

Homework #1: CS6604: Spatial Databases

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Abstract—This document is a summarization of two papers written between 2006 and 2013 on the topic of Spatial Access Methods with respect to geospatial database management systems.

I. INTRODUCTION

THIS document is a summarization of two academic papers published in 2008 and 2010, respectively, that cover the topic of spatial access methods.

II. SPATIAL INDICES IN MS SQL SERVER

The first paper [1] is about the implementation of OGC OpenGIS Simple Features Specification for SQL in Microsoft SQL Server 2008, which includes built-in support for geometry and geography data types. Spatial indexing utilizes XML schemas to store B+-Tree data via the “hierarchical decomposition of space” strategy. This is similar to Quad-Tree decomposition when creating a spatial index based on the bounding box. These indices are usually in the form of *tessellations* based on a specific bounding box and columns which allows for multiple indices to be created for specific spatial data.

Microsoft SQL Server 2008 performs three filtering steps on a spatial query: 1) candidate tessellation, 2) primary filtering (no false-negatives), and 3) secondary filtering (computationally expensive). Additionally, SQL Server performs query optimization based on the query type, i.e. non-spatial vs. spatial attributes and the pervasiveness of the spatial indices.

III. TEMPORAL SPATIAL ACCESS METHODS

The second paper [2] proposes an access method based on quad-tree analysis while using a temporal attribute to assist in minimizing redundancy and storage space. Specifically, the authors focused on vector-based quad-trees, e.g. OpenStreetMap Layers (and, to an extent, the new Google Maps interface). Dealing with and querying on vector objects is quite different as one might request if a road line passes through a region which contains neither end point.

The authors propose an extension to PM quad-trees that allows for the above query to be processed on a temporal (both historical and future) timescales. The general idea is to store a record of changes on specific parts of a vector-based polygon in a manner similar to a write-ahead log (WAL) that is stored

within the quad-tree. This enables historical as well as current analysis on the same polygonal node in the quad-tree

IV. CONCLUSION

This document quickly summarized two papers on spatial access methods that are relatively current. The first focused on Microsoft’s SQL Server 2008 spatial implementation and their approach to handling spatial queries via tessellations. The second paper focused on the addition of temporal attributes to vector-based polygons and how to perform efficient ACID operations of various sub-parts of the polygons. These changes are stored at the node in question and useful for analyzing historic, current and future changes to the polygon.

REFERENCES

- [1] Fang, Y., et al. (2008). Spatial indexing in Microsoft SQL server 2008. [Proceedings of the 2008 ACM SIGMOD international conference on Management of data](#). Vancouver, Canada, ACM: 1207-1216.
- [2] Tourir, A., et al. (2010). [A Temporal Spatial Access Method](#). Signal-Image Technology and Internet-Based Systems (SITIS), 2010 Sixth International Conference on.