Novel Survey on Ontology for Healthcare

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ABSTRACT

Ontology acts as an important technique for many real world applications and this paper presents some of ontology-based approaches. This paper describes how ontology is modeled, implemented and used in healthcare domain.

Ontology is an important emerging rule that has the huge potential to improve information organization, management, and understanding. The documented structure of ontology makes it a natural approach for information retrieval with relevant data. However, the construction of ontology is still time-consuming and error prone for Medical practitioners in Healthcare Domain. One recent development that aims to remedy this situation is the introduction of ontology design patterns, codifying best practices and promoting reuse. This paper presents a literature survey into the state of research on ontology patterns and how it is useful for saving patient's life.

Keywords

Data mining, Knowledge extraction, Keyword matching method, Knowledge theory model.

1. INTRODUCTION

Ontology techniques improves information organization, Management and understanding. It has a significant role in the areas dealing with vast amounts of distributed and heterogeneous computer based information such as World Wide Web. It will totally eliminate the Human involvement in the ontology learning.Ontology learning process is a sequence of steps like terminology extraction, identification of grammatical characteristics of extracted terms and its meaning.

Every day, the WWW grows rapidly with services like exchanging various kind of information ranging from research papers and educational content, to multimedia content and software.Due to this fact users are feeling sometimes disoriented, lost in that information overload that continues to expand. Ontology is mainly used for Knowledge Extraction with relevant Information.

2. LITERATURE SURVEY

This study is used to show how the Ontology technique can be also useful in the Healthcare Domain.Six papers have been studied which uses ontology technique in various healthcare application, which are described as follows:

In paper "An Ontology for Telemedicine Systems Resiliency to Technological Context Variations in pervasive Healthcare",uses a system because in Hospitals, clinical data is very important as it stores patients history records. It is useful for any medical case to study and understand a patient's condition and to give the patient the best possible treatment. If the data is incorrect, then it can lead to a wrong treatment decisions, which will put the Patient's life at risk. In this paper, "Pervasive Healthcare System" is used.

This system is useful to apply Information and Communication Technology (ICT) to enable the use of important clinical data by authorized medical persons. Quality of data is checked which can be determined by the technological context of the patient. This paper presents an ontology technique which specifies the relation among technological context, quality of clinical data and patient's treatment. This ontology enables the development of 'Telemedicine System' that is capable to adapt the treatment when the quality of clinical data degrades and thus guaranteeing patient's safety.This paper uses Requirement Elicitation (RE) method supported with a layering technique. It is used to build a Quality of Data (QoD) framework for telemedicine systems [1].

The Paper "Automating the Integration Of Clinical Studies into Medical Ontologies", focuses on to make the ontology model and by using this ontology technique, it is use to test various hypotheses and make predictions about a person's future health and wellbeing. The main challenge is to lower the time and provide the relevant information within the clinical studies.The researchers have to do this knowledge extraction manually, but this paper provides a means for automating this process. This paper uses the Matching technique to automatically link information from clinical studies to the concept of interests to medical researchers. The main goal of this paper is to avoid human matching of ontology concepts and provide an automatic approach to construct the queries to express each hypothesis and generate the appropriate result set.In Keyword matchingmethodthe ontology concepts means the risk factors which are compared with the questions raised in studies. Matching keywords are compared using a similarity threshold means it does not require an exact match but closely related keyword.

Keyword matching method uses triple {Cm, Qn, Wo}, where Cm- Cluster identifier, Qn –Question identifier, Wo- Word.In this paper, these three attributes are used to identify a question compared with a specified Risk Factor. So this will give the result either true or false. If the matching is correct then it will be matched as early as possible and if it does not match correctly, it must determine that which step provided the false hit. The Goal is to maximize the matched questions to risk factors while minimizing the number of false hits.Risk factors are lowered using the keyword matching method [2].

