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EFFICIENT EVALUATION OF SKYLINE RESULTS IN MOBILE ENVIRONMENT

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Abstract

Skyline query which retrieves the points that are not dominated by any other points or it helps to retrieve points based on the user preferences. I-SKY and N-SKY are used for handling spatial and non-spatial attribute of the object and it helps to reply query issued from a moving object. Skyline query which receives an interesting attention in the area of Location based service .In order to authenticate the result obtained from a location server we are using two algorithms MR-Tree and MR-Sky-Tree thus the user can ensure that they obtain result from a trustworthy data owner. Here in this paper we are integrating result of range based skyline query system with authentication thus client an ensure correctness and completeness of the received result.

Keywords: Skyline Query, Authentication, Location-Based Services, Query Processing.

1. Introduction

Database is organized as a collection of data and Database management systems (DBMSs) are specially designed application that interacts with the user, other application, and the database itself to capture and analyze data. DBMS have been increasingly used in decision support applications. All these applications are mainly characterized by several features like query, optimal result etc. In DBMS we are using query to retrieve the data, skyline query [1] is one kind of advance query which help to retrieve the data. The skyline queries and its computation have attracted much attention recently in database management system. This is mainly due to the importance of skyline results in many applications, such as multi-criteria decision making, data mining and visualization, and user-preference queries. Skyline queries are important for several database applications, including customer information systems, decision support, and data visualization. The importance of skyline computation in database systems increases with the number of emerging applications requiring efficient processing of preference queries and the amount of available data. Skyline queries are used with data extensive applications, such as mobile location based services, multi-criteria decision-making. The proposed skyline operator allows one to query for best tuples with respect to any number of attributes as preferences skyline queries are useful, particularly for expressing preference. Skyline queries ask for a set of interesting points from a potentially large set of data points. Skyline comprises the points that are not dominated by any other points.

Skyline queries are an important operator of Location Based Service (LBS) [2]. For example, mobile users could be interested in restaurants that are near, reasonable in pricing, and provide good food, service and

view. Skyline query results are based on the current location of the user, which changes continuously as the user moves. Skyline queries which consider both spatial and non-spatial input of the user and it integrate with the idea of Location Based Service. A location-based service (LBS) is an information and entertainment service, accessible with mobile devices through the mobile network and utilizing the ability to make use of the geographical position of the mobile devices. Client may want to authenticate the results produced from LBS are correct and complete. Soundness means that the original data is not modified by the LBS, while completeness means that no valid result is missing. This lead to the problem of authenticated query processing [3] and is solved by using authentication algorithm

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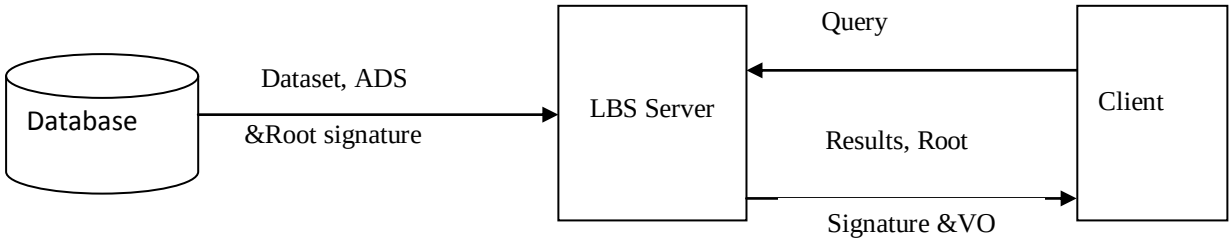

Fig.1. Authenticated Query Processing

A general framework of authenticated query processing is shown in above Fig. 1. The spatial dataset is normally stored in LBS system but before outsourcing data to LBS, the data owner (DO) builds an authenticated data structure (ADS) of the dataset. It is a tree like structure and root is signed by DO using private key. The service provider or LBS which contains root signature for spatial data set and client which check the correctness of query result by using the returned VO, root signature and DO's public key. In this paper we study the authentication location based problem with range based skyline query. In range based skyline query we are using two methods I-SKY and N-SKY algorithm. I-SKY algorithm which deals with query issued from a static environment and N-SKY algorithm is deal with query issued from a dynamic object. The authentication method is applied by using two algorithms MR-Tree and MR-Sky-Tree.

