Towards a Benchmark for Instance Matching

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Summary

- Instance matching problem
  - Definition and issues
  - Applications
- The benchmark generation procedure
  - Overview of the procedure
  - Practical example
  - Heterogeneities classification and examples
- Benchmarks evaluation
  - Quality of the generated benchmarks
- Conclusions and future work

Instance Matching

- The problem
  - The goal is to detect instances that refer to the same real world entity
  - Mainly studied in the database literature
    - ✓Record linkage, entity recognition, merge-purge
- Applications
  - BOEMIE
    - ✓support for the population task
    - ✓help in the choice between different interpretations
  - OKKAM
    - ✓Web of entities, real world entities are univocally identified over the semantic web

Instance Matching

- Different issues
  - Instance VS schema matching
    - ✓ Descriptions of the same entity VS concept with similar meaning
  - Ontology VS database
    - ✓ More complex structures
    - ✓ Implicit data, need for reasoning techniques
    - ✓ Open world assumption

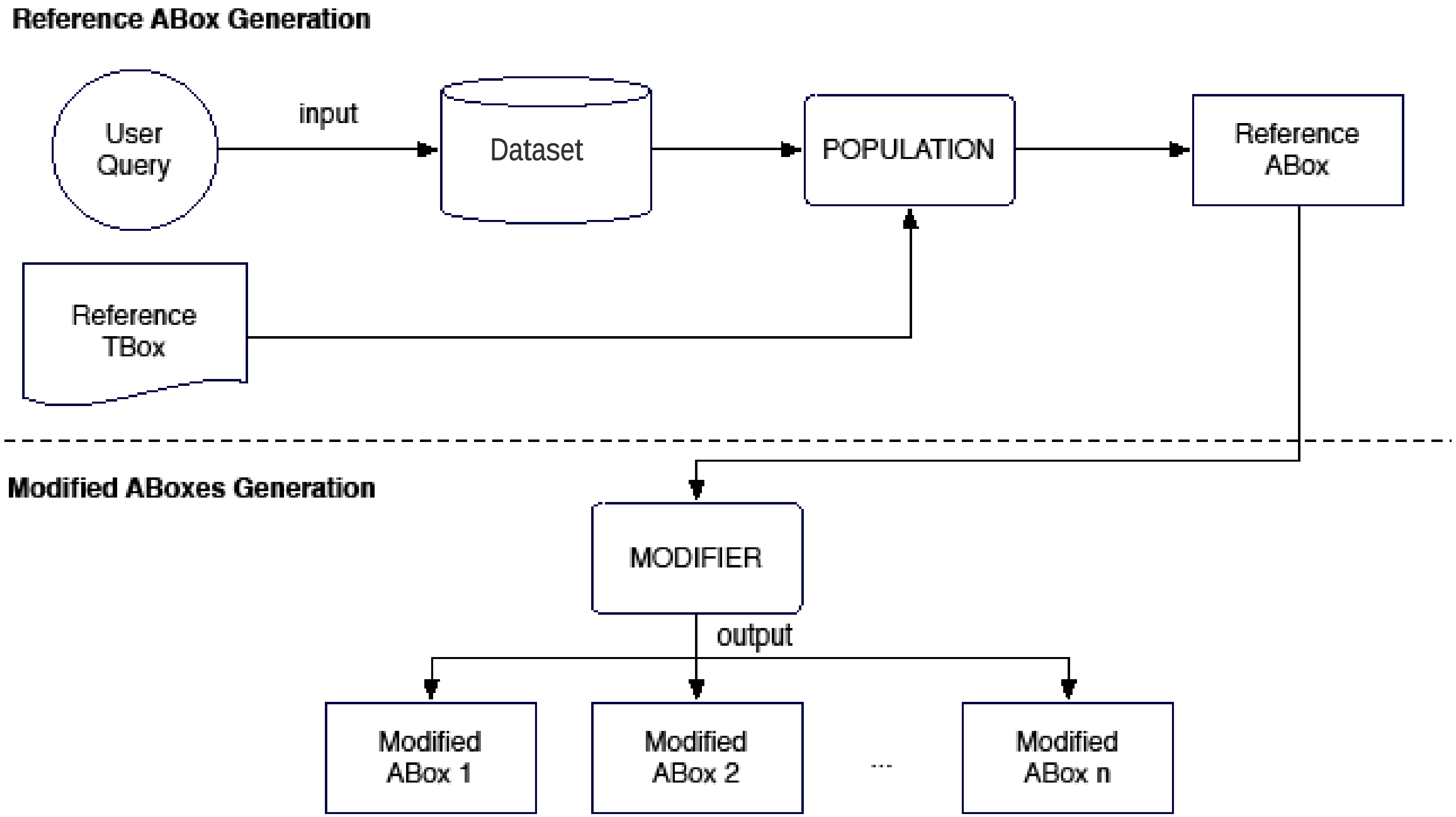
- We developed an instance matching algorithm as a component of HMatch 2.0

