

Ontology Integrated Recommender System: A Review

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Abstract— Today's world is an informative society where need is associated with the information. Recommender system is one of the software tools to spread the information among the society. Ontology is one of the pillars of semantic web to store information in semantic nature. The pace of information on the internet is growing rapidly every second due to the fact that the demand for semantic information is increasing. This paper focuses on the mechanism of integrating semantic information with the recommender system studied by the various researchers.

Index Terms— Semantic web, Machine learning, CNN, Deep learning, Neural network, Artificial intelligence.

I. INTRODUCTION

The Internet is the chief source of information in this era. The study of relationships among the information is known as semantic analysis. The data on the internet spreads with an exponential pace. There are various mechanisms to retrieve the information via the internet, recommender system is one the popular method studied by the distinct researcher. Ontology is the key mechanism to store the information in the form of axioms, classes, sub-classes and properties. It is a store of semantic information. Ontology is a knowledge base system to transform relational data to semantic information.

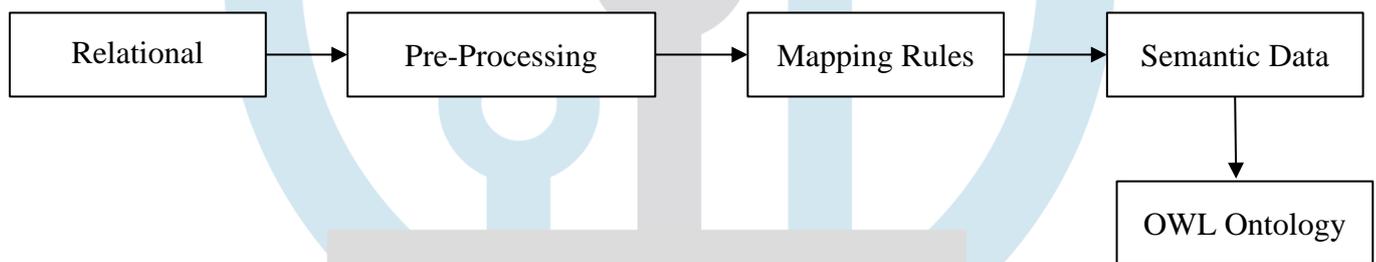


Fig. 1. Transformation Process [1]

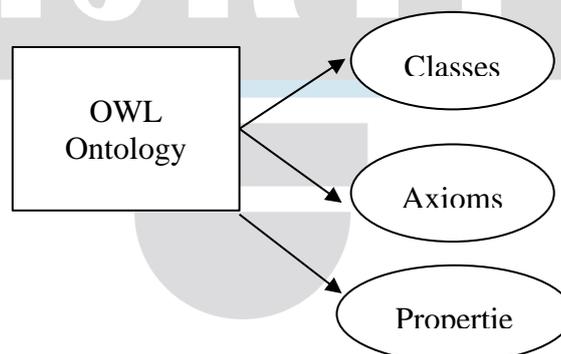


Fig. 2. Ontology Components

OWL is the web ontology language to generate the ontology from the relation database. Recommender system is a software tool to recommend the known, unknown recipient about the products, things based on the available information. Recommender systems are ubiquitous. Integrating a recommender system with ontology improves the efficiency of the recommender system.

