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A NEW COMPUTATIONAL DYNAMIC TRUST MODEL FOR USER AUTHORIZATION

D ANAND KUMAR[1], P.KARUNAKAR REDDY[2]

[1]M.Tech Student, Sree Rama institute of technology and science

Kuppenakuntla,Penuballi,Khammam,TS INDIA

[2]Asst Prof,CSE DeptSree Rama institute of technology and science

Kuppenakuntla,Penuballi,Khammam,TS INDIA

ABSTRACT:

Development of authorization mechanisms for secure information access by a large community of users in an open environment is an important problem in the ever-growing Internet world. In this paper we propose a computational dynamic trust model for user authorization, rooted in findings from social science. Unlike most existing computational trust models, this model distinguishes trusting belief in integrity from that in competence in different contexts and accounts for subjectivity in the evaluation of a particular trustee by different trusters. Simulation studies were conducted to compare the performance of the proposed integrity belief model with other trust models from the literature for different user behavior patterns. Experiments show that the proposed model achieves higher performance than other models especially in predicting the behavior of unstable users.

INTRODUCTION:

THE consumer market for location-based services (LBS) is estimated to grow from 2.9 billion dollars in 2010 to 10.4 billion dollars in 2015 [1]. While navigation applications are currently generating the most significant revenues, location-based advertising and local search will be driving the revenues going forward. The legal landscape, unfortunately, is unclear about what happens to a subscriber’s location data. The nonexistence of regulatory controls has led to a growing concern about potential privacy violations arising out of the usage of a location based application. While new regulations to plug the loopholes are being sought, the privacy-conscious user currently feels reluctant to adopt one of the most functional business models of the decade. Privacy and usability are two equally important requirements for successful realization of a location-based application. Privacy (location) is loosely defined as a “personally” assessed restriction on when and where someone’s position is deemed appropriate for disclosure. To begin with, this is a very dynamic concept. Usability has a two fold meaning— 1) privacy controls should be intuitive yet flexible, and 2) the intended purpose of an application is reasonably maintained. Toward this end, prior research have led to the development of a number of privacy criteria, and algorithms for their optimal achievement. However, there is no known attempt to bring into view the mutual interactions between

the accuracy of a location coordinate and the service quality from an application using those coordinates. Therefore, the question of what minimal location accuracy is required for an LBS application to function, remains open. The common man’s question is: “how important is my position to get me to the nearest coffee shop?”—which unfortunately

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remains unanswered in the scientific community.

Existing System:

Future LBS architectures must make room for a service provider to cooperate with the user in making sound privacy decisions. There is a growing skepticism on how a LBS provider handles (or might handle) location data. If strong market adoption is an agenda item for these businesses, then it becomes their responsibility to present evidence that the sought location accuracy is indeed a characteristic requirement of the application. Further, regulatory enforcements on location data procurement, and subsequent liability in the event of improper handling, can make the collection of unnecessarily precise geo locations an unattractive choice. From a computational perspective, only the service provider maintains the database of queried objects in real time. Therefore, it is reasonable that differences (or similarities) in the output of a query can be efficiently computed at the server side. A user cannot make informed privacy decisions without this computation. In light of these arguments, a privacy supportive LBS seems both appropriate and important.

Note that a simple opt-in LBS is not privacy-supportive, since the implications of not using ones geo location is not available to the user.

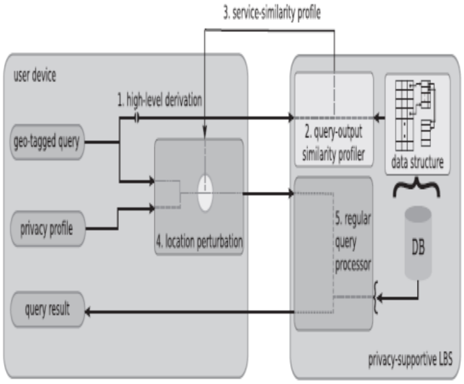

Fig. 1. Communication order for a location-based query in the presence of a privacy-supportive LBS.