2. Related Work

Skyline query processing has been extensively studied in recent years. Kung et al., [4] which proposed the first skyline algorithm which is maximum vector problem. The existing skyline query processing algorithms include Block-Nested Loop (BNL) [1], Divide and Conquer (D&C) [1], Sort Filter Skyline (SFS) [5], Bitmap [6], Nearest Neighbour (NN) [7], Branch and Bound Search (BBS) [8] etc. The primitive skyline query processing algorithms are D&C [2] and BNL [2]. In D&C algorithm it considers the whole data space and makes m-way partition. For each partition it identifies the points that are not dominated by any other points and compute the skyline result by merging the result together. In BNL algorithm it iteratively checks each record with the main memory to find out the dominating point and return the skyline result to a temporary file.BNL and D&C are non-index based algorithms that scan the whole data iteratively. Dynamic query means the query location is continuously changing so that skyline results are change frequently. The efficiency of skyline is computed in terms of accessing the data points and organizing the skyline result. Range based skyline query [9] in mobile environment which uses two algorithm I-SKY [9] and N-SKY [9]. I-SKY is mainly used static object and N-SKY is focus for dynamic object. Skyline query used in Location Based Service (LBS) [2] which receive an interesting attention in research field.LBS which provides timely information to the user. Authenticated Location based skyline results is provided by using two algorithms MR-Tree [3] and MR-Sky-Tree [3].

3. Existing System

Range based skyline query which consider both spatial and non-spatial attribute of the object and it return result based on the dominance relationship. Consider data set of objects o. Each object $o \in O$ is associated with one spatial (i.e., location) attribute and several other nonspatial attributes (e.g., parking fee and service quality). It process the query based on the non spatial dominance relationship and it is defined in definition 1 and definition 2.

Definition 1 *(Nonspatial Dominance) Given two objects* o *and* o' *, if* o' *is no worse than* o *in all nonspatial attributes, then we say* o' *non spatially dominates* o *and* o' *, is a nonspatial dominator object of* o *, and* o *is a nonspatial dominance object of* o' *.Formally, it is denoted as* $o' \lhd o$ *.The set of* o' *s nonspatial dominator objects is denoted as* $Dom(o)$ *i.e.,* o *is dominated by any object in* $Dom(o)$ *on nonspatial attributes.*

Definition 2 *(Dominance) Given a query point* q *and two objects* o *and* o' *, if 1)* o' *nonspatially dominates* o *, and 2)* o' *is closer to* q *than* o *(i.e.,* o' *also spatially dominates* o*), then we say* o' *dominates* o *w.r.t. the query point* q *Formally, it is denoted as* $o' \lhd_q o$

Definition 3 *(Range-Based Skyline query) Given a data set* o *and a query range* R *, the range-based skyline query returns a superset of objects that appear in the skyline set of some point in* R *. Formally, it is denoted as* $RSQ(R,Q)$ *, and* $RSQ(R,Q) = \{o \mid \exists_q \in R, o \in PSQ(q,o)\}$

Range based skyline query is processed by using two algorithms I-SKY and N-SKY. I-SKY is based on the index creation. Indexing is done based on the skyline scope of each object. Consider the object o and if $Dom(o)$ is empty, i.e., o has no nonspatial dominator object, then it is record as a skyline member of the query point q otherwise it will not be a skyline member or it is farthest away from q. The Skyline scope of each object o is calculated by applying Voronoi cell .The skyline scope of an object o can be obtained by computing the voronoi cell of o with the object subset containing o and its nonspatial dominator objects $i.e., \{o\} \cup Dom(o)$ Range-based skyline $RSQ(R,Q)$ can be computed by finding the objects whose skyline scopes intersect with R