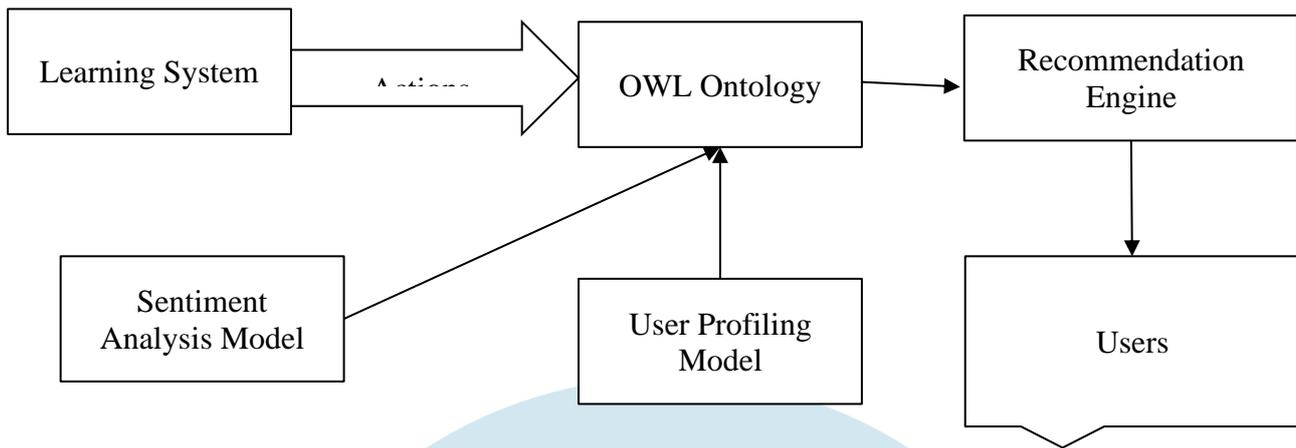


Fig. 3. Recommender System Integrated OWL Ontology [2]

II. LITERATURE REVIEW

Recommendation can be categorized into generic recommendation, personalized recommendation. Various studies have been conducted to map the interest in the field of ontology based recommender systems. In literature, various research question are addressed like

- Q1: Role of Ontology in Recommender System?
- Q2: state of the art recommendation items for OBRS?
- Q3: Various evaluation techniques and results of OBRS?

Table. 1. Review of Literature

Author	Year	Focus
Sinha et al., [3]	2019	Present the technique based classification of RS like knowledge base system (KBS), Demographic System (DS), community Based (CB) and hybridized System (HS).
Tarus et al., [4]	2018	Focused on the categorization of RS such as utility-based (UB), context-aware (CA), trust-aware (TA), fuzzy-based (FB), social Network-based (SN), group-based (GB), and hybrid RS.
Kla'snja et al., [5]	2015	Presents the recommender system classification such as matrix and tensor factorization (MTF), and association rule mining ARM).
Aggarwal, and Nur W et al., [6, 7]	2016, 2022	The major two categories of RS are domain specific RS, technique based RS. time sensitive and social RS are further categorization of domain specific RS. In the knowledge base recommender system the relational database is transformed into a knowledge attribute to store information.
Ertel et al., [8]	2017	In knowledge based recommender systems (KBS) the inference mechanism is integrated with the knowledge base to recommend things to recipients.
Rodler et al. [9]	2022	Proposed a novel quickxplain algorithm using divide and conquer technique to simplify the process of information retrieval by the recommender system.

Haller et al. [10]	2017	In this work writer focused on the ontology creation languages, SPARQL query mechanism and the interconnection among the graph based semantic sensor network.
Williams et al., [11]	2022	Security activities are a crucial task in software engineering. The use case modeling in ontology based recommender system present enhanced accuracy while identifying the security concerns.
Fatima et al., [12]	2022	Tourism, movie recommendation, and social text recommendations are the key areas of the recommender system. In this work an experiment is performed on the sudanese database to achieve 94.2 % accuracy on distinct fields for the traveler's preference, based on the recommender system.
Elkobaisi et al., [13]	2022	Human emotion is studied based on emotion ontology and a recommender system is integrated to test the emotion ontology.
Karim et al., [14]	2015	Hybrid recommender system with composition of collaborative filtering, case based reasoning and ontology is a good alternative in personalized recommendations.
Agonács et al., [15]	2020	Recommendation of MOOC using ontology has been studied with the correlation coefficient to achieve the outcome of 4.31% in the self learning phase.

Recommender systems are widely used in ecommerce, medical science and industrial applications where relational information plays a key role. Relation information can be well managed by developing ontology. There are various techniques and tools available to construct the ontology which embed the semantic information and allow the inference mechanism to infer the semantic stored relational information. Recommender systems use inferred data for further recommendations.

III. DISCUSSION

With the advancement of web technologies i.e web 4.0 and web 5.0 the self learning, autonomous services are getting popular to generate the content via software agents. Ontology is one of the pillars of web 4.0 framework where reasoning technologies as well as artificial intelligence services integrate with semantic information. The review presents the role of ontology in different domains of the recommender system. Recommender system are ubiquitous. The hybrid ontology based recommender system embed machine learning, deep learning algorithms to optimize the result. Recommender systems are themselves an artificial intelligence technique to process the clusters of information.

IV. CONCLUSION

The review presents the use-case of ontology in the recommender system. The studies prove the outcomes are reliable, accurate and the measure parameters like precision, Recall and F-measure are also improved. Ontology based recommender systems could be the future of recommender systems with the expansion of web 5.0 technologies. Ontology embedded recommender system can be the field of future study for newbies.

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