

Approaches for usage of ontologies in some domains, working with imprecise, uncertain or vague knowledge

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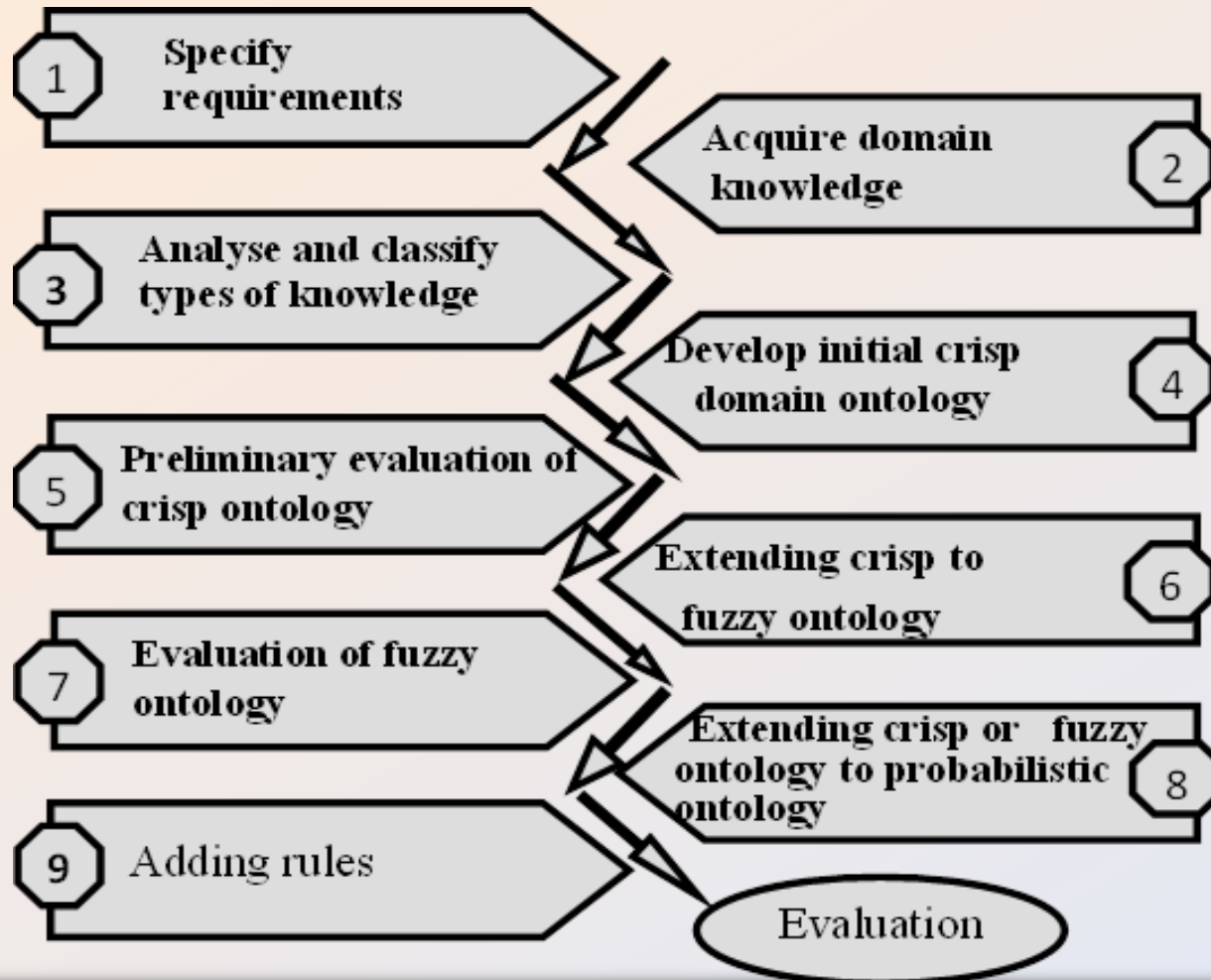
Our main research goals:

- To analyze and discuss possibilities to combine crisp, probabilistic and fuzzy knowledge in one and the same ontological system;
- To propose a methodology to handle both probabilistic knowledge and fuzzy knowledge simultaneously at the same time in ontologies.

Related Work

- Probabilistic approach
 - Classification of uncertainty reasoning problems in fuzzy knowledge bases as Existential uncertainty, Property value-related uncertainty and Type uncertainty;
 - OWL extensions, developed for modeling uncertainty in OWL ontologies: Bayesian network - based reasoning, PR-OWL.
- Fuzzy approach
 - fuzzy ontologies, based on intuitionistic fuzzy sets, type-2 fuzzy sets, compensatory fuzzy logic, fuzzy rough sets;
 - Fuzzy reasoners : DELOREAN, FuzzyDL.

Methodology for mixing crisp and probabilistic or fuzzy knowledge in ontologies



Applicability of the methodology

We think that our methodology is applicable for reasoning with medical domain knowledge as:

- It can first guide the process of crisp ontology development, evaluation and fuzification;**
- Then it can guide fuzzy ontology or ontology network development, if necessary;**
- Then, additional fuzzy rule-based reasoning module can be developed for fuzzy reasoning.**

Discussion. Probabilistic and fuzzy knowledge in some practical domains

- Medical domain is a good example for the needs of combination of the usage of crisp, fuzzy and probabilistic knowledge in one and the same recommendation or diagnostic system.
- Acquiring crisp medical knowledge and development of crisp OWL ontologies, modelling the medical domain;
- Adding Fuzzy knowledge : adding fuzzy classes (for example, infections ...); Fuzzy role assertions, Fuzzy General concept inclusion axioms (GCIs), Fuzzy axioms;
- Probabilistic knowledge can be added mainly by Bayesian models and reasoning over Bayesian networks.

Reasoning in mixed knowledge base of some practical domains

- Adding important reasoning rules in the knowledge base;
- Intelligent agents, using fuzzy ontologies and/or probabilistic reasoning algorithms can also implement an approach for complex usage of crisp, fuzzy and probabilistic knowledge;
- Fuzzy logic – based inference mechanism for example was used in information integration for generating the membership degrees for each fuzzy concept, used to classify the news, extracted from web pages;
- Developing rule-based reasoning systems on top of (fuzzy) ontological systems for generating recommendations or decision making is one of the main recent approaches for building intelligent applications in many practical domains;

CONCLUSION

- In this work we present a methodology for building mixed models, including crisp and probabilistic or fuzzy knowledge in ontologies;
- One of the main strengths of our methodology is the possibility to use some of the developed fuzzy ontologies in systems, working with crisp knowledge after defuzification.
- Probabilistic elements also can be added mainly in additional application layer;
- We also discuss the usage of our methodology for development of knowledge-based systems, working with mixed types of knowledge in several practical domains.

Questions?

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