Proposed System:

Mobile local search is demonstrating an upward market trend, the gap with the desktop counterpart diminishing in the next three years, and then rising further.2 Given the penetration of web-enabled handheld devices in the consumer market, it has become exceedingly common for a user to instantly look up the information she seeks to find. These search queries are estimated to produce 27.8 billion more queries than desktop-search by the year 2016.Avast majority of the users performing mobile search seek access to information pertinent in the locality of the query. Multiple LBS applications for example, Where, Around Me, Mee Moi, Skout, and Loopt—have spawned in the past few years to address this market segment. In general, a local search application provides information on local businesses, events, and/or friends, weighted by the location of the query issuer. Location and service accuracy tradeoffs are clearly present in a local search LBS. Aprivacy-supportive variant is, therefore, well suited for this application class. Local search results tend to cycle through periods of plateaus and minor changes as one moves away from a specified location. The plateaus provide avenues for relaxation in the location accuracy without affecting service accuracy, while the minor changes allow one to assess accuracy in a continuous manner.

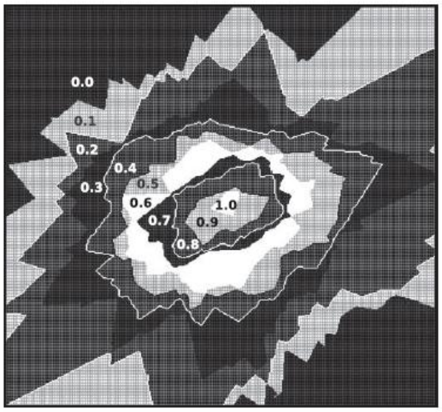

Fig. 2. Hypothetical query result set similarity with the user at the center of the area.

EMPIRICAL EVALUATION

The empirical evaluation is performed using the SimpleGeo Places data set that contains information on more that

20 million places around the world, and distributed under the Creative Commons open license. The US part of the data set has 12,993,248 entries, with data corresponding to multiple business categories and subcategories. Entries are maintained in the GeoJSON format, and includes attributes such as name, latitude/longitude, address, phone numbers, classifiers (category, type, subcategory) and tags. In our study, a place is considered a match for the search keyword if it includes the keyword in any of these attributes, and the city matches the city attribute. The evaluation is performed for the four largest cities in USA—Los Angeles, Houston, Chicago, and New York. One of the factors influencing the top-k results is the number of objects returned by a query, and their distribution around the query point. The existence of a large number of objects implies that the top-k results are likely to change for small changes in location. For objects that are low in density, large variations in the location are possible without changing the result set. This behavior can be reasonably assumed irrespective of the density of users in the city. Therefore, we choose large cities where we can obtain different densities of objects, specially ones with high densities. Objects that are high in density in large cities may not be so in a smaller city. Hence, we believe that a comprehensive evaluation can be performed by considering these large cities.

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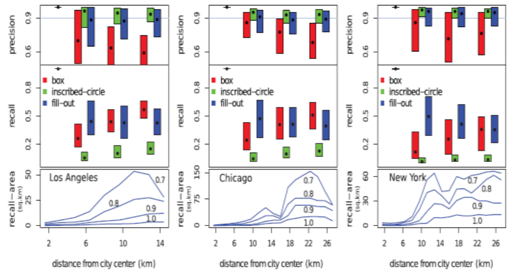

Fig. 5. Precision and recall when searching for "starbucks coffee" in a given city. Each plot shows performance of fill-out for $\delta = 1.0$ (leftmost) and then three sets of rectangles, one each for $\delta = 0.9, 0.8$, and 0.7 (from left to right). Lower edge of a rectangle represents 10th percentile, upper edge represents the median (50th percentile), and the dot represents 25th percentile. Also shown is the area recalled (in km^2) by the fill-out heuristic as a user moves away (distance in km) from the city center. Trend lines are marked with the corresponding δ value.