Instance Matching Evaluation

- How to evaluate instance matching algorithms?
- Lack of evaluation data
  - Real data:
    - ✓Need to find different descriptions of the same real-world objects
    - ✓Need to find similar descriptions referred to different real-world objects
    - ✓Need to manually create a mapping between all the couples of descriptions referred to the same real-world object
  - Artificial benchmark:
    - ✓OAEI → Benchmark for concept matching
    - ✓No benchmark for instance matching available

Our Solution

- Definition of a semi-automatic procedure for the generation of several different benchmarks



A real example: IMDb

- Reference ABox generation
  - Input:
    - ✓The reference TBox for the movie domain, built as a portion of the IMDb database
    - ✓A user query of the form: SELECT * FROM movies WHERE title LIKE ‘%Scarface%’
  - Automatic population:
    - ✓The selected data is extracted from IMDb and automatically translated as instances of the reference ABox
  - Output:
    - ✓The reference ABox contains 302 instances

The Modified ABoxes

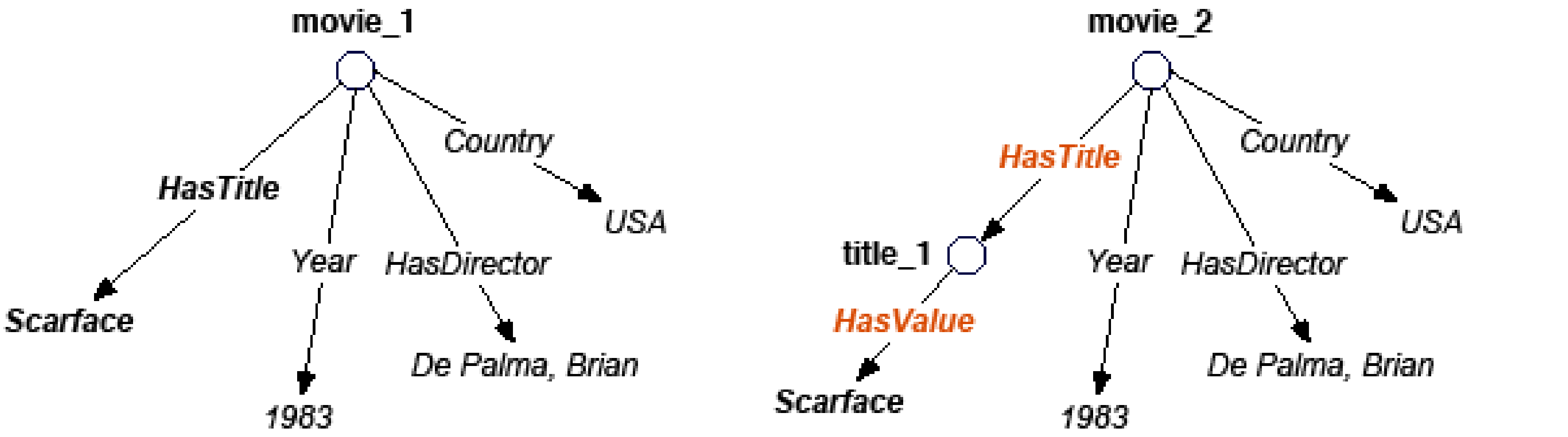
- Modified ABoxes generation
  - Input:
    - ✓ The reference ABox
    - ✓ A user specification of all the modifications to be applied to the reference ABox for each modified Abox
  - Output:
    - ✓ A set of modified ABoxes with expected alignments
- Each modified ABox simulates a different situation that can be found when comparing instances
  - We have defined three main classes of instance heterogeneities

