

# Role of AI / ML in 5G advanced

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**Abstract:** *Given the present surge in interest in generative AI, artificial intelligence is clearly going to play a major role in future wireless networks. Wireless system management has become increasingly complex and sophisticated as society moves towards 5G. The paper used the secondary source of data collection from 10 sources, with thematic qualitative analysis, done ethically with high reliability. The global telecom industry is not an exception to how artificial intelligence is changing businesses. Standardisation is necessary to allow AI to be widely used in telecom. The initial release of 5G-Advanced, 3GPP Release 18, contains a large number of AI-focused research and development items.*

**Keywords:** AI, ML, 5G-advanced, Artificial Intelligence, and Machine Learning.

## 1. Introduction

AI will play a crucial part in future wireless networks, as seen by the current spike in interest in generative AI. As the society move towards 5G, managing wireless systems has become more difficult and sophisticated [4]. Network planning and deployment are particularly difficult for operators in 5G networks because of its heterogeneous character, which includes numerous access networks, frequency bands, and cells with overlapping coverage areas. The wireless sector is being forced by this to adopt AI and ML instead of the more conventional rules-based design techniques [5].

Intelligently managing complicated networks, solving issues with system optimisation, and enhancing user experience in 5G systems and beyond are all possible with the help of AI and ML [1]. The AI/ML work in 3GPP Release 18, which spans several 3GPP groups, including radio access network (RAN) and services and system aspects (SA).

Prior to Release 18, 3GPP has begun using data analytics and AI/ML methods into the design of 5G systems. In the 5G core (5GC) network, 3GPP introduced the network data analytics function (NWDAF) in Release 15.

## 2. Background

AI/ML plays a significant role in the digital society. With the increased use of internet and more reliance on the new technologies. The core network, RAN, management and orchestration, and other components of the 5G system all integrate AI and ML [6]. In order for AI/ML to function in a 5G system, it is necessary for models to be developed, trained, tested, deployed, and managed during their whole lifecycle. In order to increase efficiency and create new services for their clients, 5G network operators can leverage artificial intelligence to extract additional information from their networks [7].

### a) Aim

The aim of the research is to understand the role that Artificial Intelligence/ Machine Learning has to play in the advanced 5G system. With the advent of internet and technology in society, every aspect is focusing on to be more driven with 5G system.

### b) Objectives

The research focuses on the following objectives as:

- To understand the role of AI in advanced 5G.
- To analyse the role of the ML in advanced 5G.
- To access the ways in which AI/ML is driving the advanced 5G technology.

### c) Questions

The research will give answer to the following questions:

- What is the role of AI in advanced 5G?
- What is the role of the ML in advanced 5G?
- What are the ways in which AI/ML is driving the advanced 5G technology?

### d) Rationale

The rationale behind this paper is to analyse that how the AI/ML is driving the advanced 5G technology, as the society is moving towards better technologies and to be more interactive and advanced. Thus, the focus needs to be more on the integration of interactive and customized AI systems that can make 5G technologies easy, advanced and convenient.

### e) Significance

The research significance is to understand the role of Artificial Intelligence and Machine Learning in the advanced 5G system in the multifaceted approach and be more pivotal towards the advanced wireless technologies in future. With the transition of the society towards the 5G, there are multiple huge complexes noted with the management of wireless system. The inadequate ways for addressing the challenge are posed by the diverse access networks, and have better coverage.

## 3. Literature Review

Service providers worldwide are already experiencing the advantages of incorporating artificial intelligence into their networks. By the end of 2020, over half of service providers (53%) anticipate having fully incorporated artificial intelligence (AI) into some capacity within their networks. An additional 19% of respondents estimated that AI adoption would occur within three to five years. Some even hope to have implemented AI by the end of this year [5].

While 55% of service providers concurred, that AI is already having a beneficial impact in this area, 68% of them listed

improving customer service as their top business goal for the next three years. Network quality and personalised services are only two of the ways AI is anticipated to assist carriers in further enhancing the client experience [3].

Network providers concur that in order to gather, organise, and analyse the massive amounts of data that AI RAN is able to accumulate, they must create efficient systems. Finding answers to today's and tomorrow's difficulties as early adopters of AI will provide them a distinct first-mover advantage [9]. Since AI 5G may be used to personalise customer service while lowering the cost of constructing and maintaining 5G RAN, it will present interesting potential for the mobile communications industry [4].

The use of AI/ML in 5G interface should be investigated as soon as possible in order to prepare for 6G standardisation, which is expected to begin in 3GPP around 2025. The 3GPP Release-18 study item on AI/ML for NR air interface marks a significant milestone in the evolution of cellular networks, as it is the first time such an approach has been taken [2]. One of the study item's main objectives is to establish a general framework for enhancing the air interface using AI/ML, with various topics currently being explored. This is because AI-native air interface is expected to be important in 6G [8].