Kerry Taylor [3] focuses on the formation of Medical and oral domains. It uses the cross-domain ontology of medical and oral health concepts. There are systems likeICT (Information and Communication Technology) which do not possess semantic interoperability for seamless sharing of patient information which result in a separation of the patient care management process in the medical and dental domains which is unfavorable. It can be overcome in this paper.SNOMED-CT is a comprehensive ontology for representing clinical medical conditions. This paper reuses 'SNOMED-CT'. This paper helps in breaking down the whole process into small steps[3].

In "Knowledge Model for Electric Power Big Data Based on Ontology and Semantic Web",Yanhao Huang et al., proposes the structure, elements, basic calculations, multi-dimensional method and reasoning method of the new knowledge model.A

new electric power knowledge theory modelis used to adapt the various knowledge expression requirements of electric power big data. The aim of this paper is to use this model in more applications. Electric power big data is very large and is changing always. So this paper focuses to manage and analyze the electric power data as much as possible. This method uses ontology theory based on description logics. The aim of this paper is to simplify the knowledge. Data clustering is used to avoid the costly calculations of the big data [4].

Jie Tao [5] proposes a method for extracting knowledge using ontology inIPO prospectus. IPO prospectus is most reliable source for exchanging crucial information between the investors and the issuers/ underwriters. It is mainly used for knowledge discovery purposes. IPO prospectus should have relevant domain knowledge, entity identification. It should be able to extract entity relations, to be able to find out the links between the entities in the form of patterns.OBIE framework ismainly used for 3 modules:1)Information extraction module2)Reasoning &Learning module3) Analyticsmodule [5].

Arnaud Rosier [6] proposed a method which demonstrates the feasibility and effectiveness of ontology-based functional annotation of devices in the cardiac domain. This paper annoted a set of devices that covered more than 50% of cardiac device replacements within a database. CIED's are used in the treatment of heart failure and in the prevention of sudden death.CDO is developed to support the functional annotation of cardiac devices and to classify replacement procedures as upgrading, downgrading or replacement with an equivalent device. CDO are used to analyze CIED registries

(to cluster cardiac devices according to their functional properties) & distinguish between therapy changes and replacement with an equivalent device [6].
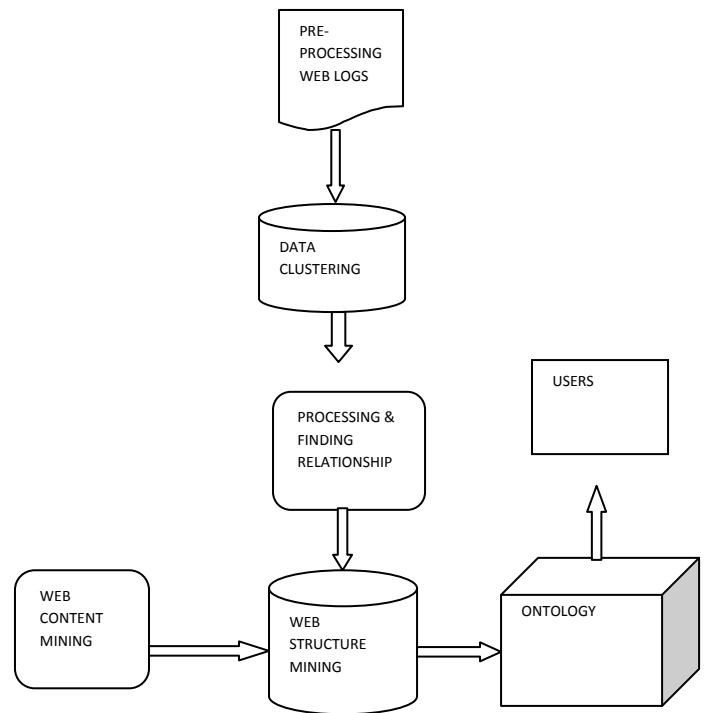

Fig 1: Proposed Architecture

Table 1. Summary

1. **An Ontology for Telemedicine Systems Resiliency to Technological Context Variations in pervasive Healthcare.**

Sr No	Approach	Advantages	Limitation
1.	Requirement Elicitation (RE) method supported with Layering Technique.	1) It Enables the development of 'Telemedicine system' which is capable to adapt the treatment guaranteeing Patient's safety. 2) A simple use case is used for the pollute free clinical guideline to provide patient treatment guidance.	1) Clinical data quality optimization is not addressed.

