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A Real Time GIS Approximation Approach for Multiphase Spatial Query Processing Using Hierarchical-Partitioned-Indexing Technique

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ABSTRACT

Spatial objects are tremendously uneven geometric components, which have not definite shape and large number of coordinate are stored for describing the shape of an object. The geographic database systems is always faced high data volume and complexity of objects/entity and query, this impose strict needs on their storage space and accessing architecture in respect to efficient query processing. To perform any data structure operation –sorting, searching, merging, etc. would be time consuming and expensive. In general, has to be improving concepts such as spatial storage, accessing structure, approximation, partition of an object, and multiphase query processing, before any computation is applied. To achieve the efficient approximations of spatial object, propose a robust, efficient and simple new spatial object partition method, called SOPMs to increase feedback of multiphase spatial query processing which is best suited for convex and non convex multifaceted spatial entity in present GIS application. The idea behind is that an entity (polygon) by partitioning recursively in sub polygon until a least bound quadrangle (LBQ) constraint is valid. To improve and increase the efficiency of SOPMs techniqueis merged with extended spatial indexing structure.

Keywords : SOPM(Spatial Object Partition Method), LBQ

I. INTRODUCTION

Spatial database queries are typically concerns with enormous volume of dataset and composite spatial objects. Spatial objects are considered as tremendously uneven geometric components that have no guarantee to exist in regular shape. The searching process is particularly for spatial objects would be expensive and time-consuming, if there is a huge numbers of such composite objects, and by multi-dimensional data that consists with huge numbers of coordinate relating the edge of spatial objects, since a number of geometrical computation is required to locate the spatial objects exactly. Locating the spatial objects efficiently, it need to be approximated before any geometric computations is applied. To get the efficient approximations for spatial object, the object partition is the best suited. However, simple spatial objects such as point, line and rectangle are generally discussed, and less consideration is dedicated to composite spatial object. For this, introduced a new object partitioning approach for composite spatial object like point(cities), line(roads), and connected lines forms Network (transportation), area (group of cities) in real world geographical applications. The existing spatial indexing structure extended to increase the efficiency of proposed approach. Derived points, regions and spatial join query pseudocodes are discussed in the proposed spatial indexing structure. This approach is analytically compared with existing partitioning methods and attempt has been made superior in compare to existing partitioning approach.

II. METHODS AND MATERIAL

Two methods are selected for approximation of spatial objects. In the first method, a smallest align quadrangle enclosed with an object, a least bound quadrangle

(LBQ), is used in approximation of spatial object, which is irregular in shape. To preserve the spatial identity and elimination of many potential intersections testing rpidly, LBQs allows appropriate proximity query processing. The second one method is much approximate in accuracy than the LBQ, used convex contained in approximation of spatial objects.

It is expected that the query processing performance is directly proportional of the quality of the approximation of original object. There are two most popular approximation approaches, the filter-refinement and the object transformations can used in the first method. With the filter-refinement approach, the filtering phase reduces the complete sets of object into a subsets of candidate with respective LBQs, further next the refinement phase inspect for accurate representation of each object of the candidate. Even though LBQs offers a speedy approximation with existing spatial access approach to design for LBQs container, considered as quite in-accurate approximations because a simple quadrangle is not able to represent an arbitrary spatial object accurately. To approximate this approach, the candidate may have a number of false hits that not fulfil the query conditions. In addition, the entire candidate has to be transmit in to the phase of refinement although occurs in false hits. In the object-transformation approach, k-dimensional spatial object is transformed to bit strings i.e. 1-dimensional, or k-dimensional intervals are transformed into points in 2k-dimensional spaces. However, this approach also considered as a “rough approximation” as considering assumption that spatial objects are LBQs. A attempt has been made to increase the approximation quality in the second approach, convex approximation and object partitioning is considered. Though, more composite accessing methods required for more composite containers in convex approximations approach as composite container required more parameter in compare to LBQs. Furthermore, used one container on an original composite spatial object representation is not able to reduce the complexity of the spatial object. It is concluded that there is a need of applying time consuming geometrical computation to decide the composite object that satisfy the query condition. In disparity, object partitioning approaches, partitions a composite spatial objects into sets of simpler spatial component like trapezoid, leading in simpler spatial object and better quality approximations. Though, huge components are generated with these partitioning approaches on composite spatial object. A huge number of partitioned components resulting overhead regarding storage as well as query processing. In order to increase the approximation quality, object partitioning approaches has given with one single LBQ to each composite spatial objects. The original composite object is partitioned into a set of simpler components. In similarity with existing LBQ method, all partitioned component can be approximated by means of LBQs. Traditional object partitioning method occurs difficulty on partitioned components. It is fact that the much composite spatial object having much spatial component is generated with composite object. The performance of spatial query decreases as a huge number of partitioned component of such composite object. Consequently, the expansion of a new object partitioning approach is required to conquer above said problem.

1. PROPOSED PARTITIONING METHOD

We introduce a new object partitioning method called Partitioned Least Bound Quadrangle (PLBQs). The concept behind is a polygon is partitioned into two sub-polygons in respect to disjoint half regions of its LBQ spaces, further next a new LBQ, recognized as PLBQ, for every that sub-polygons is generated. The process is performed recursively until each PLBQ fulfils a set constraint. The constraint is uttered as Accuracy of The Partition (AOP). If the resulting PLBQ size is greater than a threshold, partition is allowed. In order to carry the recursively partitioning in efficient manner, used the perpendicular edge and the parallel edge in strict sequence alternatively. The effectiveness of alternate partition has been proved by a lot of researchers. Since a polygon generate accurately two partitioned polygon in this pseudo code, and the binary tree is exactly suitable for this kind of illustration. PLBQs and their components variables are stored at leaf-nodes, quadrangles enclosing sub-polygons are stored at non- leaf nodes in binary tree.