#### 4. Methodology

##### a) Data Collection

The data collection is done from the secondary sources which includes the data to be taken from the already published papers, journals, articles and researches. The secondary data enhances the research validity as it gives the authentic and real data that is already published. The data collection plays a significant role in framing the entire research, as the outcomes of the paper will be based on the collected data. The paper has focused on authentic sources from which data is collected, to be real across.

##### b) Search Strategy

The search strategy is by selecting the most relevant secondary sources which are about the AI/ML in the advanced 5G technology. The search strategy is been filtered with the recent 5 years sources. As the part of this paper, the study seeks on evaluating the prominent academic database, which gets with the keywords inclusion about the AI in 5G technology, ML in 5G technology, its role and get with efficiency.

##### c) Data Analysis

The data analysis is done with the qualitative analysis, which includes the thematic analysis about the AI/ML in 5G technology which makes the system more driven. The theme analysis is done to study the trends and patterns for the AI/ML role in the 5G technology. As this technique uses with the thorough analysis of the study paper and get with better modification to comprehend with the role of the system technologies in the advanced system. This is helpful in the paper to create the thematic study analysis.

##### d) Ethical Considerations

The paper is conducted in compliance with the highest ethical guidelines. Anonymity, confidentiality, and informed consent

are standards that the study project must always strictly uphold. All sources must be properly cited in order to maintain academic honesty. Nor will primary data from individuals or organisations be gathered for this study. The entire paper is done within confidentiality and the code of conduct of the research.

#### 5. Findings and Analysis

AI is interactive and generative, the figure 1, indicates the key market players in the field of AI/ML in the 5G technologies. With the constant increase in the use of AI across, there is a huge untapped market, on which multiple businesses are coming up to acquire a significant market share and get the opportunities to grow in future. Ericsson is the market player in this field, followed by LG and Huawei [1].



Figure 1: Key market players in the field of AI/ML in 5G (Source: Intricate Research, 2023)

Artificial intelligence and machine learning can help wireless operators switch from a human-driven to a self-driven autonomous management model for their network operations and maintenance procedures. Mobile devices can build dynamically adaptive clusters based on learnt data, and intelligent base stations with AI/ML incorporated into 5G advanced can make decisions on their own. Consequently, network applications will operate with reduced latency, increased reliability, and increased efficiency.

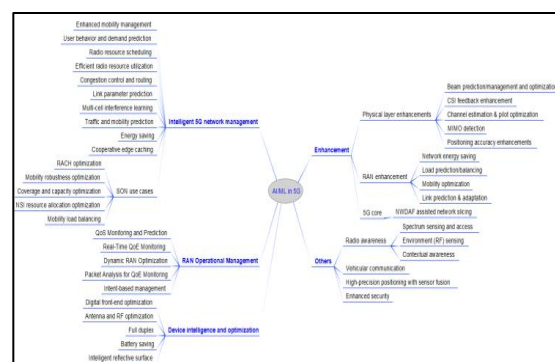


Figure 2: Taxonomy of AI/ML use-cases in 5G (Source: Intricate Research, 2023)

While machine learning and artificial intelligence are still relatively new in the field of wireless communication, they will advance to a more advanced stage in the next few years, allowing for the development of more intelligent wireless networks [1]. Artificial intelligence and machine learning will therefore be the driving forces behind the future generation of wireless networks.

The largest global organisation for mobile network standardisation specifications is 3GPP. The first look into AI/ML incorporated across device, radio, and RAN is provided by its ongoing work on the 5G-Advanced study of AI/ML in air interface [1]. It will lay the groundwork for AI/ML functionality in all upcoming releases, including 6G. With the use of AI/ML approaches, a family of use cases is enabled by the study's overall framework. Improvements in beam management, device positioning precision, and channel information feedback are some of them [8].

## 6. Conclusion

Artificial Intelligence is transforming industries globally, and the telecom sector is no exception. To enable the broad use of AI in telecom, standardisation is essential. A wide range of research and development items devoted to AI are included in 3GPP Release 18, which is the first release of 5G-Advanced. The state of the art in 3GPP work on AI in 5G-Advanced has been comprehensively summarised in this article. A paradigm shift in wireless communications and networking is expected as a result of 3GPP's continued promotion of AI adoption from 5G to advanced 5G.

## 7. Recommendations

The potential of AI/ML in 5G technology is immense, and there is a huge room to tap for these opportunities. The focus shall be on making higher investment in research and development for the better initiative for the AI/ML for advanced 5G, as this will be facilitating the innovative algorithms in the system, get with better ideas for the network optimization. Another recommendation is to get with enhance capacity building. The focus is on being to get with more collaborative efforts to have advanced interface, active participation should be invited with the standard processes.

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