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Yahia Chabane, Christophe Rey, Farouk Toumani

► **To cite this version:**

Yahia Chabane, Christophe Rey, Farouk Toumani. WApproximation: computing approximate answers for ontological queries. The Description Logics Workshop, Jul 2014, Vienna, Austria. hal-04720097

**HAL Id: hal-04720097**

**<https://hal.science/hal-04720097v1>**

Submitted on 3 Oct 2024

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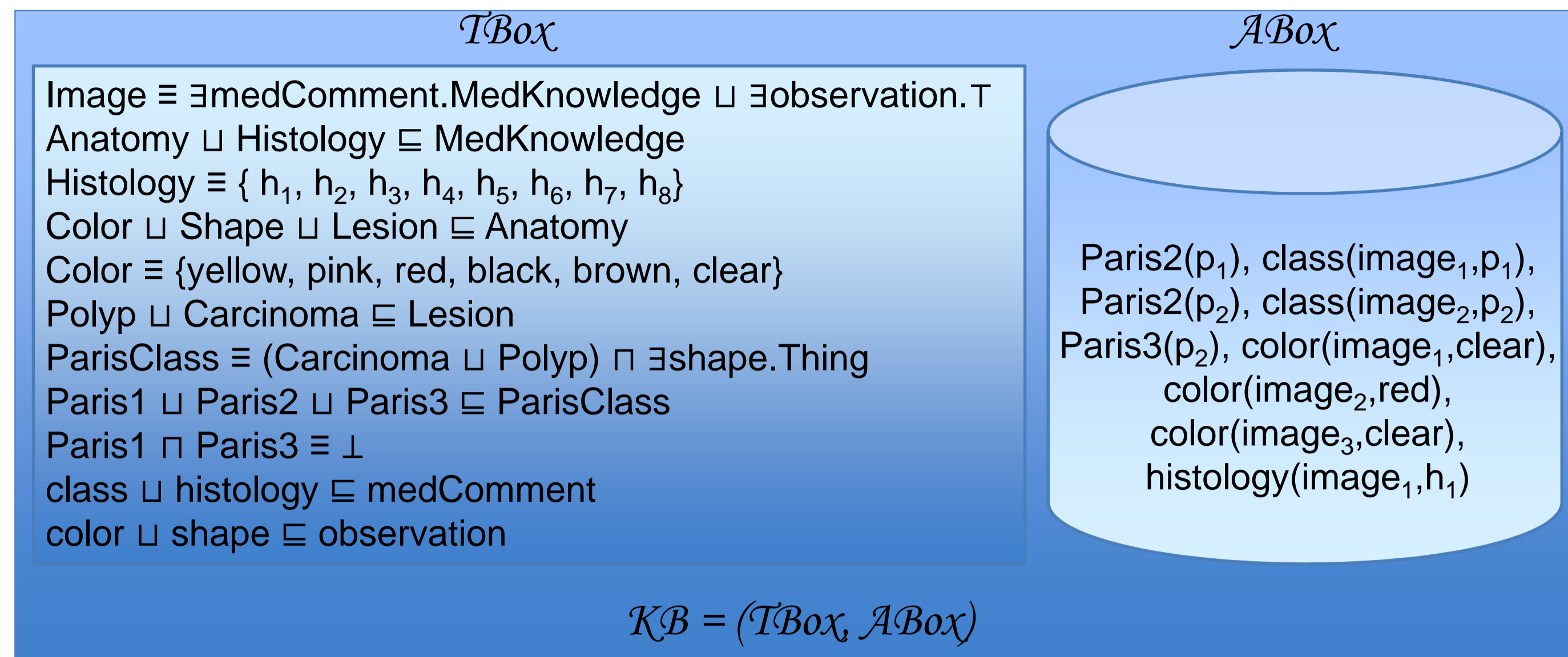


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# WApproximation: computing approximate answers for ontological queries

Yahia Chabane, Christophe Rey and Farouk Toumani  
Blaise Pascal University, LIMOS UMR 6158, CNRS, Clermont-Ferrand, France  
{yahia.chabane, rey, ftoumani}@isima.fr

## PROBLEMATIC



### New flexible reasoning for ontological queries

- Exploit the knowledge available in the database
- Define the distance of a given individual w.r.t. a given query

