

## **Accuracy Mediation within a Spatial Wrapper-Mediator System.**

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Query evaluation strategies in traditional databases do not consider possible data inaccuracy and vagueness of predicates. However, measurement considerations and data quality are inherent components of geographic information. The purpose of this work is to explore query evaluation in distributed spatial information mediation system that takes into account different accuracy characteristics of data sources. A mediator-based system is a data integration architecture that supports homogeneous views over heterogeneous sources. A 'spatial mediator' is software that can dispatch portions of a user query to multiple sources of XML-wrapped spatial data and services, and assemble query results (as described in Gupta et al., 1999). We explore the following research questions: (1) how accuracy specification can be formulated as part of a query; (2) how accuracy information is used by the spatial mediator for selecting sources and determining query evaluation plans, and (3) how accuracy considerations and query results are exposed to the user.

Assembling a query result, the mediator constructs abstract information layers and then instantiates them with data from one or more spatial data sources. The instantiation process depends on (1) data quality on both collection and feature levels, (2) accuracy specification in the query, and (3) a set of rules for accuracy propagation adopted in the mediator.

We consider three types of accuracy specification in a query reflecting three models of accuracy specification for geographic data:

- (1) Most accurate: all abstract layers are instantiated with the most accurate sources available
- (2) User specified: The user specifies the bounds on expected query accuracy. Abstract layers are instantiated with a constellation of sources that ensures expected overall query

accuracy; if such a constellation cannot be found the mediator suggests a query relaxation strategy leading towards the desired accuracy (such a procedure is described in Zaslavsky,1997);

(3) Incremental: abstract layers are instantiated with sources according to some external rules (or randomly), users can improve query accuracy incrementally by manually selecting appropriate sources.

Generation and evaluation of query plans in the spatial mediator is based on (1) data quality information returned by each source in response to GetFeatureInfo and GetCapabilities requests, (2) transformation and query capabilities of each source (as described in Gupta et al, 2000), and (3) a set of error propagation models for a particular transformation type. The set of models is incomplete and remains an active research area. A query plan represents a gain graph connecting states of the query expressed in terms of Chrisman's (1997) measurement frameworks. The edges of the graph represent transformations between measurement frameworks as well as various conflation and coordinate transformation procedures.

Accuracy mediation output in XML is used to generate a series of maps on a Web client: (1) the query result itself, against geographic context of the query, (2) accuracy of the result, and (3) data sources for each component of the result. For interactive mapping on the Web, we use a lightweight DHTML client that generates multi-layer thematic maps from distributed XML sources, using VML (Vector Markup Language) (Zaslavsky, 2000).

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## References

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