Chapter 76
Semantic Web Based Agricultural Information Integration

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ABSTRACT

Huge volume of information is available in the WWW. However, the demand is on relevant information rather than available information, which are often heterogeneous and distributed. Agriculture is one such domain, which includes information like soil, crops, weather, etc., under one roof. This information is in different representations and structures e.g. weather. This scenario leads to a challenge that how to integrate the available and heterogeneous agricultural information to deliver better production. The information on the web is syntactically structured but, the need is to provide semantic linkage. The semantic web supports the existing web to easily process and interpret information. In this paper, a semantic based Agricultural Information System (AIS) is proposed which addresses heterogeneity issues among weather systems and integrates information like soil, weather, crop and fertilizers. AIS helps the farmers regarding the type of crop/soil, crop/climate, fertilizer applications, diseases and prevention methods using effective retrieval of information from integrated systems.

INTRODUCTION

Huge volume of information in agriculture and its related fields is being published on the internet in diverse representation, structure and formats. Agriculture is the main occupation of many countries in the Asia-Pacific region as nearly 60 percent of its people derive their livelihood from agriculture. Recent FAO 2016 (Food and Agriculture Organization of the United Nations) report estimates that to meet the projected demand, global agricultural yield will have to increase at least 60 percent above 2006 levels. At the global level, the yield rates for many crops have been decelerating in recent decades, while de-

mand continues to increase in absolute terms. A holistic approach in agriculture production is the need of the hour. This can be achieved by providing relevant information to the farmer and using knowledge engineering methods to extract efficient agricultural information from integrated information sources.

Though the available information on the web is huge, most of them are heterogeneous due to the design and development autonomy of users and systems. For effective utilization of available information, the heterogeneity among the information systems must be redeemed and integration of related information systems has to be done. This assures enhanced information retrieval from the integrated information sources.

The motivation for information integration in agriculture system is to provide required knowledge to the farmers to make more informed and valuable decisions. Recently available systems support syntactic based service and complete integration of services are not adequately available. The existing approaches are time consuming, difficult and expensive. There is a need for a sophisticated system, which is more efficient. In order to provide a technological development for the growth of the agriculture, a semantic based agriculture framework is proposed that resolves heterogeneities among weather systems, integrates related information from disparate sources such as soil, crop, pesticides, weather and fertilizers thereby ensuring proper information retrieval.

In this paper, a semantic based agriculture framework is proposed which represents the information using ontologies. Ontology mapping technique is used to reduce heterogeneities among information systems thereby providing semantic interoperability between them. Then ASDOM algorithm (Asymmetric Source Driven Ontology Merging) is used to integrate mapped ontologies and INRON algorithm (INformation Retrieval from ONtology) is used for effective information retrieval.

This paper is organized as follows; in next section, some related works are discussed to assess the state of the art methods and techniques that are used to improve agriculture production using semantic web technologies. Third section narrates proposed AIS framework and its functionalities. Last section concludes the proposed work and gives directions for future use.

RELATED WORK

Agriculture is an essential domain, which is entrenched in our lives and economy. To fulfill the food demands of the increasing population and to improve the economy of the nation, existing agriculture systems need to cope up with emerging technological inventions. Various information systems based on semantic web techniques to improve the agriculture production are discussed below.

An application framework is proposed to support the agricultural knowledge integration for better production based on semantic web concepts (Sun, Zhu, Gu, Wu & Feng 2009). This framework is designed to overcome existing agricultural knowledge representation, which is a complex and difficult task due to the distributed and heterogeneous characteristics of the agricultural knowledge sources. Layered approach is suggested for structural and functional description. An Integrated Agriculture Information Framework (IAIF) is developed to enable knowledge extraction from many domain related repositories (Shoaib & Basharat 2010). IAIF has been designed with the core aim of representing, combining and aggregating the data available from existing knowledge repositories through the help of metadata and domain ontologies. This domain ontology is used to link the sources to the domain knowledge with the help of corresponding metadata. A model that uses ontology, semantic web technology into agriculture knowledge system in order to improve precision and recall rate of information retrieval is discussed in

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