### Why OWA and GCWA ?

- OWA is the standard for DL
- Application context for GCWA
  - Decision is based on image
  - Accurate annotation of images is essential
  - Validation of images annotation



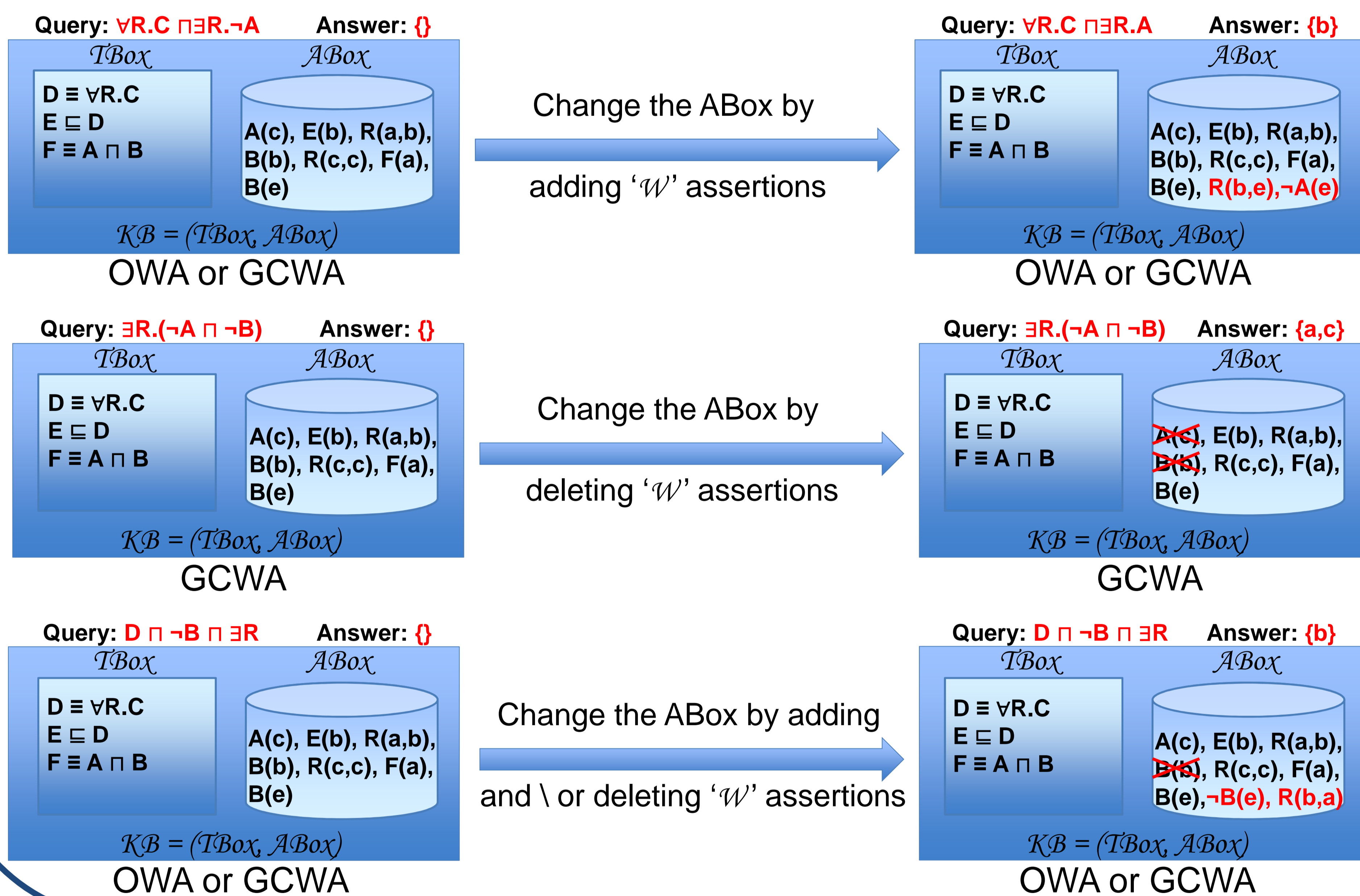
Query<sub>1</sub>:  $\exists \text{class.Paris1} \sqcap \geq 1 \text{ class.Thing}$   
Query<sub>2</sub>:  $\exists \text{color.}\{\text{pink, red}\} \sqcap \exists \text{class.Paris3} \sqcap \exists \text{histology.}\{h_6\}$