Definition 4 *(Skyline Scope) For an object* $o \in O$ *, its skyline scope in a 2D plane P is denoted as* $SS(o) = (q \mid q \in P \wedge o \in PSQ(q,O)$ *where* $o \in PSQ(q,O)$ *means* $\forall m \in Dom(o), dist9o,q) \prec dist(m,q)$

The index construction maintenance cost of the I-SKY is very high when the object updates the location frequently. So in order to avoid the high update cost of I-SKY they propose the idea of non index algorithm called non index algorithm N-SKY. In N-SKY algorithm it applies the concept of segment-based skyline query. The query range R is solved by using segment based skyline query and it is defined in definition 5. In a dynamic environment query range or skyline result set is continuously varying based on the user query point. In N-SKY they proposed queue structure to store all the dynamically changing entering points , ie., left and right entering points. it update the queue continually based on the object movement.

Definition 5 *(Segment-based Skyline Query) Given a data set* o *and a line segment* l *the segment-based skyline returns a superset of objects that appear in the skyline set of any point on* l *. Formally, it is denoted as* $SSQ(l,O)$ *and* $SSQ(l,O) = \{o \mid \exists_q \in l, o \in PSQ(q,O)\cdot$

The query issued from a dynamic environment is effectively handled by I-SKY and N-SKY algorithm or it effectively provide the location based service based on the user preference on spatial and non spatial attribute of the object. The skyline query result which produced does not ensure the correctness and completeness of the result set. LBS system must authenticate the trustworthy of the server by using proper authentication system. So in our proposed architecture we are ensuring that range based skyline result with proper authentication that achieves the correctness and completeness of the skyline result set.

4. Proposed System

Skyline query used in location based application which received an interesting attention in many fields and location based system which provides service based on the location of the user. LSQ which return skyline result set based on the query point and it is not dominated by any other objects and it is defined in below definition 6.

Definition 6 *(Location-based Skyline Query (LSQ)) Given an object set O, the location-based skyline of a query point q is a subset of O, LSQ (O, q), in which each object is not dominated by any other object in O w. r. t. q.*

In the proposed system we authenticate skyline query results obtained from I-SKY and N-SKY by using MR-Tree and MR-Sky-Tree algorithms. In MR-Tree it indexes spatial object with a proper authenticated R-Tree structure with a root signature and it create verification object for each location based skyline query on the client. Client can authenticate the integrity of result by root signature, to verify the correctness of the skyline results and it return the result based on the mindist between a data object and a query point. The completeness and correctness of MR-Tree result is guaranteed by comparing the signature of the root signed by the data owner to the digest that dynamically computed at the client side.

In MR-SKY-TREE it uses the idea of skyline scope for each queried object and return the corresponding skyline scope as result set. In order to support query authentication all skyline scope is inserted into an MR-Tree as data points so it is called solution based index as MR-Sky-Tree. So for each time client check whether skyline scope of every object is covered by the user query and it ensure that result obtained has no incorrect results. Authentication is achieved by verifying the root signature with the digest computed from the tree. The overall system architecture is shown in Fig.2.

