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Design and Analyze the 5G and Beyond Networks Using Several Machine Learning Algorithms

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ABSTRACT

In today's world, wireless communication systems are extremely important for applications related to entertainment, business, commerce, health, and safety. The deployment of fifth generation (5G) wireless technologies is currently taking place all around the world as these systems continue to advance from one generation to the next. Beyond 5G wireless systems, which will represent the sixth generation (6G) of the evolution, are already being discussed in academia and industry. The application of artificial intelligence (AI) and machine learning (ML) to such wireless networks will be one of the primary and essential elements of 6G systems. According to our present understanding of wireless technologies up to 5G, every component and building block of a wireless system, such as the physical, network, and application layers, will involve one or more of them. Here we try to use several ML algorithms to identify the suitable aspects related to the deployment of 5g and above networks by taking several features and ml algorithms into account. By comparing several algorithms we finally conclude which algorithm is best among several algorithms.

KEY WORDS:

Sixth Generation, Machine Learning, Artificial Intelligence, Wireless Technologies.

INTRODUCTION

Wireless technology is constantly developing and improving to help consumers with more sophisticated needs with more and more useful applications[1]-[4]. With the 5G mobile communication system, there is an increase in data rates, a decrease in energy consumption of devices connected with latency and energy, coupled with more

precise localization.Many academics believe that greater attention should be paid to achieving latency and energy goals by strengthening the current wireless system from many angles due to the current increase in data quantity and usage.This inspired me to create an application that uses machine learning methods to classify 5G services.

For many academics and researchers, sixth generation (6G) wireless technology is still a relatively unexplored subject. The main advantages of 6G are that they will be accessible to wireless networks and users alike. 6G will also provide advancements in technical metrics using AI and ML techniques, such as quick throughput, enabling new, in-demand apps, improved radio frequency band utilisation, and many more. Because to its wide range of applications in learning from settings that are more akin to those encountered by humans, DL, one of the primary ML technologies, is one of the key technologies for 6G. For instance, DL can choose the most resource-rich resource controller and the 6G access point to connect to.

For instance, DL can choose the most resource-rich resource controller and the 6G access point to connect to. It's interesting to think about it. The submission was evaluated by the assistant editor, Zhenyu Zhou, who also granted the final clearance for publication. Although it has achieved positive results and been effectively used to classification problems, its usefulness in wireless networks is still being researched. However, we present a thorough overview of ML techniques in this article, including deep learning (DL), and we go over how they might be applied in impending 6G communication systems. In this study, we examine numerous studies that used one or more data mining techniques to predict when 5 G services would be available based on network and bandwidth. Several studies show that classifying 5G services manually is very difficult, hence our goal is to classify 5G networks using ML algorithms. We want to use certain ML algorithms in this system to assess whether 5g service is offered in a specific area based on the signals that are present in that network region. Here, we attempt to categorise the number of sites that are forbidden from accessing 5G services and the number of regions that enable connections. In this work, we use a number of machine learning (ML) methods, such as SVM, KNN, Random Forest, and XGBoost Algorithms, to ascertain which one is best for identifying potential 5G services.

1. LITERATURE SURVEY

In this section we will mainly discuss about the background work that is carried out in order to prove the performance of our proposed 5g model.

[1]." Artificial Intelligence and Machine Learning in 5G and beyond: A Survey and Perspectives," by A.Haidine , with DOI : 10.5772/intechopen.98517.

The main issue of high capacities, to develop true broadband mobile Internet, has been resolved by the introduction of 4G/LTE (Long Term Evolution) mobile network. Strong physical layer security and adaptable network architecture were principally responsible for making this possible. Yet, services that consume a lot of bandwidth, like virtual reality (VR) and augmented reality (AR), have been developed in a way that has never been

done before. Furthermore, emerging services like vehicle communications and the Internet of Vehicles are putting a lot of pressure on mobile networks to perform with near-zero latency (IoV). Several of these issues have been resolved by 5G, which uses a new radio interface based on massive MIMO. A higher level of flexibility has also been introduced by the introduction of software-defined networks (SDN) and network function virtualization (NFV), enabling the operators to support extremely demanding services from different networks.