Instance retrieval reasoning is used for semantic gastroenterological images retrieval

No image for these two queries

## CONTRIBUTION

**Principle of the WApproximation:** add and/or remove  $\mathcal{W}$  (i.e. an arbitrary number of) assertions so that an individual become instance of a concept description (while not belonging to it before)



### Three approaches

- $\mathcal{W}^+$ Approximation (add assertions)
- $\mathcal{W}^-$ Approximation (remove assertions)
- $\mathcal{W}$ Approximation (add and remove assertions)

### Common objectives

- Minimize  $\mathcal{W}$
- Find new query instances
- Preserving consistency of KB

### Three main problems

- Deciding if ' $\mathcal{W}$ ' assertions exist
- Computing ' $\mathcal{W}$ ' assertions
- Computing approximate answers

## DEFINITIONS

$InsR_{\mathcal{W}}^+(C, \mathcal{KB}) = \{a \in Ind(\mathcal{A}) \mid \exists \mathcal{A}' \text{ that satisfies :}$

### $\mathcal{W}^+$ Approximation

- $\mathcal{A}' \subseteq \mathcal{A}$
- $\mathcal{A}' \setminus \mathcal{A} = \bigcup_{i=1}^{\mathcal{W}} \{p_i \mid p_i \text{ is an assertion of an atomic concept, a negation of an atomic concept or an atomic role}\}$
- $\mathcal{KB}' = (\mathcal{T}, \mathcal{A}')$  is consistent
- $a \in InsR(C, \mathcal{KB}')$
- $\nexists \mathcal{A}''$  which satisfies (i), (ii), (iii), (iv) and  $|\mathcal{A}''| < |\mathcal{A}'|$

$InsR_{\mathcal{W}}^-(C, \mathcal{KB}) = \{a \in Ind(\mathcal{A}) \mid \exists \mathcal{A}' \text{ that satisfies :}$

### $\mathcal{W}^-$ Approximation

- $\mathcal{A}' \subseteq \mathcal{A}$
- $\mathcal{A} \setminus \mathcal{A}' = \bigcup_{i=1}^{\mathcal{W}} \{p_i \mid p_i \text{ is an assertion of atomic (or its negation) concept or atomic role}\}$
- $a \in InsR(C, \mathcal{KB}') \mid \mathcal{KB}' = (\mathcal{T}, \mathcal{A}')$
- $\nexists \mathcal{A}''$  that satisfies i, ii, iii and  $|\mathcal{A}''| > |\mathcal{A}'|$

$InsR_{\mathcal{W}}(C, \mathcal{KB}) = \{a \in Ind(\mathcal{A}) \mid \exists \mathcal{A}' \text{ that satisfies :}$

### $\mathcal{W}$ Approximation

- $(\mathcal{A}' \setminus \mathcal{A}) \cup (\mathcal{A} \setminus \mathcal{A}') = \bigcup_{i=1}^{\mathcal{W}} \{p_i \mid p_i \text{ is an assertion of atomic (or its negation) concept or atomic role}\}$
- $\mathcal{KB}' = (\mathcal{T}, \mathcal{A}')$  is consistent
- $a \in InsR(C, \mathcal{KB}')$
- $\nexists \mathcal{A}''$  that satisfies i, ii, iii and  $|\mathcal{A}'' \setminus \mathcal{A} \cup (\mathcal{A} \setminus \mathcal{A}'')| < |(\mathcal{A}' \setminus \mathcal{A}) \cup (\mathcal{A} \setminus \mathcal{A}')|$

Note that,  $\mathcal{KB}=(\mathcal{T}, \mathcal{A})$  is a consistent knowledge base,  $C$  is a concept and  $\mathcal{W}$  is an integer

## PERSPECTIVES

- Detailed study of some related problems, properties, algorithms and complexity
- Extend approach to assertions of defined concepts and roles and propose to normalize the computation of the distance in this context
- Use  $\mathcal{W}$  Approximation in other applications than instance retrieval