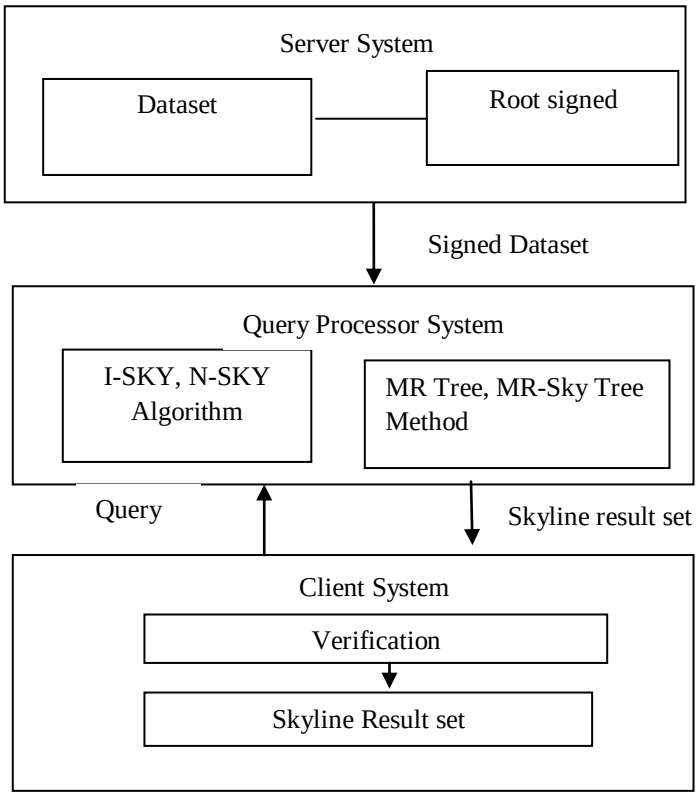

Fig.2. System architecture

Entire architecture of the system mainly consists of three unit's server, query processor and client system. In the server system which contain collection of information or latitude and longitude of each place that data is loaded to query processor system. The dataset used in server which is root signature to ensure that data from a trustworthy server or to validate skyline result set is correct. Client gives the input query and it is processed by the query processor by using I-SKY and N-SKY algorithm. Based on the query point it retrieve the data and authentication is done by query processor which ensure that data is from a trustworthy owner. Client can verify the obtained skyline result set and ensure the correctness and completeness of the skyline result.

5. RESULTS

In this section which discussed the performance of the proposed system. We are implemented this system by written stimulating code in java (JDK 1.7). The paper which measures the performance of system in

terms of accuracy of skyline result set. Here we are trying to compares the accuracy of result sets with after applying authentication and before applying authentication. The Fig.3 shows that accuracy for large data set is tremendously increased after applying the authentication. Authentication ensures the correctness and completeness of the skyline result set. In addition to accuracy other measuring metrics are IO cost and CPU time but it is increased with authentication techniques.

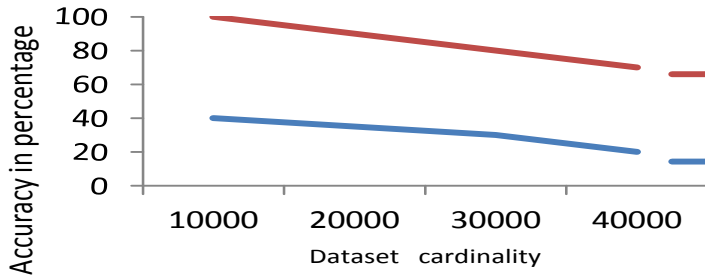

Fig.3. Accuracy comparison

6. CONCLUSION

Skyline queries are used with data extensive applications, such as mobile location-based services and multi-criteria decision-making. Skyline queries which return interesting points from database, i.e. best tuple from the database. Range-based skyline query as an extension to point- and line-based skyline queries and it uses two algorithms index-based (I-SKY) and non-index (N-SKY) solutions to resolve the range-based skyline problem. I-SKY and N-SKY algorithm which process the input query based on the user preference. Skyline query which helps to process user preference and it return the non-dominated points. In order to achieve the correctness and completeness of result set we are using authenticated query processing system that is achieved by using two methods one is MR-TREE method and other is MR-SKY-TREE. The result set ensure that dataset is from a trustworthy data owner and every data is verified by signature generated from the root node and it is represented as index structure. The experimental result shows that these algorithms are well performed in terms of accuracy of skyline result set.

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A Brief Author Biography

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