A Flexible Approach for Planning Schema Matching Algorithms

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CooPIS'08
Monterrey, Mexico

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Introduction

Schema Matching

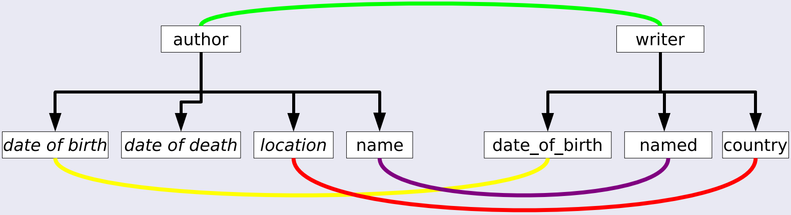

Figure: Discovering semantic correspondences between 2 schemas still a challenging issue in many applications

Semi automatic matchers combine several match algorithms to improve matching quality [Rahm and Bernstein, 2001, Euzenat et al., 2004]

Related Work

COMA++ [Aumueller et al., 2005]

- combination of many terminological measures and a user-defined synonym table
- a matrix is built for each couple of elements and for each measure
- a strategy is applied to select the mappings
- mappings are modified and/or validated by the user

Similarity Flooding [Melnik et al., 2002]

- a simple string matching algorithm to provide initial matchings
- structural rules and propagation to refine the matchings
- mappings are modified and/or validated by the user

Motivations

A brutal aggregation function entails drawbacks:

- **quality** → more weight to closely-related match algorithms can have a negative impact
- **flexibility** → how to aggregate new match algorithms ?
- **threshold** → one threshold for each match algorithm instead of a global one
- **performance** → useless measures are computed.

Recall vs precision:

- most matching tools **promote precision**
- easier to remove irrelevant discovered matches than finding relevant missed matches → **recall seems a better choice**

Contributions

Our approach: MatchPlanner:

- it is based on decision trees to combine match algorithms and avoid previous drawbacks.
- notion of planning in the schema matching process.
- a tool has been designed based on the planning approach.
- experiments demonstrate that our tool provides good performance and quality of matches w.r.t. the main matching tools.

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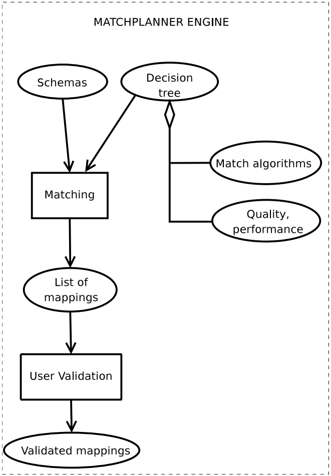
MatchPlanner



Input: schemas to be matched
a decision tree

Algo: for each pair of schema elements, match it with the decision tree.

Output : list of matches (optionnally validated by an expert)

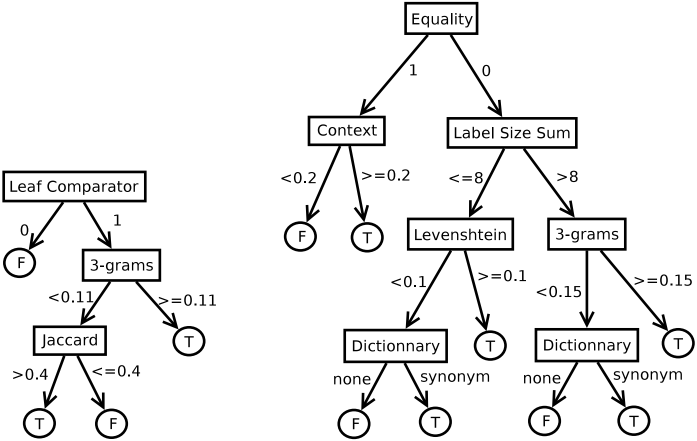


Figure: Examples of decision trees

Definitions

A decision tree contains plans (i.e ordered sequences) of match algorithms. More formally, it is a set of

- internal nodes → the match algorithms
- edges between 2 nodes → conditions on the result of match algorithms
- leaf nodes → the relevance of the match

Features

- **performance**, in terms of discarded match algorithms
- **quality**, minimum F-measure obtained during training phase (for learned decision tres only)