[2] " **A survey: Distributed Machine Learning for 5G and beyond** " April 2022 with DOI : **https://doi.org/10.1016/j.comnet.2022.108820.**

5G is a cellular network that is in its fifth generation. It is a significant enabler in Industrial Internet of Things (IoT) applications because it allows billions of linked devices to gather and share data in real time. It is more capable in terms of processing power, latency/delay, bandwidth, and flexibility to use edge or cloud resources. Moreover, 6G is anticipated to have the ability to combine ubiquitous communication, processing, sensing, and controlling for a number of industries, which will increase complexity in a more diverse environment. Use of Machine Learning (ML) and distributed ML is required due to this increased complexity, energy efficiency needs, and Service Level Agreement (SLA) requirements.

[3] " **Artificial intelligence (AI) and machine learning (ML) for beyond 5G/6G communications** ," by M.Abdul Springer 2023.

In recent years, there has been a significant increase in the use of digital technologies for a variety of services across modern society and the economy, which has in some ways impacted our daily lives. These cutting-edge digital technologies and services are driven by artificial intelligence and machine learning, which are expanding quickly and becoming increasingly important. Beyond 5G and 6G communication technologies are anticipated to offer services with increased system capacity, low latency, high reliability, and greater spectrum efficiency, as well as to enable a significant number of Internet of Things devices (IoT). Without the network systems' automation, it will be extremely difficult to meet these needs. Consequently, when designing future wireless systems, all potential applications of AI/ML must be taken into account.

2. EXISTING METHODOLOGY

The key characteristics of 5g and higher networks could not be effectively extracted from the given area. The forecast of 5G services in the suitable area utilising data mining methods was not properly handled in the current system. The main drawbacks of the current system are listed below.

LIMITATION OF EXISTING SYSTEM

1. Finding the predicted 5G services in the right place takes more time.
2. There is no reliable forecast.

3. This strategy is ineffective for predicting the location of 5G services.

4. For anticipating the presence of 5G services in the relevant area, all primitive solutions employ a manual approach.

3. PROPOSED SYSTEM & ITS ADVANTAGES

The proposed system makes an effort to present an up-to-date evaluation of concepts for future wireless networks, including 6G, and the role that ML approaches will play in these systems. As a result, we attempt to apply certain algorithms that can forecast both the probability of finding access spots based on the network and other parameters existing in that region as well as the prohibited areas. With the suggested technique, it is simple and accurate to classify restricted and normal zones.

ADVANTAGES OF PROPOSED SYSTEM:

The following are the benefits of the proposed system. They are:

1) It takes less time to estimate the availability of 5G services in the right area when data mining techniques are used.

2) In this study, we review various papers that used one or more data mining methods to anticipate the availability of 5G services.

3. Analysis results show that the Random forest provides the greatest results in a short amount of time

4) The proposed system can easily identify the prediction of 5g services in an area based on some important features.

4. PROPOSED METHODOLOGY

The following are the set of models or algorithms which are deployed in this current application. They are as follows:

MACHINE LEARNING

Machine learning is a subfield of artificial intelligence (AI). Understanding data structure and incorporating it into models that people can understand and utilise is the core goal of machine learning. Machine learning is unique from traditional computational techniques even though it is a subfield of computer science. Algorithms are sets of purposefully crafted instructions that computers use to do calculations or address issues in traditional computing. Alternatively, using statistical analysis and machine learning techniques, computers may train on data inputs and create outcomes that fall within a specific range.

SUPPORT VECTOR MACHINE

The Support Vector Machine (SVM), a supervised machine learning method, may do classification, regression, and even outlier identification. The linear SVM classifier works by drawing a straight line between two classes. A single class label will be applied to all of the data points that fall on one side of the line, and a second class label will be applied to all of the points that fall on the opposite side. Although it appears simple, there are countless lines to choose from. How can we identify the line that will categorise the data the most precisely? This circumstance

makes use of the LSVM approach. The LSVM algorithm will select a line that divides and maintains a minimum separation from the closest samples.

