SR-Match: Discovering Complex Semantic Matches based on Semantic Relationship of Attributes

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In data integration, schema matching plays an important role. Present schema matching tools combine various match algorithms, each employing a specific technique to improve matching accuracy. However there is still no fully automatic tool is available and also there is lack of accuracy. As a step in this direction, we propose a new and efficient Semantic-Relationship schema matching (SR-Match) approach which considers the semantic relationships as one of the parameters for matching. Here in SR-Match, the initial mappings performed by the basic schema mapping techniques, acts as input to the relationship matcher. Relationship matcher compares the remaining unmapped elements based on their semantic relationship with their parents and discovers remaining complex matches among attributes of two schemas. It is observed that, if both semantics and relationships are taken into account, the degree of accuracy in matching results is improved.

Keywords: Data Integration, Ontology, Schema Mapping, Semantic Relationship

1. INTRODUCTION

Continued high interest in information integration has led to a large body of research work on schema matching (E.g., [1-3]). Schema matching work focuses on taking as input two or more data sources (E.g., XML, OWL, Schemas) and some auxiliary information like a dictionary (E.g., WordNet) to produce a mapping between the similar elements of input data sources [1]. Schema matching for small scale applications, where the number of schema elements are less, can be done manually. But applications that require matching a large and different sets of schemes per user query, cannot have the opportunity of end user guidance. Applications where adhoc or on-the-fly data integration is needed, requires automatic schema matching approaches [4].

In today’s era, user view of the database is different from the real world view. Our attempt is to map the user view into the real world accurately. In this environment users are allowed to ask any query using any website in an ad-hoc manner and a fully autonomous schema matching is not only prudent, its a necessity. To illustrate the issue on a more intuitive ground, let us consider the following example shown in Figures 1(a) and 1(b) extracted from two popular flight search web sites.

To find a good fare from Delhi to Goa, a user must search both sites manually and integrate the two schemas in his mind where he reasons that the terms depart and origin, return and destination are similar. It is required to actually resolve such schema heterogeneity to operate efficiently. On-the-fly or ad hoc integration systems require this ability to support a platform where no such autonomous schema matching will be needed. But supporting such a flexible environment is by no means easy because current schema matchers are not equipped to handle such visions. The numerous research efforts have been done on schema matching. However automatically generating semantic mappings is a task not accomplished till date. Semi-automatic semantic mapping has gained tremendous interest in the field of databases (schema matching) [1, 2, 4-11]. Schema-based match algorithms take account of schema information and ignore instance data. We briefly examine three of im-
Algorithm 2: OntologyBasedMatcher()

Data: OntologyBasedMatcher(): Two Ontology $O_1$ and $O_2$, mapping
returned from algorithm 1 $M'$ and unmarked element and their scores.

Result: Final Mapping $M$ among attributes of two different schemas.

/*Method: In this Algorithm the output of the Algorithm 1 and two ontology are taken
as input. First algorithm extract relationships specified by ontology (using function
extractRelation()) between each unmarked attribute and its parents. Then we find
the best mapping for each unmapped attribute $u_i$ in $S_1$ with unmapped attribute $v_k$ in $S_2$
based on their relationships and previous scored returned by Algorithm 1.*/

begin
  /* Extract Relationship of unmarked
  attributes ($u_i$ of $S_1$, $v_k$ of $S_2$) with their
  parent*/
  $R_{u_i} ← extractRelation(u_i, P_{u_i}) ∀ u_i ∈ S_1$
  $R_{v_k} ← extractRelation(v_k, P_{v_k}) ∀ v_k ∈ S_2$
  $maxscore[u_i] ← 0$
  $bestMatch[u_i] ← NULL$
  foreach $r_{u_i} ∈ R_{u_i}$ do
    foreach $r_{v_k} ∈ R_{v_k}$ do
      $score[u_i, v_k] ← compare(r_{u_i}, r_{v_k}) + Prevscore(u_i, v_k)$
      $maxscore[u_i] ← max(score[u_i, v_k], maxscore[u_i])$
      if $maxscore[u_i] == score[u_i, v_k]$
        then
          $bestmatch ← v_k$

  Output the mapping of $u_i$ with bestmatch
  /* ExtractRelation($u, P$) function returns
  the parent child relationship between $u$ and $P$ in ontological hierarchical tree */
  Return($M$)
/* $M$ is output mapping */

7. CONCLUSIONS

In this paper we proposed a schema matcher (SR-Match) which uses semantic relationships of elements as an additional parameter for schema matching. An example is simulated using SR-Match and results are analyzed and compared which shows improvement in accuracy of matching. Our main contributions include (1) designed an architecture and algorithms that gives a way for semi-automatic schema mappings based on semantic relationships of elements with their parents,(2) ordering schema based matchers in way to improve mapping results, (3) This improved the efficiency of matcher by applying relationship matcher only on partial unmapped elements.

REFERENCES


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