Example of matching with a decision tree

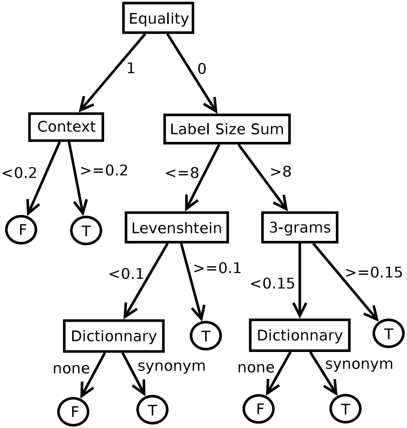
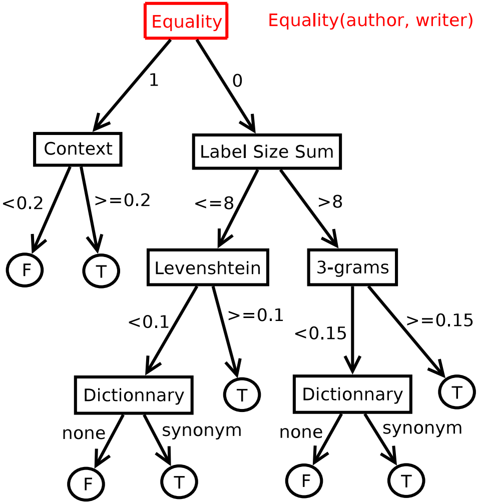
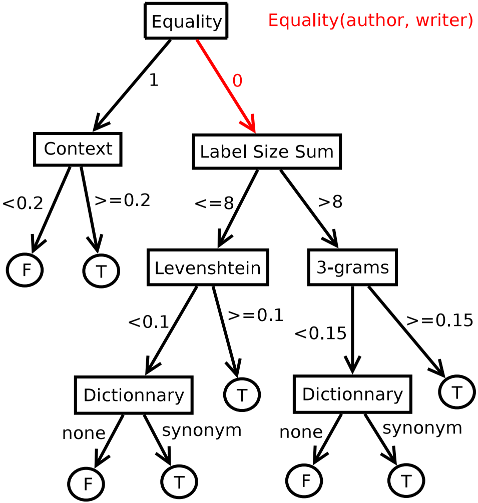


Figure: How to match the pair of elements *(author, writer)* with this decision tree ?



Equality(author, writer) = 0



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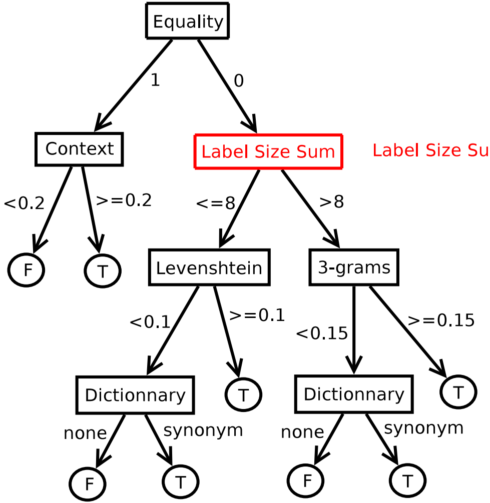
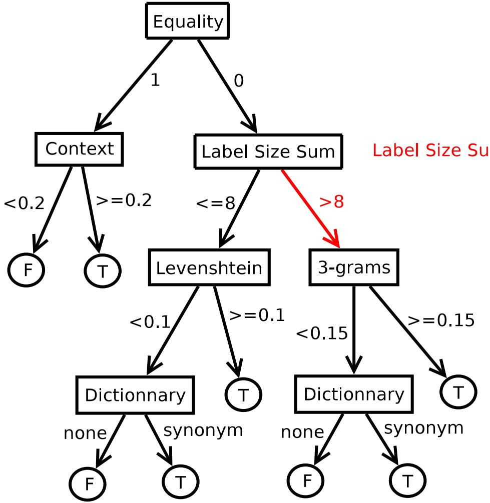
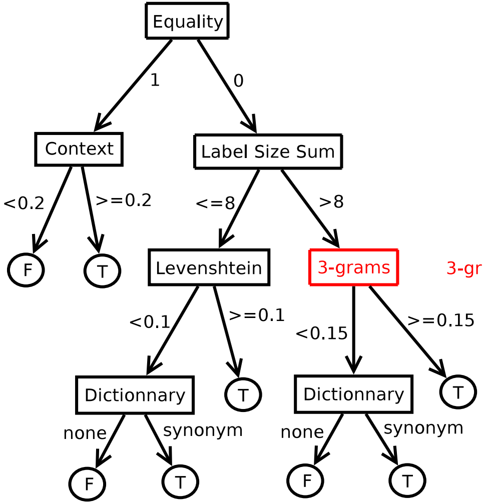


