A scalable schema aware instance matching benchmark for semantic publishing

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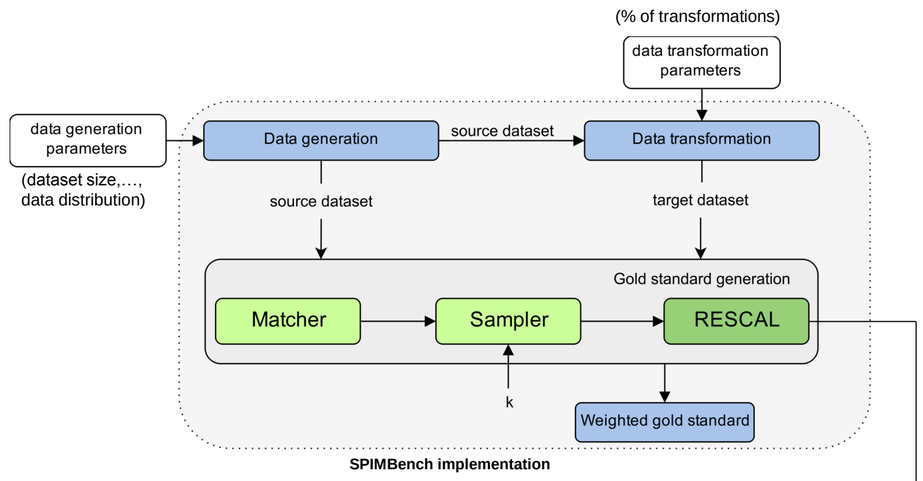
Motivation

The widespread adoption of Semantic Web Technologies and the publication of large interrelated RDF datasets and ontologies in the Web has made the integration of data a crucial task. Data linking in this context is essential in order to provide an integrated view of the underlying information; this is achieved by instance and schema matching techniques. To aid the users to choose among the systems that perform such tasks, a number of benchmarks have been developed.

SPIMBench Approach

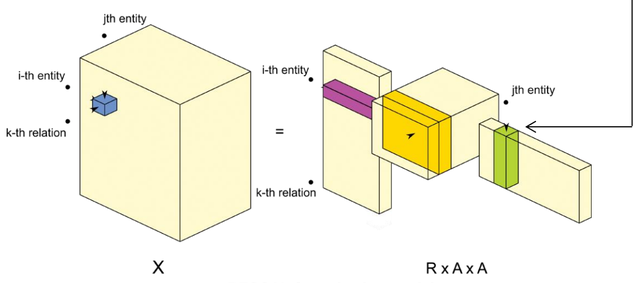
SPIMBench is a benchmark for the Semantic Publishing Domain which takes into consideration RDFS and OWL constructs in order to evaluate instance matching systems.

- Schema aware transformations (logical).
- Standard value and structural transformations.[3,4]
- Multithreaded scalable data generation in order of billion triples.
- Weighted gold standard based on tensor factorization.



SPIMBench implementation

RESCAL[1] is a tensor factorization for large-scale relational learning from Linked Data, multi-relational data and large multigraphs.