K NEAREST NEIGHBOR ALGORITHM

K-Nearest Neighbors, sometimes known as KNN for short, is one of the most widely used machine learning algorithms. KNN is a non-parametric lazy learning technique. If a technique does not make any assumptions about the underlying data, it is said to be non-parametric. In other words, it makes a decision based on how closely the selection resembles other data points, regardless of the attribute that the numerical values represent. This definition states that a lazy learning algorithm has little to no training phase. As a result, we can swiftly classify new data points as they come into existence.

DECISION TREE CLASSIFICATION

How to build and fine-tune Decision Tree Classifiers using Python's Scikit-Learn module, along with metrics for attribute selection. As a marketing manager, you want a set of customers who are most likely to purchase your products. You might cut your marketing costs by determining your audience. As a loan manager, you must identify risky loan applications in order to lower the rate of defaults. When clients are split into groups of potential and non-potential clients or safe or dangerous loan applications, a classification challenge arises. Learning and prediction are the two stages in classification. The learning phase's provided training data is used to build the model. The model is used to anticipate the outcome of the given data during the prediction step. Decision Tree is one of the easiest and popular classification algorithms to understand and interpret. It may be applied to problems involving classification and regression

RANDOM FOREST ALGORITHM

Random forest is a supervised machine learning technique built on ensemble learning. You can combine different sorts of algorithms or employ the same strategy more than once in ensemble learning to produce a more accurate prediction model. The name "Random Forest" refers to the way that the random forest method combines several decision trees or algorithms of the same type to create a forest of trees. The random forest method can be used to perform both classification and regression problems.

5. EXPERIMENTAL RESULTS

Here we try to use google collab as working platform and try to develop the application in Python programming language.The application is mainly divided into 4 modules such as:

1) Import Libraries

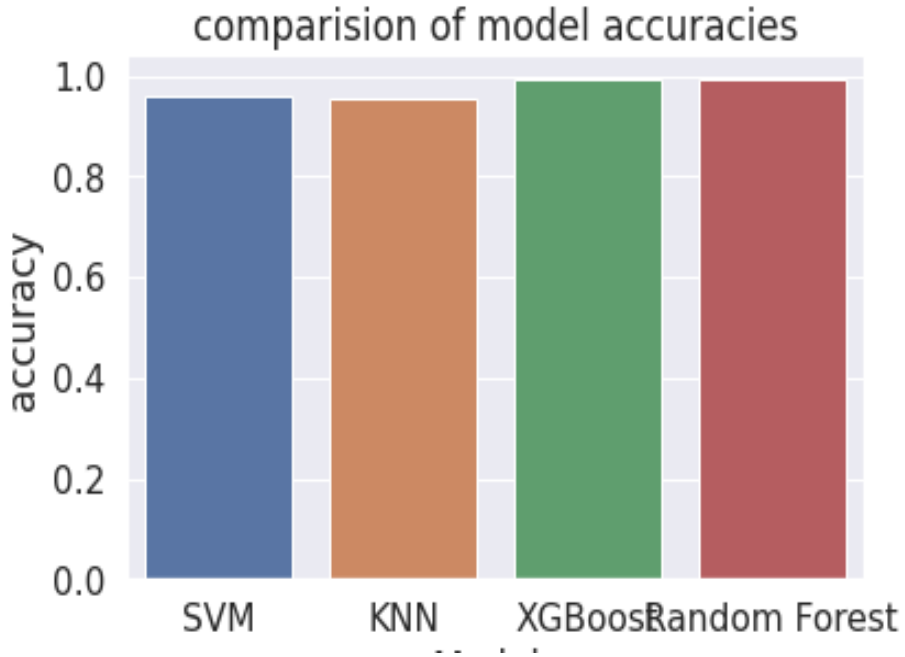
2) Data Pre-Processing

3) Train the Model Using Several ML Algorithms

4) Find the Performance of ML Algorithms

PERFORMANCE ANALYSIS MODULE

On a given input dataset, we compare each classification method in this module in an effort to determine which one is most effective at producing correct results. Finally, we will choose the method that produces the most accurate results in the shortest amount of time. As we can see, Random Forest outperforms other machine learning algorithms in terms of accuracy.



