

Case Studies For 5G Wireless Communications Using AI and ML

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Abstract. Wireless communication systems must be able to support the high demands of new networks and devices in order to meet the rapidly expanding economic and cultural needs of human society. 5G/Beyond 5G systems must connect with a high number of devices, have significantly lower latency than 3G/4G wireless networks, and meet strict quality-of-service (QoS) requirements. The application of artificial intelligence (AI) and machine learning (ML) to wireless applications will be one of the primary and essential elements of 5G systems. These methods are used in all parts and building blocks of wireless systems at the physical, network, and application layers. Researchers from all over the world are very interested in the 5G criteria and these technologies. A 5G network needs AI technologies to be completely functional and effective. On the other hand, ML is a promising technology that may be applied to data processing. Existing generations broadcast using Internet Protocol (IP) broadband access, which is inefficient. Hence, in order to function 5G networks they must be proactive and predictive to ML and AI. In this regard, this paper highlights the role and significance of AI and ML in 5G communications and also provide potential future research directions.

INTRODUCTION

In comparison to 3G/4G wireless services, 5G wireless services and mobile networks face several hurdles in meeting the unprecedented expanding demand for low latency and high data rates. The latest technologies such as internet of things (IoT), smart grid, and many more, rely on the 5G network. These technologies require higher data rates and massive connectivity for potential service. In order to satisfy these rising needs of diverse networks and users, 5G wireless networks must be characterised by great flexibility in design and resource allocation. The introduction of new radio interfaces, massive MIMO, high modulation orders, and other features in 5G networks have solved the primary capacity issues [1]. This merging makes the network operators to accommodate existing and future services that are more demanding. The major difficulty is to be prepared to assist consumers in a variety of vertical industries, such as e-health, Industry 4.0, and so on. In order to fully and properly understand the operational environment's behaviour and demands, The amount of intelligence used by network operators must increase. Machine learning (ML) and artificial intelligence (AI) technologies must be adopted to foresee the evolution of the environment and service behaviour in order to construct a proactive and efficient updating network.

Many leading wireless research organizations believe that AI will be the next great game-changing and breakthrough technology, poised to provide 5G [2]. The 5G-based technologies are now being evaluated and deployed in a wide range of applications. These technologies have enormous promise because they enhance data transfer speeds and provide a framework for new types of communication capabilities, such as machine-to-machine (M2M) communication. With the introduction M2M technique, large amount of data need to processed. This huge amount of data cannot be processed individual teams and it can be processed and solved using ML algorithms [3].

In this study, AI's function and integration technique in next-generation mobile networks, as well as several ML methodologies are discussed. This research paper also undertakes a sequential analysis of scientific literature with an emphasis on 5G-based technologies and ML solutions, as well as potential obstacles. This paper also discusses the role of AI and ML in 5G wireless networks and issues are also taken into account. Finally, the benefits of AI, ML, and future research prospects are highlighted.

The contents of remaining paper is as follows. Section II gives the introduction and key pillars of 5G technology. section III and section-IV give an overview of AI, ML and their applications in 5G wireless networks.