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SURVEY ARTICLE

A Survey on LARS: An Efficient and Scalable Location Aware Recommender System

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Abstract- LARS - A location aware recommender system which uses ratings based on location to provide recommendations. Available recommender systems do not consider spatial properties of items and users. Whereas LARS takes into account the three classes of location based ratings viz spatial ratings for non spatial items, non spatial ratings for spatial items and spatial ratings for spatial items. LARS exploits user rating location as well as the item locations. User rating locations are exploited by user partitioning technique which influences recommendations with ratings close to the querying user spatially, without diminishing the system scalability and recommendation quality. Item locations are exploited by using travel penalty technique which favors recommendations which are close in travel distance to the querying user by avoiding exhaustive access to all items. Depending on the location based ratings available LARS can use these techniques together or separately. LARS is an efficient, scalable and capable of producing recommendations accurately than the available recommendation techniques.

Key terms: Spatial, LARS, location, scalable

I. INTRODUCTION

Data mining is an analytic process to explore large amounts of data usually in business or market related data in a way to get consistent patterns and relationships between variables and to validate findings by applying the detected patterns to new subsets of data. The goal of data mining is prediction. Data Mining consists of following stages i) the initial exploration ii) model building or pattern identification with verification and validation iii) deployment stage. The task is to extract previously unknown and interesting patterns such as data records and dependencies.

Predictive analytics is a variety of statistical techniques for modeling, machine learning and data mining which analyses the current and past facts to make prediction about future or unknown events. Predictive analytics has its applications in actuarial science, marketing, financial services, telecommunication, retail and many other fields.

Recommender system uses community opinions in a way to help users identify useful and interesting items from large search spaces. The usual techniques used by all these systems is Collaborative Filtering(CF) which analyses past community opinion to get correlations of similar items and users to suggest K personalized items (ex movies) to a querying user. The community opinions are expressed through ratings which are represented by the triple (user, rating, item) which means a user giving a numeric rating to particular item.

Currently applications can produce location based ratings which uses user and/or item location for example social network based location (ex Foursquare and Facebook places) allows user to check in at particular place be it a restaurant, park or a touring spot and rate their visit. Thus these are capable of using both user and item location with ratings. These types of ratings motivate a new and interesting paradigm of LARS where the recommender system exploits the spatial aspect of ratings while producing recommendations.

II. LITERATURE REVIEW

Location Based Services:

Currently available location based services uses two main methods to provide interesting destinations to users a) KNN technique and variants (ex aggregate KNN) which simply retrieves the K nearest neighboring objects to a user. b) Preference methods like skylines and location based top K methods which require users to provide explicit preference constraints. Recent research proposed the problems of hyper local place rankings. Given a user location and query string it provides top k ranked Points of Interest (POI) which are influenced by previously logged queries. Thus hyper local ranking does not provide responses to the querying user that is two users entering same search query from same location will get same ranked answer set.

Traditional recommenders

There are many techniques which are capable of generating recommendations using non spatial ratings for non spatial items which are represented as the triple (user, rating, item). By incorporating contextual attributes in statistical models of recommendations we get the closest to these approaches by considering location. Some of the already available commercial systems make use of location while proposing interesting items to users. For example Netflix gives a list of movies for a particular region categorized as “local favorites”. However these are not personalized to every single user but this list is generated using aggregate rental data for a given city.

Location aware recommenders:

These systems takes the use of GPS trajectory data of the users to predict where in future the user may go by determining her preferred shopping sites and sites of interest by providing recommendations. For this to be determined the spatial activity recommendation system uses GPS trajectory data with tags which are provided by users to detect the interesting activities which are located in the city. This data is used to answer two queries i) given an activity type, to return location in the city where this activity is happening. ii) given an explicit spatial region or location, providing the list of activities available in that region. Geo measured friend based collaborative filtering gives recommendations by using ratings that are from users social network friends who live in the same city. This technique focuses on user’s location with ratings.

