Chapter 68
Big Data Analytics in Mobile and Cloud Computing Environments

Muhammad Habib ur Rehman
University of Malaya, Malaysia

Atta ur Rehman Khan
King Saud University, Saudi Arabia

Aisha Batool
Iqra University, Pakistan

ABSTRACT

Multiple properties of big mobile data, namely volume, velocity, variety, and veracity make the big data analytics process a challenging task. It is desired that mobile devices initially process big data before sending it to big data systems to reduce the data complexity. However, the mobile devices have recourse constraints, and the challenge of processing big mobile data on mobile devices requires further exploration. This chapter presents a thorough discussion about mobile computing systems and their implication for big data analytics. It presents big data analytics with different perspectives involving descriptive, predictive, and prescriptive analytical methods. Moreover, the chapter presents a detailed literature review on mobile and cloud based big data analytics systems, and highlights the future application areas and open research issues that are relevant to big data analytics in mobile cloud environments. Lastly, the chapter provides some recommendations regarding big data processing, quality improvement, and complexity optimization.

INTRODUCTION

Research in micro and nanotechnologies has led to the development of small, handheld, mobile, and wearable devices with adequate computational power (Rehman, Liew, Wah, Shuja, & Daghighi, 2015). It is believed that the integration of network and communications technology, such as IPv6, Internet of Things (IoT), and high-speed networks, together with the advancement in mobile devices, and cloud computing technologies will revolutionize the whole digital lifestyle and play a vital role in the evolution

DOI: 10.4018/978-1-5225-1837-2.ch068

of new technologies (Rehman et al., 2015). However, it is an undeniable fact that these technologies will generate a massive amount of data in mobile environments; a challenge that demands timely consideration.

Big data is defined as the amount of data that cannot be stored or processed on conventional Database Management Systems (DBMS) (Hashem et al., 2015). Similarly, the "big data analytics", is defined as the process of executing data analysis methods over large-scale data (streams) to discover maximum actionable knowledge patterns. Big data systems collect a massive amount of multi-format (structured, semi-structured, and unstructured) data from heterogeneous data sources, which makes the big data analytics process a challenging task compared to the conventional data analytics. The popularity of big data is motivating the researchers to develop big data analytics tools and new systems. A variety of data analysis methods and systems are proposed in the literature to effectively analyze the big data and uncover the actionable knowledge patterns (Gaber, Gomes, & Stahl, 2014; Jayaraman, Perera, Georgakopoulos, & Zaslavsky, 2014; Kreps, Narkhede, & Rao, 2011; Palankar, Iamnitchi, Ripeanu, & Garfinkel, 2008). The resultant knowledge patterns are handy for preserving user privacy and provisioning personalized services in user-centric big data environments.

Mobile computing systems are replacing wired computing infrastructures by providing adequate computational power through new computing technologies. In addition, wireless connectivity with Internet, on-board sensors, and the availability of rechargeable power sources has popularized these systems. This popularity is witnessed by the fact that the sales of smartphones and tablet PCs outnumber the sales of desktop computers (Rehman et al., 2015). The addition of wearable devices, unmanned aerial vehicles, and smart cars to mobile computing ecosystem are a few examples that show continuous evolution in mobile computing field. Although, the mobile devices/systems facilitate in provisioning computational power, they are unable to handle the massive amount of big data stream that is generated by the on-board sensory and non-sensory equipment.

Cloud computing technologies ensure provision of on-demand and highly virtualized computing resources. The cloud provides computing, networking, and storage services with the highest level of elasticity to meet the subscribers' demands (Armbrust et al., 2010). The cloud services are orchestrated as Software-as-a-Service (SaaS), Platform-as-a-Service (PaaS), and Infrastructure-as-a-Service (IaaS). SaaS allows deploying cloud-based web applications that are accessible via web browsers. The main advantages of SaaS are the scalability and application access from any Internet connected web browser based computing system. SaaS also ensures to save the applications from data loss in case of unusual termination. PaaS provides tools and cloud services for development and deployment of applications in the cloud environment. Next, IaaS ensures provision of cloud computing resources for commercial users who need infrastructure (CPU cycles, networks, and massive storage) to reduce on-premises management load of computational resources. The cloud computing infrastructures are public (owned and managed by cloud service providers), private (solely operated for a single user/organization), and hybrid (combination of private and public clouds).

This chapter articulates the Six Vs of big data and data processing workflow, and discusses the emergence of big mobile data and their respective sources in mobile environments. It also discusses the prevalence of mobile and cloud computing technologies and presents a thorough literature review of mobile and cloud based big data analytics systems. Lastly, it highlights application areas and open research issues for future research directions.