IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 12, Issue 6, June 2024

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.379

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | A Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 6, June 2024 ||

| DOI: 10.15680/IJIRCCE.2023.1206056 |

Artificial Intelligence-Fire Detection and Alarm System Wireless Communications A Survey

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ABSTRACT: The full potential of artificial intelligence (AI) technologies in future wireless communications such as beyond 5G (B5G) and 6G is an extremely hot inter-disciplinary research topic around the world. On the one hand, AI empowers intelligent resource management for wireless communications through powerful learning and automatic adaptation capabilities. On the other hand, embracing AI in wireless communication resource management calls for new network architecture and system models as well as standardized interfaces/protocols/data formats to facilitate the large-scale deployment of AI in future B5G/6G networks. This paper reviews the state-of-art AI-empowered resource management from the framework perspective down to the methodology perspective, not only considering the radio resource (e.g., spectrum) management but also other types of resources such as computing and caching. We also discuss the challenges and opportunities for AI-based resource management to widely deploy AI in future wireless communication networks.

KEYWORDS: Wireless Communicational, 5G (B5G) and 6G, ultra-reliable and low-latency communications.

I. INTRODUCTION

The modern wireless communication industry has experienced several generations of creative development for several decades. Future wireless networks, including 5G networks and beyond will support eMBB (enhanced broadband), uRLLC (ultra-reliable and low-latency communications), and mMTC (massive machine type communications). To support such innovative applications, effective large-scale resource management will play a vital role. Unfortunately, typical resource management problems, such as subcarrier allocation, user association, and computation offloading, are non-convex and computationally challenging. Moreover, they need to be solved in a real-time manner in the presence of time varying wireless channels, given the latency requirement of novel mobile applications. Existing algorithms are often based on convex optimization tools, which suffer from sub-optimal performance for non-convex problems and scale poorly with the problem size.

Motivated by the recent successes of AI techniques, especially deep learning (DL), in computer vision and natural language processing, AI-based methods have been proposed to solve the challenging wireless resource management problems. The main purpose is to achieve near-optimal performance in multiple applications including power control beam forming, computation offloading and intelligent reflection surfaces in a real-time manner. Existing methods can be classified into two categories. The first category is based on a data-driven approach. These methods treat the neural network as a black box and use it to approximate the optimal solution of a given optimization problem. For example, multi-layer perceptrons (MLPs) are adopted to approximate the input-output mapping of the classic weighted minimum mean square error (WMMSE) algorithm to speedup computation. Although they can achieve good performance for some specific settings, the black box nature of these methods leads to two major issues, namely, poor interpretability and high dependence on the quality of training data. The second category is a model-driven approach, which nicely addresses these two issues by introducing the inductive bias of optimization-based algorithms into neural networks. Specifically, they unroll one iteration of a classic algorithm as one layer of a neural network and replace the ineffective policies in the algorithms by neural networks. However, the unrolled algorithm should be carefully chosen and it often suffer from the model mismatch issue. More recently, some intermediate methods have been proposed, which enjoy the benefits of both approaches. For example, the message passing graph neural network (MPGNN) is a data-driven approach, which can also be viewed as an unrolled decentralized algorithm. MPGNNs have shown their superior performance, scalability, and interpretability in the beam former design and phase shifter design problems. Despite all of these efforts, two fundamental questions from machine learning perspectives remain open: 1) what are the main

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advantages of AI-based methods compared with classical methods? 2) Which neural network should we use for a specific resource management task?

There have been some attempts to address these questions. Nevertheless, they mainly rely on empirical results. In this paper, we attempt to develop theoretical justifications and practical guidelines. For the first question, we investigate the recent development in no convex optimization and wireless communication and identify four unique advantages.