Amazon.com Recommendation item to item Collaborative filtering

An Industry report by Greg Linden, Bren Smith, and Jeremy York Amazon.com briefed about the item to item collaboration filtering at Amazon.com recommendations. Recommendation algorithms usually employed on e-commerce web sites

by taking inputs as customers interest to produce a list of items recommended. Most of the applications uses only the items purchased by customers and explicitly rate those items to represent customer's interest. In addition to that, system can also use other attributes such as items viewed, favorite artists and subject of interest. Recommendation algorithms are used to personalize the online store for each individual customer. This store keeps on changing based on customer's interest.

These recommendation algorithm functions in challenging environment for example a retailer may have large amount of data, millions of customer and thousands of items. Many application needs the result set returned in real time within fraction of seconds along with producing the best and accurate recommendations. New customers will be having only less information which is based on few purchases and their ratings. Three common ways to solve the recommendation problems are 1) Traditional collaborative filtering 2) Cluster Models 3) Search Based methods. A traditional collaborative filtering method represents customers as n dimensional vector of items where n is the number of distinct catalog items. In order to get the customers who are similar to the user the cluster model divides the customer base into many segments. The goal of the algorithm is to assign user to segments which contains most similar customers. The problem of search for related items is focused in Search Based methods.

Towards the Next Generation of Recommender systems: A survey of state of the art and possible extensions.

Gediminas Adomavicius and Alexander Tuzhilin presented an overview of current approaches in the field of recommendation systems and briefed about different limitations of those methods. Recommendation systems are generally categorized into three categories i) Content Based ii) Collaborative and iii) Hybrid. In the content based recommendation the customers are recommended products or items which are similar to those which the customer preferred in the past. In collaborative recommendation users are recommended with items which the people with same taste, interest and preference liked in the past. The hybrid method takes into account both the collaborative as well as content based approaches. Various extensions were also discussed, which can be helpful in improving the capabilities of recommendation systems to make them compatible to a broader range of applications. The understandability of users and products or items incorporating the contextual information in the recommendation process, supporting multicriteria ratings and extending flexibility with minimum intensive types of recommendation techniques.

Evaluating Collaborative filtering recommendation systems

Jonathan I Herlocker, Oregan state university and Joseph a Konsten, loren g.Terveen and John t.Riedl, University of Minnesota evaluated the different recommendation systems in many ways. The key decisions to evaluate the collaborative filtering methods of recommendation systems are the user tasks which are being evaluated, the type of datasets and analysis being used, different ways of measuring the prediction quality, evaluating different prediction attributes apart from quality and evaluating system as a whole based on users with different evaluation strategies which were previously used and researched we present various empirical results from analysis of different accuracy metrics on content domain where the tested metrics fell roughly in three equivalence classes. These metrics in each equivalence class were correlated and various metrics in different equivalency class were uncorrelated.

Scalable Incremental Processing of continuous Queries in Spatiotemporal Databases.

Mohamed F Mokbel, Xioping Xiong Walid G, Aref Department of Computer Science, Purdue University presented a paper introducing the Scalable Incremental Algorithm (SINA) which is hash based algorithm for evaluating a set of continuous concurrent spatiotemporal queries. SINA is designed with two goals i) Scalability with respect to number of continuous concurrent spatiotemporal queries. ii) The other is incremental evaluation of three queries. This algorithm achieves scalability by using shared execution paradigm where executions of spatiotemporal queries which are continuous are abstracted as spatial join with set of objects which are moving. We get incremental evaluation by computing the updates of the answers which were previously reported. Computation of different updates like positive and negative updates were introduced in the paper, when certain object should be added or removed from the answers which were reported previously indicates the positive or negative updates respectively. These

updates are managed in the algorithm in three phases, the hashing phase, invalidation phase and joining phase. We use an in memory hash-based join algorithm which gives the set of positive updates. The second phase is involved when memory is fully occupied to give set of negative updates or it is triggered every t seconds. At the end of this phase the joining phase is triggered which produces set of both positive as well as negative updates. Comparing with previous results experimentally proves that this algorithm is scalable and efficient as compared to other spatiotemporal algorithm.

