

Software Agent as an Effective Tool for Managing the Internet of Thing Data Complexity

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Abstract

The Internet can be considered as the most disruptive technology of the 21st century. The Internet may start as a technology, but today it has become as part of our modern culture. Today the Internet serves many purposes, from social interaction to information search and conducting business activities to smart connectivity. The Internet has created new business opportunity and models that are not even considered in the pre-internet era. E-commerce and m-commerce are the method of choice by the business and consumer to perform the buying and selling activities.

The interconnectivity of the Internet has resulted in increasing self-disclosure over the internet, where people share their personal detail, their thoughts, preferences, giving comments and reviews about anything and everything from politics to products or services. As the Internet is expanding, the volume of data is expanding exponentially. With the expanding volume of data, Big Data Management becomes an important aspect of managing the data made available on the web. Big Data Management includes storing, retrieving and analyzing the data to provide meaningful and relevant information.

For business organizations, information provided by users including personal detail, preferences, comments and reviews about products or services, can be exploited for marketing advantages. Marketing is the art of getting the right product to the right people at the right time. Businesses have adopted certain algorithms that can help them to extract information from the Internet to discover potentially significant patterns inherent in the database, which can help the online marketing strategy. However, the key question is that, which data best describe the user's intention to purchase. Many of the algorithms examine user's past activities and traits to predict the buying intention.

With the expansion of the Internet (web 2.0) towards the Internet of Thing (IoT), where anything and everything can be connected to the internet, extracting useful information from a complex sensing environment at different spatial and temporal resolutions is challenging. In IoT, the data are not only furnished by users during the interaction with computers but also from the various devices that connected to the Internet.

As the data complexity increases, users, as well as business organizations, need to have a new form of data analysis tool beyond what is available today. The current analysis tools and algorithms employed by the business organization were not designed to analyze the ever dynamic changes in taste and preferences of users when predicting the buying intention. On top of that, the existing analysis tools and algorithms did not consider the data generated by sensory devices connected to the Internet.

A possible solution is to employ an intelligent middleware that can analyze both the human-generated data and sensory generated data. Software-agent based middleware can be an effective form of e-assistance for the business organization in managing and analyzing the IoT big data. In the agent-based approach to middleware, the agent's property such as autonomous, mobile and intelligent are suitable as e-assistance tool for big data management. Software agent-based middleware in IoT can facilitate injection and distribution through the network using mobile agents, allowing the tool to manage very large data. Agents can migrate from one node to another, and at the same

time maintain their execution state, allowing the design of decentralized systems capable of tolerating partial failures of IoT.

In the context of the IoT middleware requirements, software agent can perform the following: managing resources such as network load reduction and network latency reduction, code management such as asynchronous and autonomous execution and protocol encapsulation, availability and reliability as well as adaptiveness and heterogeneity. On top of that software agent-based approach to big data management in IoT consider resource-constrained devices, allowing better resource management.

The use of software-agent based middleware that is intelligent, enables the system to adapt to the ever changing in taste and preferences of users when predicting the buying intention, thus making the online marketing to be highly effective. The agent can learn and adapt its analysis of the data so as to improve the prediction of the buying intention among the users.

The autonomous property of software agent enables it to continuously search for the suitable data that can meet the need and the expectation of the organization in maximizing the marketing effectiveness. It also enables the middleware to be self-dependent and automatically response to new data or pattern that emerges from the IoT.

With IoT is about to be realized in the near future, business organizations must take immediate actions to exploit the benefit it can offer in term of maximizing the marketing effectiveness. However, IoT possesses new challenges in data management as the volume of data become extremely complex. Software agent-based middleware can be an effective solution due to the nature of agents as being both intelligent and autonomous.

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