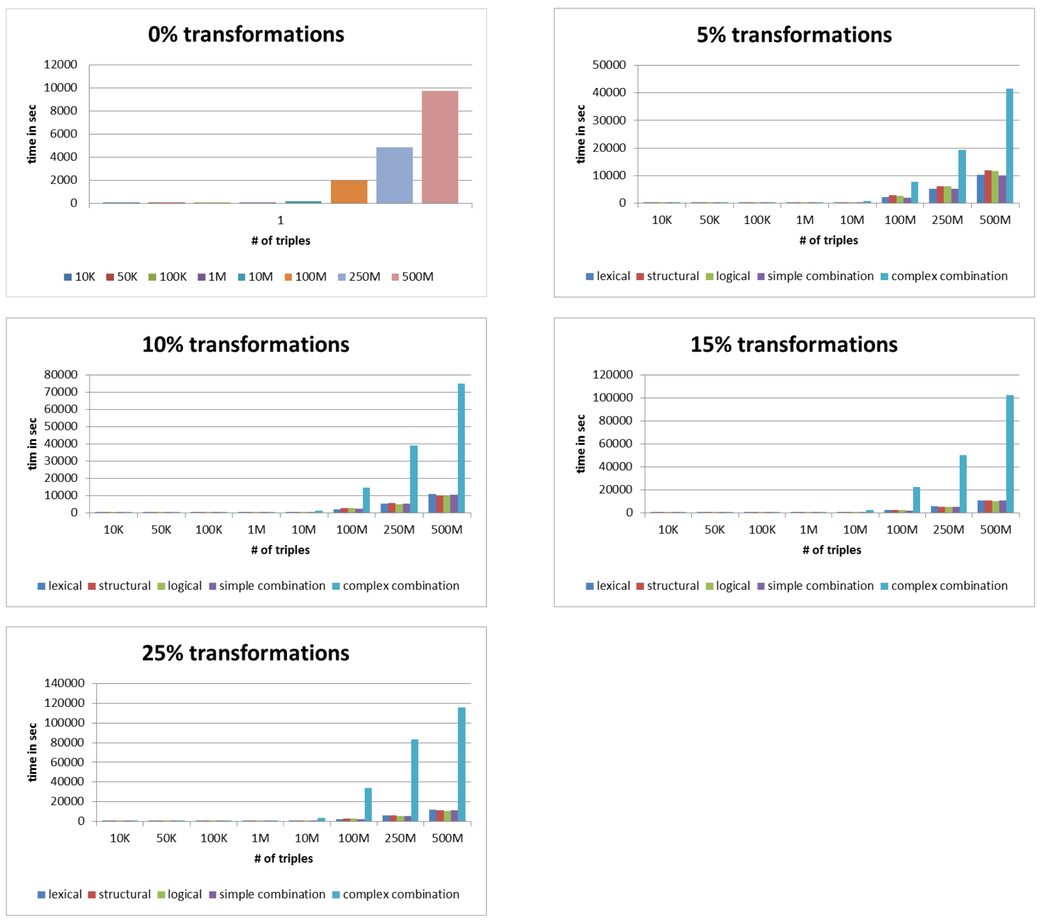


RESCAL factorization model

Scalability

Scalability experiments for datasets up to 500M triples with simple combination of transformations.

- 1000 triples ~ 36 entities.
- Data generation is linear to the size of triples.
- Transformation overhead is negligible for lexical, structural, logical and simple combinations.
- Overhead for logical transformations is higher by one magnitude.



Scalability experiments for n% of simple combination transformation type

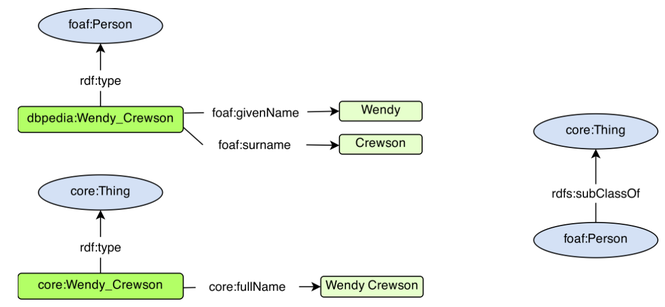
Transformations

Lexical

- Blank Character Addition/Deletion
- Random Character Addition/Deletion/Modification
- Token Addition/Deletion/Shuffle
- Date Format
- Abbreviation
- Synonym/Antonym
- Stem of a Word
- Multilinguality

Structural

- Property Addition/Deletion
- Property Aggregation
- Property Extraction



rdfs:subClassOf and property aggregation transformations

Logical

RDFS/OWL	SD	TD	SCHEMA TRIPLES	GS
owl:sameAs	(u_1, rdf:type, C) (u_2, rdf:type, C)	(u_1', rdf:type, C) (u_2', rdf:type, C) (u_1', owl:sameAs, u_2')		$u_1 \sim u_1$' $u_1 \sim u_2$' $u_2 \sim u_2$' $u_2 \sim u_1$'
owl:differentFrom	(u_1, rdf:type, C)	(u_1', rdf:type, C) (u_1'', rdf:type, C) (u_1', owl:differentFrom, u_1'')		$u_1 \sim u_1$'
owl:equivalentClass	(u_1, rdf:type, C)	(u_1', rdf:type, C')	(C, owl:equivalentClass, C')	$u_1 \sim u_1$'
owl:disjointWith	(u_1, rdf:type, C)	(u_1', rdf:type, C')	(C, owl:disjointWith, C')	
owl:FunctionalProperty	(u_1, rdf:type, C) (u_1, p_1, o_1)	(u_1, rdf:type, C) (u_1, p_1, o_2)	(p_1, rdf:type, owl:FunctionalProperty)	$o_1 \sim o_2$
owl:InverseFunctionalProperty	(u_1, rdf:type, C) (u_1, p_1, o_1)	(u_1', rdf:type, C) (o_1, p_1, u_1')	(p_1, rdf:type, owl:InverseFunctionalProperty)	$u_1 \sim u_1$'
owl:unionOf	(u_1, rdf:type, C)	(u_1', rdf:type, C')	(C', owl:unionOf, {C_0, C_1,..})	$u_1 \sim u_1$'
owl:intersectionOf	(u_1, rdf:type, C)	(u_1', rdf:type, C')	C owl: intersectionOf{C,D,E,F} C' owl: intersectionOf {C,D}	$u_1 \sim u_1$'

Combination of transformations

More than one transformation types per instance.

Simple:
One transformation per triple.

Complex:
Combination of two transformations per triple (Lexical – Structural or Lexical - Logical) based on the data transformation parameters.

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References

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