Model Based Mediation With Domain Maps

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Model-based Mediation with Domain Maps

**ISIS Mediation Architecture**

MULTI-agent System Architecture

User/Client

Domain Map

Integrated View Definition

Mediator

CM Integrated View

CM Wrapper

XML Wrapper

CM Wrapper

CM Wrapper

CM Wrapper

**Different Schemes**

<table>
<thead>
<tr>
<th>Federated Databases</th>
<th>XML-Based Mediation</th>
<th>Model-Based Mediation</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-World</td>
<td>One-World/Multiple-Worlds</td>
<td>Complex Multiple-Worlds</td>
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**Our Goal**

- Given different data sources: $S_1 \ldots S_n$
- And we have different queries: $(Q_1, Q_2, \ldots, Q_k)$ over $(S_1, S_2, \ldots, S_k)$
- Find answers to these questions: $(A_1, A_2, \ldots, A_k)$

**Problem**

- How to answer the following query that requires two heterogeneous databases:

```
Query Starts from here
What kind of image? Image Bottom Left
Which neuron? CA
What kind of cell? Pyramidal Neuron
Which compartment? Soma
What effect expected? Hormone Release
Submit
```

- In our Project:
  - Similar Things referred to by different references:
    - Pyramidal Neuron is called a *Pyramidal* in LTP
    - Basket Cell is called a *Basket* in Hippocampus
  - CA1 is a *Region* in LTP database
  - CA3 is a *Area* in Hippocampus
  - Area is a *Region*

- Different things referred to by the same reference:
  - Soma is called a *Portion* in LTP
  - Glutamate Receptor is called a *Portion* in Hippocampus
  - Soma is *structurally* different from Glutamate receptor in hippocampus and
    *functionally* different from cell
  - Soma is a *compartment* in the cell
  - Glutamate receptor is a *Receptor* in the cell
Related Work (1)

- Dr. Bertram Ludaescher et al (SDSC)
- Introduced the problem of complex multiple world
- Proposed a mediation architecture
- Introduced the idea of CM and GCM

Related Work (2)

- Proposed the idea of domain map
- Used CM Plug In mechanism
- Used F-Logic as GCM
- Developed a mediator prototype (KIND)

Related Work (3)

- For this project, used the idea of the domain map as a digraph to incorporate into our system
- Added a Query Processor Agent
- Used ER as the GCM

Improvement of our approach

- Implementation of a simple version of a Conceptual Model wrapper
- Worked a complete example
- Extensible to simple problems

System Overview

Inputs to the mediation system

LTP database
Hippocampus database
Domain Map

Query Processor Agent

- Get user input and transform into query
- Communicate with database
- Consult the domain map
- Send result of query back to user (interface)
- www.cs.uic.edu/~wsunna/594/qpa.html

User Interface

Lifted Data to Conceptual Model (Relational tables)

Complete DDL File

10 Things we learned

1. Introduced to the problem of databases heterogeneity.
2. Examined different approaches and ideas to solve the problem of databases heterogeneity.
3. What issues to take in mind when implementing a system to solve the problem
4. Learned more about RDF
5. Learned how to use Protege to build ontology
10 Things we learned

6. How to export semi-structured XML databases to a Conceptual Model
7. How to build a domain map that lifts data to a semantic level and fills the ontological gap between databases
8. Learned how to write a Query Processor Agent
9. Learned how to effectively use XML
10. Learned how to do good team work

Conclusion

• Solving multiple complex worlds problem is achieved by using a mediator architecture with domain maps, which provide the means to connect multiple complex worlds.
• To add more semantics to the source data, we need to use a conceptual model wrapper that will lift the data with the help of the domain map
• The domain map overrides local ontology.

Future Work

• Find better formulism for GCM
• Generalize to other applications (Geospatial)
• Learn from and incorporate with other data integration method
• Write parsers for the system
• Connect the system to Oracle DBMS

References

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