Chapter 7
Enhancing Quality of Service in Internet of Things: Deep Learning Approach and Its Challenges

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ABSTRACT

The potential growth of internet of things (IoT) brings people and things together to handle daily tasks in a smart way. The major advancement the IoT offers is quality data sensing and faster data analytics through hurdle-free communication. The increasing number of devices and heterogeneous network natures unwrap more challenges in terms of quality of service. Currently, the deep learning algorithm explores different dimensions of service quality gradually in IoT scenarios. In order to effectively handle a dynamic IoT environment, it is essential that the design of IoT must be supplemented with an intelligent agent for providing effective QoS. The traditional methods are not capable of utilizing historical data to find insights into service quality improvement. In this chapter, a comprehensive analysis of deep learning techniques for improving QoS of the internet of things is carried out. Deep learning solutions for improving QoS and the challenges involved are compared. The deep reinforcement learning (DRL) for improving QoS in IoT and its evaluation technique are also explored.

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INTRODUCTION

The growth of computation and communication technology empowers people to manage daily task digitally on the fly. Evolutionary areas such as machine learning, Cloud computing, Internet of things, big data analytics, virtual reality, digital twin and augmented reality changed the traditional approach of solving problem. Internet of things perceived as one of the hot area for more than one decade. Today, IoT is the most widely using technology in smart home, smart city, smart industry and so forth. It brings physical and digital worlds together to make the environment smarter and responsive. The IoT was first most intriguing to business and manufacturing. But, the focus is now on populating our homes and offices with smart gadgets, making it relevant to practically all.

According to international data corporation (IDC) USA, it is expected that by 2025 41.6 billion IoT devices will be deployed across the world. Industries have largest possibility of adapting IoT technology than the smart home and wearable gadgets in the near future.

The amount of data generated by IoT devices exponentially increasing and all of these IoT data must be gathered, saved, and analysed either locally or at cloud. due to limited resources in local system data transmission between IoT device and cloud become unavoidable. It subsequently increases latency and decrease the overall performance. As the number of IoT devices grows possibly millions, managing QoS for all of those devices will be difficult.

Due to complex service requirements and heterogeneous network, IoT applications face computational and communication delay. Edge technology as distributed paradigm allows execution near to the user end. Even though edge computing technology allows local execution, a resource allocation scheme is required to meet complex and customised service requirements. The branches of Artificial intelligence (AI) offers more flexibility to collect and process data in IoT through improved service quality even under dynamic environment.

An advancement in IoT data sensing and faster data analytics by removing connection barriers. However, as the number of devices grows and the network becomes more heterogeneous, new issues in terms of quality of service emerge. In the IoT, several parameters of service quality have been continuously growing with the help of machine learning algorithms. Energy efficiency, delay minimization, throughput, bandwidth, and resource usage are major concerns in this. To efficiently handle a dynamic IoT environment, IoT architecture must be augmented by intelligent agents for optimal QoS provisioning. Traditional methods are incapable of exploiting historical data to uncover insights about how to improve service quality. Quality of service can be increased by forecasting optimal or near optimal service that fits in dynamic IoT by introducing intelligent models built using historical data.

BACKGROUND

Response time, throughput, latency, computing cost, training cost, offloading, load balancing, path selection, channel allocate, security, and energy cost are the terminology that are most frequently used in QoS enhancement. The research studies used one or more parameters to improve overall system performance.

In (Vimal, S., *et al.,* 2020) have proposed resource allocation in MEC using the swam intelligence and reinforcement learning algorithm. In Mobile Edge Computing (MEC) environment, execution delay-causing factors are anticipated to improve Quality of Services. IoT resource allocation strategies must ensure at least two qualities: good performance and a reasonable turnaround time for resource allocation