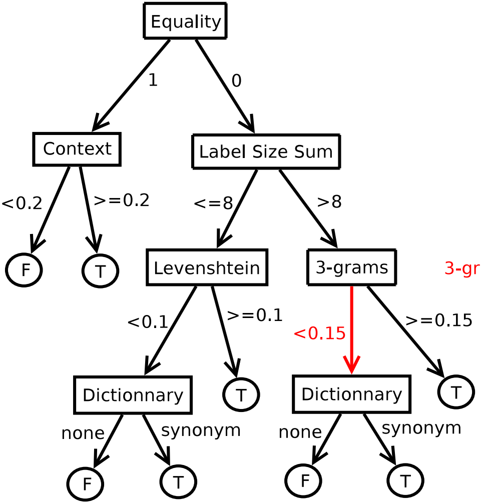
Label Size Sum(author, writer) = 12



Label Size Sum(author, writer) = 12



3-grams(author, writer) = 0.125



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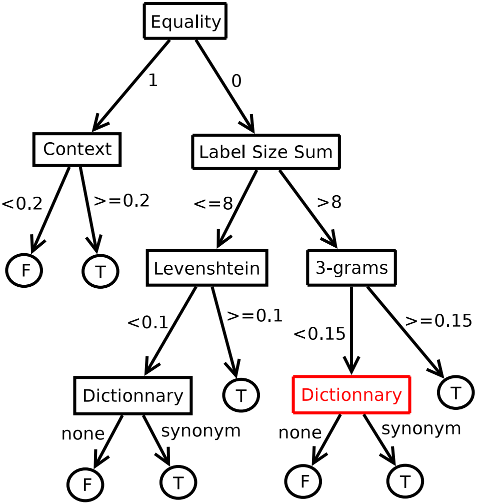
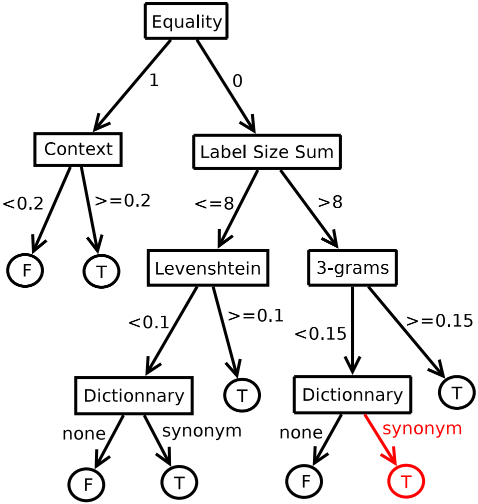


Dictionary(author, writer) = synonym



Dictionary(author, writer) = synonym

Discussion

Advantages of the decision trees

- simple to understand or interpret (boolean logic).
- handles both numerical and categorical data.
- many related match algorithms cannot have a very strong impact on a similarity value, thus improving matching quality.
- threshold is specific for each match algorithm.
- applies only a subset of the match algorithms, thus improving performance.

Shortcoming

How to build reliable or appropriate decision trees ?

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Experiments

Comparison with COMA++ and SF on two aspects:

- quality (precision, recall and F-measure)
- performance (time in seconds)

Seven scenarios:

- **book** and **university** (widely used in the literature)
- **thalia** (benchmark with the courses offered by some American universities)
- **travel** (airfare web forms)
- **person** (describing people)
- **currency** and **sms** (popular web services).