Data Value Differences

- Errors in the data values
  - Typographical errors
    - ✓*Scarface -> Scrface*
- Values expressed with different formats
  - Dates
    - ✓*26/10/08 -> October 26th 2008*
  - Person names
    - ✓*Brian De Palma -> De Palma, B.*

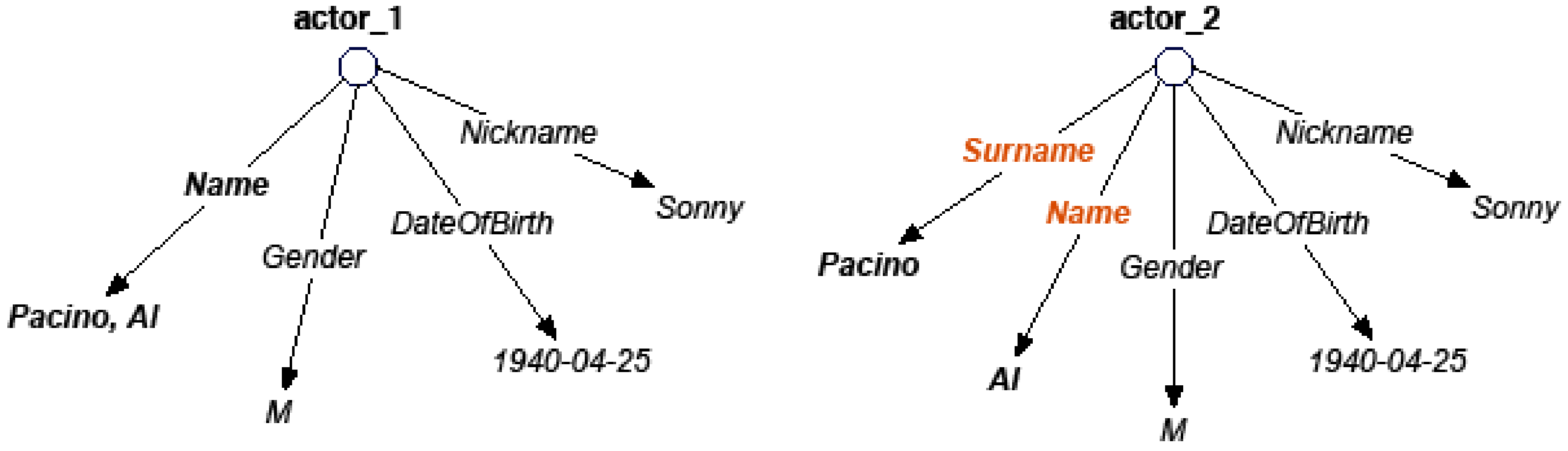
Structural Heterogeneity

- Use of different levels of depth for properties representation
  - ✓ I.E. The property value is designed as an independent instance