II. LITERATURE SURVEY

1. Artificial Intelligence-Empowered Resource Management for Future Wireless Communications: A Survey

Author- Mengting Lin, Youping Zhao

Year-2020

in future wireless communications such as beyond 5G (B5G) and 6G is an extremely hot inter-disciplinary research topic around the world. On the one hand, AI empowers intelligent resource management for wireless communications through powerful learning and automatic adaptation capabilities. On the other hand, embracing AI in wireless communication resource management calls for new network architecture and system models as well as standardized interfaces/protocols/data formats to facilitate the large-scale deployment of AI in future B5G/6G networks. This paper reviews the state-of-art AI-empowered resource management from the framework perspective down to the methodology perspective, not only considering the radio resource (e.g., spectrum) management but also other types of resources such as computing and caching. We also discuss the challenges and opportunities for AI-based resource management to widely deploy AI in future wireless communication networks.

2. AI Empowered Resource Management for Future Wireless Networks

Author- YifeiShen† , Jun Zhang? , S.H. Song† , and Khaled B. Letaief

Year-2019

Resource management plays a pivotal role in wireless networks, which, unfortunately, leads to challenging NP-hard problems. Artificial Intelligence (AI), especially deep learning techniques, has recently emerged as a disruptive technology to solve such challenging problems in a real-time manner. However, although promising results have been reported, practical design guidelines and performance guarantees of AI-based approaches are still missing. In this paper, we endeavor to address two fundamental questions: 1) What are the main advantages of AI-based methods compared with classical techniques; and 2) Which neural network should we choose for a given resource management task. For the first question, four advantages are identified and discussed. For the second question, optimality gap, i.e., the gap to the optimal performance, is proposed as a measure for selecting model architectures, as well as, for enabling a theoretical comparison between different AI-based approaches. Specifically, for K-user interference management problem, we theoretically show that graph neural networks (GNNs) are superior to multi-layer perceptrons (MLPs), and the performance gap between these two methods grows with $\sqrt{K}$.

3. A Comprehensive Survey of 6G Wireless Communications

Author- Declan Humphreys, Abigail Koay, Dennis Desmond & Erica Mealy

Year-2021

While fifth-generation (5G) communications are being rolled out worldwide, sixth-generation (6G) communications have attracted much attention from both the industry and the academia. Compared with 5G, 6G will have a wider frequency band, higher transmission rate, spectrum efficiency, greater connection capacity, shorter delay, wider coverage, and stronger anti-interference capability to satisfy various network requirements. In this paper, we present a survey of potential essential technologies in 6G. In particular, we will give an insightful understanding of the paradigms and applications of the future 6G wireless communications by introducing index modulation (IM), artificial intelligence (AI), intelligent reflecting surfaces (IRS), simultaneous wireless information and power transfer (SWIPT), space-air-ground-sea integrated network (SAGSIN), terahertz (THz), visible light communications (VLC), blockchain-enabled wireless network, holographic radio, full-duplex technology (FD), Cell-Free Massive MIMO (CFmMM), and security and privacy problems behind technologies mentioned above.

III. EXISTING SYSTEM

How to explore and exploit the full potential of artificial intelligence (AI) technologies in future wireless communications such as beyond 5G (B5G) and 6G is an extremely hot inter-disciplinary research topic around the world. On the one hand, AI empowers intelligent resource management for wireless communications through powerful learning and automatic adaptation capabilities. On the other hand, embracing AI in wireless communication resource management calls for new network architecture and system models as well as standardized interfaces/protocols/data formats to facilitate the large-scale deployment of AI in future B5G/6G networks.

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DISADVANTAGES

- This paper reviews the state-of-art AI-empowered resource management from the framework perspective down to the methodology perspective, not only considering the radio resource (e.g., spectrum) management but also other types of resources such as computing and caching.
- We also discuss the challenges and opportunities for AI-based resource management to widely deploy AI in future wireless communication networks.