2. **Automating the Integration Of Clinical Studies into Medical Ontologies.**

Sr No	Approach	Advantages	Limitation
1.	Keyword Matching Method.	1) It helps in breaking down the whole process into small steps such that the problems can be recognized and addressed. 2) It prevents the duplication of resultant ontology.	1) Matching the new concepts to older datasets, this type of structured approach to medical studies does not exist.

3.   A Guiding Framework for Ontology Reuse in the Biomedical Domain.

Sr No	Approach	Advantages	Limitation
1.	SNOMED-CT(Systematized Nomenclature of Medical Clinical Terms).	1)It Focuses to manage and analyze the electric power big data as much as possible. 2) It proposes a method to Break down Barriers between data in different domains and realize a unified processing platform. 3) Data clustering is used to avoid the costly calculations of the Big data. 4) It express the descriptive electric power knowledge which cannot be used by the traditional logic rules.	1) It is reusing already existing ontology technique.

4.   Knowledge Model for Electric Power Big Data Based on Ontology and Semantic Web.

Sr No	Approach	Advantages	Limitation
1.	Electric power knowledge theory model.	1) It proposed a formalized framework to facilitate the knowledge discovery process in order to align the hidden link between the changes in the informative contents of the prospectus and the trends of the price offerings in the market. 2) It can be useful for the average potentials investors to identify the indicators of the price changes from the textual contents in the Ipo prospectus.	1) Checking, integration, automated analysis and multi-type data unified management are some applications where this method is still not used in electric power big data.

5. An Ontology-based Information Extraction (OBIE) Framework for Analyzing Initial Public Offering (IPO) Prospectus.

Sr No	Approach	Advantages	Limitation
1.	1) Information extraction module. 2) Reasoning and Learning module. 3)Analytics module	1) It is used in the treatment of heart failure & the prevention of sudden death. 2) The ontology based functional annotation of medical devices is feasible, useful & performs better than straightforward exploitation of CIED codes for analyzing registry data.	1) The proposed framework is not fully implemented.

6.   **An Ontology-Based Annotation of Cardiac Implantable Electronic Devices to Detect Therapy Changes in a National Registry.**

Sr No	Approach	Advantages	Limitation
1.	Cardiac Device Ontology (CDO).	1) It is used in the treatment of heart failure & the prevention of sudden death. 2) The ontology based functional annotation of medical devices is feasible, useful & performs better than straightforward exploitation of CIED codes for analyzing registry data.	1) In the case of CRT devices, artrioventricular pacing is always possible. As a consequence, when switching from or to a CRT device, one cannot be sure that the artrioventricular function was used unless one knows if an arterial lead was physically connected to the pulse generator. 2) A CDO using a French registry, but it can be used to annotate and analyze other data repositories within the same domain.

3. CONCLUSION

Based on these six papers, it isstudied that ontology plays a vital role in healthcare domain. It is mainly used for information extraction of relevant data for making search of data more exactly and correctly. Ontology thus helps in making searching process in less time. So using various ontology techniques person's life can be saved. Person's future health predictions can be made using Ontology.

In future works, ontology is planned to extend with Quality of Data (QoD)optimization mechanisms, with simplerStrategies like sending technological recommendations to the Patient to improve the performance of the system. The future work is focused on whole Quality of Data (QoD)-aware Healthcare system to use Associated Quality of Data (QoD) along with the clinical data that can be beneficial for the patient treatment.

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