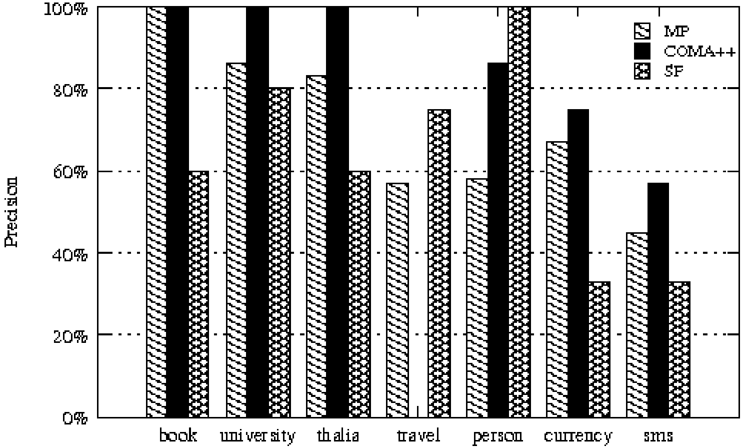

Figure: COMA++ achieves the best precision in 5 scenarios

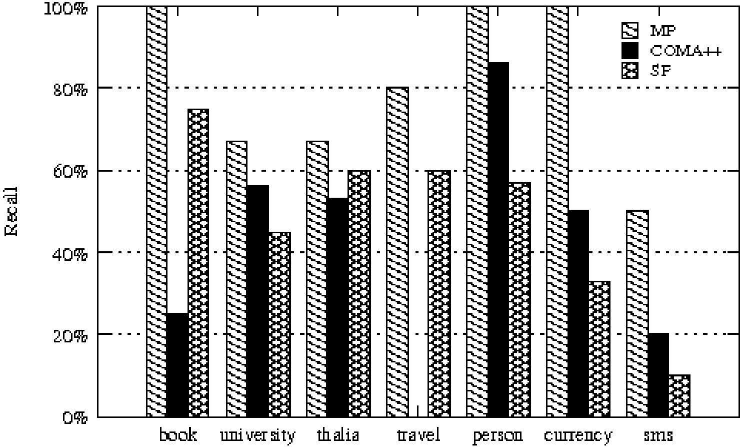

Figure: MP obtains the highest recalls (mostly above 60%) and it discovers all the relevant matches for 3 scenarios

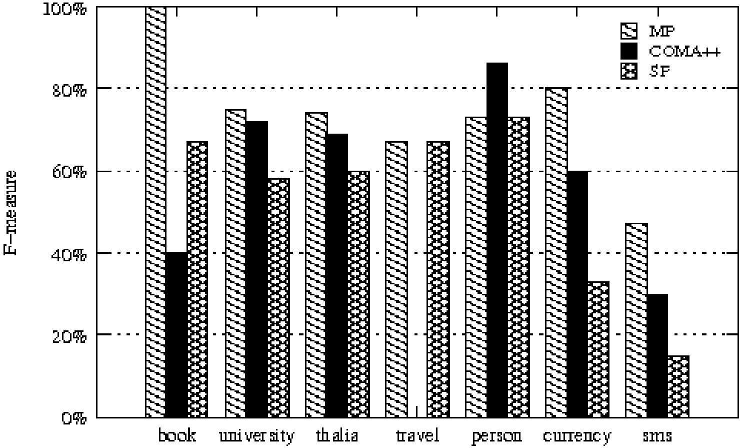

Figure: MP performs best on 6 scenarios

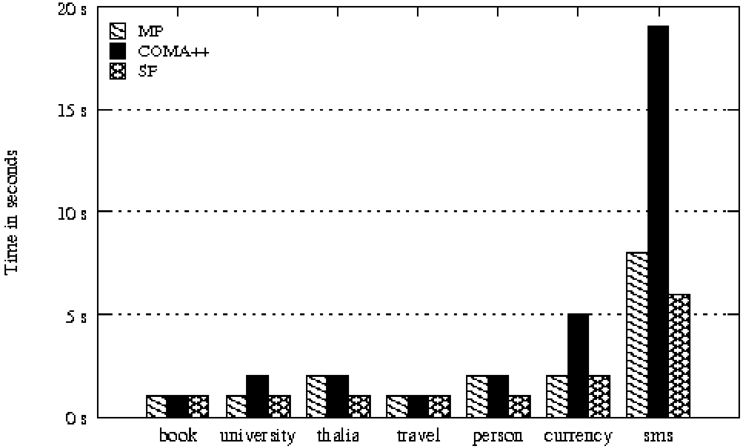

Figure: Time performance for matching each scenario

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MatchPlanner, a new schema matching approach

- based on decision trees to plan match algorithms
- flexible and it promotes recall
- outperforms the existing matching tools on the quality aspect
- provides an acceptable time performance

Ongoing work

- automatic generation of decision trees with machine learning techniques
- improving results with expert feedback
- comparing our approach with SMB ;-)

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