisis events such as earthquakes, however there was no method like MoboQ to push questions to a specific location for extracting needed information. Thus, the information could be greatly helpful for assessing the extent of the disaster and then for effectively allocating the valuable rescue and relief resources to the hardest hit areas.

6.1.3 Shopping Information

Real-time (or so-called semi-real time) information about shops, restaurants, and entertainment facilities can be helpful for supporting customers' decision-making processes. Often, people need such additional information for making plans to visit a location. For example, “which department store has the larger sale today”, “is there a ticket left for the movie”, or “which restaurant has no line waiting outside.” We discovered that this type of questions that were accounted for a large proportion of the questions asked in the current MoboQ system, which suggests that it is an especially useful application of this technology.

6.1.4 Event report

Check-ins sometimes occur at an event rather than at a location. It is therefore possible to find people who are currently at big on-going events such as conferences, sports games, music concerts,

and so forth. Although there are alternative studies [23, 6] about mining social media data to summarize on going or past events such as football games, for people with specific questions or purpose, question answering type of service could be more useful. Moreover, for small events while it is less likely that there will be enough information to generate a summary, Q&A approach could be a good alternative.

6.1.5 Context Acquisition Systems

Stranger-sourcing technicalities could also support an existing context sensing system for extracting data that cannot be collected otherwise. For example, a computer system can automatically and autonomously generate questions, translate system needs into human language, and extract data from answer content (i.e., natural language). Thus, such system can constantly fetch high-level context data such as a social environment or human activities, and can store the information that is needed to build a rich context information database.

7. CONCLUSIONS

We investigated the concept of stranger-sourcing on Social Media via a deployed application called MoboQ. Using MoboQ, a user can ask temporal and geo-sensitive questions, such as how long is the line at a popular business right now, and then receive answers that are crowdsourced from other users in a timely fashion. To obtain answers for questions, the system analyzes the live stream from the public microblogging service Sina Weibo to identify people who are likely to be currently at the place that is associated with a question and sends them the unsolicited question through the microblogging service from which they were identified.

Through nine months of real-world operation data, we verified the feasibility and advantages of building real-time social question-answering services on top of an existing microblogging platform, we analyzed users' behavior and preferences, we discussed lesson learned, and we proposed a list of future applications that could be built on top of the MoboQ platform. We foresee that there is great potential for MoboQ to become an important infrastructure component for building future context-aware applications.

ACKNOWLEDGMENTS

The authors would like to thank Dr. Jeffrey Nichols at IBM Research Almaden for providing valuable suggestions and comments and Gang Chen, Rui Tao, and Shengyu Huang at Diggerlab Inc. for their great efforts on the system implementation.

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