The pseudo code is detailed below.

Pseudo code

1: Partition (v, p)

Input State: A series of polygons’ vertex v=(v_1 , v_2 ,..., v_n), where edges of the polygon are from v_i to v_{i+1} for i=1,2,...,n-1 and from v_n to v_1 . A Boolean identifier p, here p is toggled on the way that partitions the regions to result the alternating test on the perpendicular and parallel edges.

Output State: A new two-dimensional binary tree.

Search LBQ or PLBQ coordinate from v.

Case LBQ: compute LBQ space.
PLBQ space = LBQ space.
Initializes a rootnode in the 2-d binary tree.

Case PLBQ: compute PLBQ space.
if PLBQ space > LBQ space, then make a mid perpendicular (or parallel) edge.

For

every polygon edge in array v,

If the edge lies in the right (below than) of the middle edge, then endpoints of the edge are added into array v_1.

If the edge lies in the left (or higher than) of the mid edge, then add the endpoint into array v_2 of the edge.

If the edge intersects against the mid edge, then find the intersection point and add this point into both v_1 and v_2.

End for

PLBQ coordinates related v_1 added into the right node of the current node.

PLBQ coordinates related v_2 added into the left node of the current node.

/* call partition pseudo code recursively */
p= ¬p
call Partition (v_1, p)
call Partition (v_2, p)
else terminate this program.

End of Pseudo code 1.

The controlled partition pseudo code has a parameter, which controls the number of component for every object. The number of components can be minimized, with minimum value of the parameter, but this partition serves a relatively poor approximations of the objects. On the contrary, the approximation accuracy can be good at higher side, but the linearly increment in the number of component can be experimented. With this experimentation, concluded that a balanced ratio in between the number of components and the approximation accuracy is achieved.

2. OBJECT PARTITIONING USING SPATIAL QUERY PROCESSING

With using two-dimensional binary tree, an extend version of an existing indexing structure is introduced in this subsequent paragraph. With this structure pseudo code of spatial query processing on the basis of object partitioning is discussed further.

1) Two phase indexing structure: The success of the object partitioning method depends upon the capability to narrow down rapidly the sets of component which is affected by spatial query. In terms of making a decision which components are appropriate for a exacting geometrical testing required an competent indexing structure that organize a set of components of one spatial object. A number of spatial indexing structures based on LBQs has been generated. The most promising group includes the R-tree and their variations. Though, structure are considered inappropriate to organize the partitioned components, since component with the same variable are distributed independently on the secondary storages. These randomly distributed objects over the secondary storages leading with high access costing while query processing. As exist indexed structure, the well-liked R-tree is elected to store LBQs. The developed indexed structure may be appropriately extended further to others R-tree variations in easy way. Non leaf-nodes are developed to group quadrangles at the lower level.

2) Two-phase processing of spatial queries: Spatial database system is used in different applications environment, there currently existing, no standard set of spatial query fulfil the requirement of spatial application. Therefore, it is essential to offer a small set of fundamental spatial queries supported by database query facility. These fundamental spatial queries which is used by other researchers as before can be summarized as follows:

• Point query: Given a query point P and a set of objects M, the point query yields all objects of M geometrically containing P.

• Region query: Given a polygonal query region R and a set of objects M, the region query yields all objects of M sharing points with R. A spatial case of the region query is a window query.

• Spatial join query: Given two sets of objects S1 and S2 , a spatial join query yields all pairs of objects (s1 , s2), s1 ∈ S1 , s2 ∈ S2 whose spatial components intersect.

More precisely, for each object s1 ∈ S1 , look for all objects in s2 intersecting with s1 . In general, the spatial query processing consists of two steps: filter step and refinement step.

III. RESULTS AND DISCUSSION

With analytical approach, the proposed controlled partition method has been compared with traditional partition approach. There are various object-partitioning approaches used to represent spatial object. All these approaches is based on divide and conquer strategy. Considering three properties of recursive partitions the spatial objects as condition of partitions, numbers of partition, and container of component. In order to conclude which spatial query processing approach is best in respect to performance measure, it is essential to analyze every class in respect to criterion to evaluate the fitness of partition approach. The filtering and the refinement phase is considered to improve the performance of spatial query processing. The filtering phase performance is significantly depends upon the approximation quality of the spatial object container used to filter issues. The quality of the approximation is the amount of the area covered by the containers not by the objects itself. The amount of area is directly proportion to the filtering performance. The refinement phase performance depends upon the numbers of refined object with their complexity. Reducing the numbers of object to be refined is the task of the filtering phase. Therefore, the complexity of an object is to be examine in the phase of refinement. A generalization of the refined object with object-partition approach leading to good performance of the refinement step. However, a number of components gives the main drawback. As criteria for evaluating partition methods, we considered the total number of component, the approximation quality and the simplification of objects in easy way.

IV. CONCLUSION

We introduced a new object partition approach, called PLBQs, to increase the spatial query processing in respect to performance. Also the extended version of exist indexed structures, two-phase index structure, to increase the efficiency of the PLBQs approach. At that time derived, points, regions and spatial join query pseudo codes under this new structure. Through the analytical study, introduced method has been compared with existing partition approach. This approach is superior to the existing partition approach due to its capacity of tuning the trades-off among evaluation of criterion. Further, the experimental verifications is also required for this study.

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