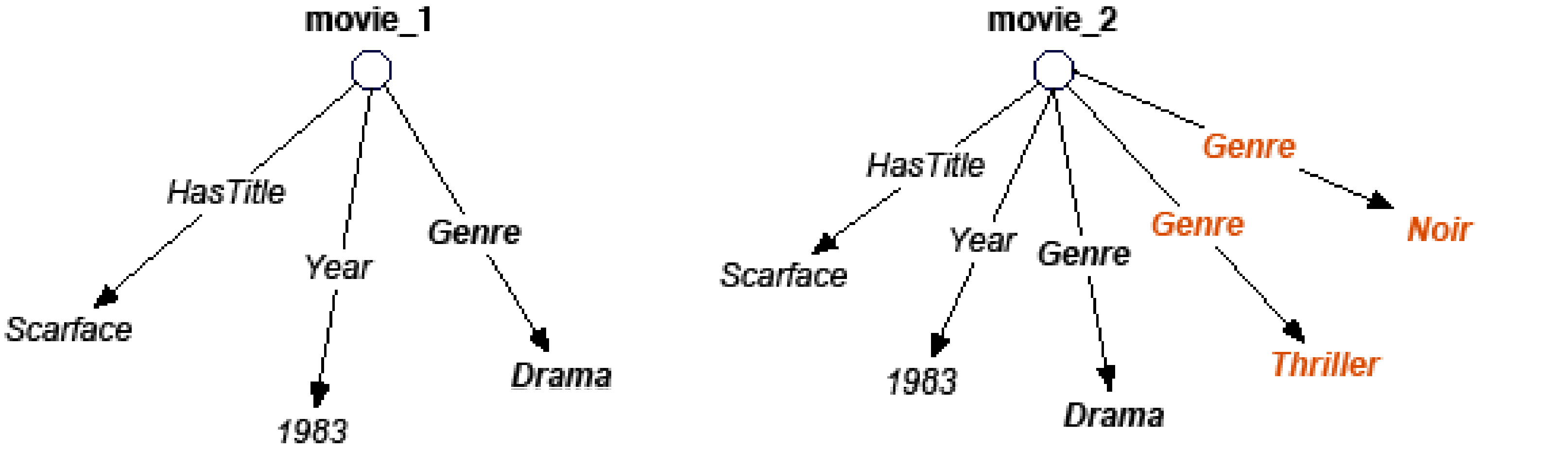
Structural Heterogeneity

- Use of different aggregation criteria for properties representation
  - ✓ I.E. different properties are concatenated or merged in a single property



Structural Heterogeneity

- Missing values specification
  - ✓ I.E. one or more values are not defined
  - ✓ For the open world assumption we cannot consider the "null" value as a negative evidence in the comparison



Logical Heterogeneity

- Instances of different subclasses of the same superclass
  - *Tbox:* Movie $\subseteq$ Item, Film $\subseteq$ Item
  - *Ref. Abox:* movie_1 : Movie, *Mod. Abox:* movie_1 : Film

- Instances of different classes of a class hierarchy explicitly declared
  - *Tbox:* Action $\subseteq$ Movie
  - *Ref. Abox:* movie_1 : Movie, *Mod. Abox:* movie_1 : Action

- Instantiation on different classes of a class hierarchy implicitly declared
  - *Tbox:* Movie $\subseteq \exists$p.G, SubM $\subseteq \exists$p.SubG, SubG $\subseteq$ G
  - *Ref. Abox:* movie_1 : Movie, *Mod. Abox:* movie_1 : SubM

Logical Heterogeneity

- Instances of disjoint classes
  - *Tbox:* Movie $\cap$ Product $\subseteq \bot$
  - *Ref. Abox:* movie_1 : Movie, *Mod. Abox:* movie_1 : Product

- Implicit values specification
  - *Ref. Abox:* movie_1 : Movie, (movie_1, “Scarface”) : HasTitle
  - *Mod. Abox:* movie_1 : Movie, movie_1 : ($\exists$HasTitle.“Scarface”)

Benchmark evaluation

- How to evaluate the effectiveness of the generated benchmarks?
  - We need a relevant number of different instance matching algorithms
  - The quality of the benchmark is affected by
    - ✓ The source dataset: instances referring to different real world entities must not be too much similar
    - ✓ The level of modifications: the instance description must not be changed completely

- The benchmark created from the IMDb dataset is available at **http://islab.dico.unimi.it/iimb**

Conclusion and Future Work

- A Semi-automatic procedure to create instance matching benchmarks
  - ✓Doesn’t require to manually define the mappings
  - ✓Can work with any domain and any dataset
  - ✓Provides good flexibility with the combination of different classes of modifications

- Future work
  - ✓Automatic population of the reference Abox through mappings between DB and Tbox
  - ✓Easier interface to define the instance modifications