

Agent-Based Big Data Analytics in Retailing: A Case Study

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Abstract — The advent of social networks and the Internet of Things have created massive data sets with huge and complex structures. Thus, new technology for storage, analysis, and pattern visualization must be developed for further processing. Such data sets are appropriately termed as “Big Data.” Big data Analytics is concerned with exposing and visualizing hidden patterns, as well as with analyzing the knowledge that is produced to facilitate decision making. In retailing, analyzing the massive data generated from business transactions is crucial to enhancing the insights of vendors into consumer behaviors and purchases, thus providing them an advantage in decision making. The capability to extract value from big data is a relevant issue, but the process is difficult as the volume and velocity of data increase. As a result, traditional business intelligence methods become inadequate. Consequently, we propose an agent-based paradigm in this study to facilitate the use of Big Data Analytics in retailing. The paradigm exploits agent characteristics such as autonomy, pro-activity, and intelligence in performing data analytics processes. We also review the background of the situation and discuss the characteristics, properties, applications, and challenges of integrating Big Data with multi-agent systems in retailing.

Keywords—*Big Data; Big Data Analytics; Multi-Agent Systems; Retail; Industrial automation; Agent-Based Big Data Analytics.*

I. INTRODUCTION

The amount of data worldwide has increased significantly. These data have progressed from numerous resources, such as images, click streams, logs, posts, search queries, health records, online transactions, emails, audios, and videos, to social networking interactions, sensors, and mobile phones, as well as related applications [1, 2]. In 2012, The Human Face of big data (thehumanfacebigdata.com) accomplished a global

project, to collect, visualize, and analyze large amounts of data in real time.

In 2015, the world’s digital expanded to 5.6 exabytes of data created each day. This figure is expected to double every 24 months or so [3]. As of the first quarter of 2015, Facebook had 1.44 billion active accounts interacting in 70 languages, uploading 140 billion photos, establishing 125 billion friend connections, posting 30 billion pieces of content, and posting 2.7 billion likes and comments daily. On YouTube, 48 hours of video are uploaded every minute, with 4 billion views daily. Google has more than one million servers around the world that support the many services monitoring 7.2 billion pages per day. Google processes 20 petabytes of data daily and translates content into 66 languages. Twitter generates 1 billion Tweets every 72 hours from more than 140 million active users. By the year 2020, 50 billion devices will be connected to networks and to the Internet [4], and the amount of information will increase by 50 times within the next decade [3]. The datasets generated from the aforementioned resources and activities are stored in databases that have become massive. As a result, storing, managing, sharing, analyzing, and visualizing information via typical database software tools is difficult.

In the following sections, we provide an overview of big data definitions, characteristics, development, and value, along with the challenges of this concept and its applications. We also introduce multi-agent system (MAS) and the significance of using this technology for big data analysis. Then, we discuss the fundamentals of big data analytics with a focus on its use in retailing. We emphasize the integration of big data, which is inherently of a distributed nature, with the MAS paradigm. Then, we focus on the selected dominant synergy of big data with MASs in retailing. We conclude this paper by summarizing steps that can be taken in future research.