7. CONCLUSION

In this post, we discussed several ML methods and how they work. We have also explored the 6G communication system's acceptability, as well as its limitations and promise. After defining the 6G future vision, we have explained how ML at the application and infrastructure levels may be more effective to address the approaching 6G difficulties. The current requirement for 6G is compared to the state-of-the-art and assessed. Applications are found to be better adapted to fill up the gaps left by 6G issues compared to infrastructure level. After best fit, the case study-biometric application has been investigated. The case study provides evidence of the infrastructure and

application levels of smart biometric applications in use. Here we finally showed the performance of several ML algorithms and how each algorithm is differed with others in order to check the performance of our proposed application.

8. REFERENCES

[1] "A vision of 6G wireless systems: Applications, trends, technologies, and open research challenges," by W. Saad, M. Bennis, and M. Chen. IEEENetw., May 2020, pp. 134_142, vol. 34, no. 3.

[2] "A speculative research on 6G," IEEE Wireless Commun., vol. 27, no. 4, pp. 118_125, August 2020. F. Tariq, M. R. A. Khandaker, K.-K. Wong, M. A. Imran, M. Bennis, and M. Debbah.

[3] "6G wireless communication systems: Applications, needs, technologies, problems, and research directions," IEEE Open J. Commun. Soc., vol. 1, pp. 957–975, 2020; M. Z. Chowdhury, M. Shahjalal, S. Ahmed, and Y. M. Jang.

[4] E. O'Dwyer, I. Pan, S. Acha, and N. Shah, "Smart energy systems for sustainable smart cities: Current advancements, trends, and future directions," Appl. Energy, vol. 237, no. 3, March 2019, pp. 581–597.
[5] "Intelligent edge computing for IoT-based energy management in smart cities," IEEE Network, vol. 33, no. 2, pp. 111_117, March 2019. Y. Liu, C. Yang, L. Jiang, S. Xie, and Y. Zhang.

[6] "Towards a smart city built on cloud of things: a survey on the smart city concept and paradigms," by R. Petrolo, V. Loscr, and N. Mitton. Trans. Emerg. Telecommunications Technology, Jan. 2017, p. e2931, vol. 28, no..

[7] Current developments in smart city initiatives: Some stylized facts, P. Neirotti, A. De Marco, A. C. Cagliano, G. Mangano, and F. Scorrano, Cities, vol. 38, pp. 25_36, June 2014.

[8] 6G. Retrieved on: May 27, 2020. [Online]. Accessible at: mmwave.dei.unipd.it/research/6g/

[9] "UAV communications for 5G and beyond: Recent developments and future trends," IEEE Internet Things J., vol. 6, no. 2, pp. 2241–2263, April 2019. B. Li, Z. Fei, and Y. Zhang.

[10] Learning-based context-aware resource allocation for edge computing-powered industrial IoT, IEEE Internet Things J., vol. 7, no. 5, pp. 4260_4277, May 2020. H. Liao, Z. Zhou, X. Zhao, L. Zhang, S. Mumtaz, A. Jolfaei, S. H. Ahmed, and A. K. Bashir.

[11] An application of wireless brain-computer interface for sleepiness detection was described by A. K. Tripathy, S. Chinara, and M. Sarkar in Biocybernetics Biomed. Eng., vol. 36, no. 1, pp. 276–284, 2016.

[12] Wireless Personal Communications, vol. 106, no. 4, june 2019, pp. 2163–2177; S. R. A. Jafri, T. Hamid, R. Mahmood, M. A. Alam, T. Ra, M. Z. Ul Haque, and M. W. Munir, "Wireless brain computer interface for smart home and medical system."

[13] "5G-enabled tactile Internet," IEEE J. Sel. Areas Commun., vol. 34, no. 3, pp. 460_473, March 2016. M. Simsek, A. Aijaz, M. Dohler, J. Sachs, and G. Fettweis.

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