Chapter 5
A Novel Resource Management Framework for Fog Computing by Using Machine Learning Algorithm

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ABSTRACT

With the development of edge devices and mobile devices, the authenticated fast access for the networks is necessary and important. To make the edge and mobile devices smart, fast, and for the better quality of service (QoS), fog computing is an efficient way. Fog computing is providing the way for resource provisioning, service providers, high response time, and the best solution for mobile network traffic. In this chapter, the proposed method is for handling the fog resource management using efficient offloading mechanism. Offloading is done based on machine learning prediction technology and also by using the KNN algorithm to identify the nearest fog nodes to offload. The proposed method minimizes the energy consumption, latency and improves the QoS for edge devices, IoT devices, and mobile devices.

INTRODUCTION

In this era, the most upcoming technique is the edge devices IoT and mobile device users are increasing in drastic manner. By this same speed, the high complexity real time applications and data intensive applications gadgets such as Virtual Reality, Augmented Reality, Drones are developed. The resources limitations, energy consumption, mobile network traffic, high computation and storage are the main difficulties facing by the user. It is very difficult to solve these limitations with cloud computing model

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to support the cloud, a new concept to deploy task and storage, edge computing, fog computing, mobile edge computing are introduced.

To overcome the challenges and to support the cloud fog computing is proposed by Cisco, virtual platform provides storage, computation, network services and plays its role between the end devices and cloud (Bonomi et al., 2012). A decentralized networks which performs actions as cloud server but it relays on the cloud computing for high computation (Mahmud & Buyya, 2017). It performs wonders for edge devices, IoT devices and mobile devices due its low latency for real time applications and low mobile network traffic. In fog computing, main challenge is resource allocation and heterogeneous devices.

Offloading (Hyytia, Spyropoulos & Ott, 2015) is the way of transferring the task from the edge device to the fog nodes or to the cloud. Due to large complex applications and lack of resource its task or the part of the task offloaded is to the cloud or to the fog node to overcome the above mentioned challenges. Offloading decision is made based on the prediction technology and KNN algorithms to provide the best resource management for fog nodes. The important of fog computing and its characteristics are represented the energy minimization IoT devices resource management is discussed (Dastjerdi & Buyya, 2017).

Machine learning is way to increase the intelligence of the system and it is important to analyze. It is the way of learning the system for high computational real time applications (Angra & Ahuja, 2017). Detailed learning process about the data to understand and to classify accordingly will lead to improve the knowledge about the data (Mitchell, 1997). Machine learning algorithms applied to large data set to learn the data. Machine learning algorithm is used to improve problem solving with the prior knowledge about the data. It leads the dataset to train according to the learned information and it will find the way to reduce the problem and improves its performance. There some challenges in the machine learning while using in the data like how much data need to learn?, what algorithm is fit for this data? etc.,

The proposed method of this system used the machine learning algorithm KNN for resource allocation in fog nodes. It will show the nearest fog node to the user by using the machine learning KNN algorithm for efficient offloading and resource management. K- Nearest Neighbors (KNN) (Parsian, 1015) is the machine learning classification algorithm, here K is a numerical value always greater than 0.

KNN algorithm is used to find out the nearest data points in the dataset using the standard Euclidean distance. The (KNN) is a non-parametric method used for classification, to calculate the accuracy and for the validation of the KNN classification confusion matrix and the statistical method likelihood-ration is also used (Huang et al., 2013).

This chapter covers the introduction about this proposed work with brief discussion. It also includes about the new techniques, machine learning algorithms how it supports to this proposed system and also about the issues and challenges with the technique. In related works it shows analyse and survey about how the fog computing works and its issues, how the machine learning technique and KNN is useful for making decision and its challenges. In this related work, the discussion about offloading and its challenges are in wide manner. In the proposed work part it shows how to find the execution location and how KNN is works with this proposed system.

In the experimental result part, shows how the implementation takes part, how the task identify its execution location and it also gives how to evaluate and performance accuracy in classification is done, how R programming is used for statistical learning and how this proposed system implemented using R. In the last section, discussed about what this proposed system achieves, how the resource managed in the complex application and it shows the latency and high resource utilization, future work is also discussed related to this proposed system.