Precision/Recall Trends

The precision and recall trends we observe for the case of "starbucks coffee" are repeated for the other medium density experiment (derived using the keyword "police"). For the fill-out heuristic, Fig. 7 shows the mean (across the search keywords) of the 25th percentiles of the precision scores for different object densities. Full precision for low density objects is almost guaranteed, irrespective of the service accuracy threshold. However, the approach has difficulty maintaining those same values for high-density objects. High-density objects are often located close to each other, thereby creating a scenari where moving small distances significantly changes the result set. It also means that finding such objects is not difficult in the real world. Note that the density designation is not based on what is being queried—a "gas station" could be a high-density object in parts of a city, and low/medium in others.

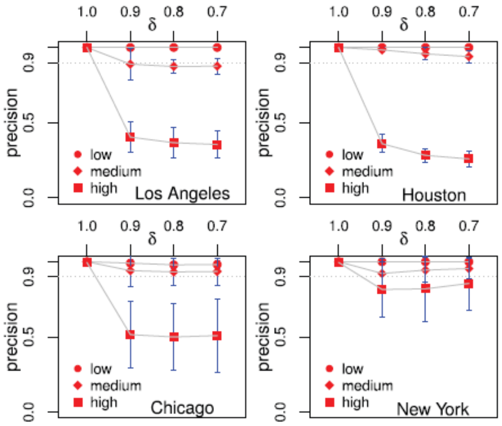

Fig. 7. Precision of fill-out heuristic for different service similarity thresholds ($\delta = 0.7, 0.8, 0.9, 1.0$) and object densities (*low*, *medium*, *high*). Vertical bar shows one-standard-deviation.

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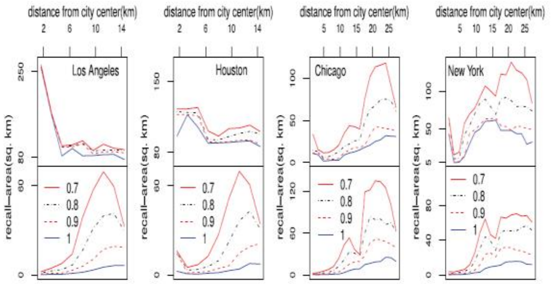

Fig. 8. Area (km^2) recalled by the fill-out heuristic for different service similarity thresholds ($\delta = 0.7, 0.8, 0.9, 1.0$), as user moves away (distance in km) from city center. Top plots are for low-density objects and bottom plots for medium density objects.

Conclusions

In this paper we presented a dynamic computational trust model for user authorization. This model is rooted infindings from social science, and is not limited to trusting belief as most computational methods are. We presented a representation of context and functions that relate different contexts, enabling building of trusting belief using crosscontext information. The proposed dynamic trust model enables automated trust management that mimics trusting behaviors in society, such as selecting a corporate partner, forming a coalition, or choosing negotiation protocols or strategies in e-commerce. The formalization of trust helps in designing algorithms to choose reliable resources in peer-to-peer systems, developing secure protocols for ad hoc networks and detecting deceptive agents in a virtual community. Experiments in a simulated trust environment show that the proposed integrity trust model performs better than other major trust models in predicting the behavior of users whose actions change based on certain patterns over time.

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D ANAND KUMAR is an M.Tech Depart ment of Co mputer Science & Engineering, Sreerama Institute of Technology & science, Penuballi Mandal, Khammam, Kotha Kuppenkuntla

P. Karunakar Reddy is an efficient teacher, received M.Tech from JNTU Kakinada is working as an Associate Professor in Department of C.S.E, Sree Rama Institute of Technology & Science, Kuppenakuntla, Penuballi, Khammam, TS,India. He has published many papers in both National & International Journals. His area of Interest includes Data Communications & Networks, Information Security, Database Management Systems, Computer Organization, C Programming and other advances in Computer Applications

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