GroupLens: An Open Architecture for Collaborative Filtering of Netnews

Paul Resnick, Mitesh Suchak, MIT Center for Coordination Science and Neophytos Iacovou, Peter Bergstrom, John Riedl, University of Minnesota presented a paper on open architecture for the collaborative filtering. Collaborative filters helps user make choices based on the opinions of other users. A system of collaborative filters of Netnews known as GroupLens helps people to get articles which they like from a large stream of all the articles available. Users need to rate the article after they finished reading with predicted scores being displayed by news reader client. The rating server collects and disseminates the ratings. The rating server evaluates the predicted rating using the heuristic that the people who agreed previously will agree again. User's privacy can be protected by allowing the user to enter the ratings under pseudonyms, without compromising the effectiveness of predicting the scores. This Architecture is open with alternative software for clients and rating servers can be developed separately or independently which are interoperable with the components developed.

III. CONCLUSION

The proposed system LARS: Location Aware Recommender System solves the problem which were previously unseen by traditional recommender systems using three types of ratings which are based on location i.e spatial ratings for non spatial items, non spatial ratings for spatial items and spatial ratings for spatial items. LARS uses two techniques one is user partitioning and the other is travel penalty which supports spatial ratings and spatial items respectively. Experimenting with real and synthetic datasets show that this recommender system is efficient and scalable which gives the better quality of recommendation as compared to the approaches which were used by traditional recommender systems.

REFERENCES

[1] G. Linden et al, "Amazon.com Recommendations: Item-to-Item Collaborative Filtering," *IEEE Internet Computing*, vol. 7, no. 1, pp. 76–80, 2003.
[2] P. Resnick, N. Iacovou, M. Suchak, P. Bergstrom, and J. Riedl, "GroupLens: An Open Architecture for Collaborative Filtering of Netnews," In *CSWC*, 1994.
[3] "The Facebook Blog,"Facebook Places" Available: http://tinyurl.com /3aetfs3."
[4] G. Adomavicius and A. Tuzhilin, "Toward the Next Generation of Recommender Systems: A Survey of the State-of-the-Art and Possible Extensions," *IEEE Transactions on Knowledge and Data Engineering, TKDE*, vol. 17, no. 6, pp. 734–749, 2005
[5] "MovieLens *Available*: http://www.movielens.org/."
[6] "Foursquare *Available*: http://foursquare.com."
[7] New York Times – A Peek into Netflix Available: http://www.nytimes.com/interactive/2010/01/10/ nyregion/20100110-netflix-map.html."
[8] J. J. Levandoski, M. Sarwat, A. Eldawy, and M. F. Mokbel, "LARS: A Location-Aware Recommender System," in *Proceedings of the International Conference on Data Engineering, ICDE*, 2012.
[9] B. Sarwar, G. Karypis, J. Konstan, and J. Riedl, "Item-Based Collaborative Filtering Recommendation Algorithms," in *Proceedings of the International World Wide Web Conference, WWW*, 2001.
[10] J. S. Breese, D. Heckerman, and C. Kadie, "Empirical Analysis of Predictive Algorithms for Collaborative Filtering," in *Proceedings of the Conference on Uncertainty in Artificial Intelligence, UAI*, 1998
[11] M. F. Mokbel, X. Xiong, and W. G. Aref, "SINA: Scalable incremental processing of continuous queries in spatiotemporal databases," in *Proc. SIGMOD*, Paris, France, 2004.
[12] G. K. Gupta, *Introduction to Data Mining with Case Studies*, 2nd ed, PHI Learning Pvt Ltd 2013.