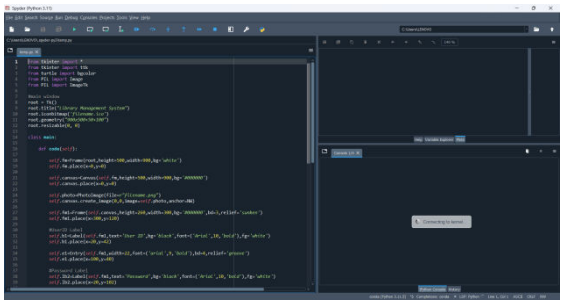
IV. PROPOSED SYSTEM

This research presented an overview of the advancement of artificial intelligence applications towards the 6G wireless communication network. The document has four parts, what 6G promises, the existing gaps and technical challenges, then the role of machine learning in various aspects, then the challenges of including AI/ML.An overview of the applications has been presented along with the literature review. In addition, the challenges and barriers were reported.

ADVANTAGES

- While fifth-generation (5G) communications are being rolled out worldwide, sixth-generation (6G) communications have attracted much attention from both the industry and the academia.
- Compared with 5G, 6G will have a wider frequency band, higher transmission rate, spectrum efficiency, greater connection capacity, shorter delay, wider coverage, and stronger anti-interference capability to satisfy various network requirements.
- In this paper, we present a survey of potential essential technologies in 6G.

OUTPUT RESULT



V. MODULES DESCRIPTION

1. Detecting fire: The flame sensor, gas sensor, and temperature sensor work together to detect the presence of fire. The flame sensor detects the presence of flames, while the gas sensor can detect smoke and other gases associated with a fire. The temperature sensor can detect sudden increases in temperature, indicating a fire.

2. Sending data to the IoT server: The sensors send data to the IoT server, which processes the data and determines if there is a fire. If the server detects a fire, it triggers the alarm and activates the water sprinkler system

3. Activating the alarm: When the IoT server detects a fire, it triggers the buzzer to sound an alarm, alerting people in the area to the presence of a fire.

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4. Activating the sprinkler system: The IoT server also triggers the pump to start pumping water to the sprinkler system. The sprinkler system is designed to extinguish the fire by releasing water over the affected area.

VI. CONCLUSION

We provide a temporal evolution of the wireless communication network generations from 1G to AI-enabled 6G and capture the inherent challenges and technological requirements that lead to the development of a given network generation over a certain period.

We present self-learning models that would be infused in 6G to accommodate the strict requirements of smart city applications in terms of low latency, high reliability, security, energy efficiency, execution time, and context awareness. We propose a taxonomy of distributed, dynamic, and contextual AI applications in 6G networks based on the underlying technology used by those applications. In addition, we provide insights on the requirements of these applications that should be considered by the underlying 6G networks.

We propose future directions toward the realization of a trustworthy and efficient digital ecosystem consisting of intelligent and connected applications, the middleware, the underlying technologies, and the 6G network systems.

VII. FEATURE ENHANCEMENT

It functions interactively, offering guidance to penetration testers during their tasks, even during specific operations. PentestGPT has shown efficiency in handling easy to medium-difficulty problems on platforms like HackTheBox and other 'Capture The Flag' (CTF) challenges. CTF challenges are specific types of cyber security competitions, where participants are required to find and exploit vulnerabilities to 'capture' a specific piece of data, referred to as the 'flag.' These challenges provide a legal and constructive platform for cyber security enthusiasts and professionals to test and improve their skills. Another potential misuse is the automated analysis of code. With a large enough dataset of known software vulnerabilities, an AI model could be used to scan new code for similar weaknesses, identifying potential points of attack. While AI-assisted tools like PentestGPT serve legal and constructive purposes, their underlying principles could be exploited by malicious actors. Such actors could potentially develop similar models to automate unethical hacking procedures. If these models are programmed to identify vulnerabilities, generate strategies to exploit them, and subsequently execute these strategies, they could pose substantial threats to cyber security.

REFERENCES

[1] H. Sun, X. Chen, Q. Shi, M. Hong, X. Fu, and N. D. Sidiropoulos, "Learning to optimize: Training deep neural networks for interference management," IEEE Trans. Signal Process., vol. 66, pp. 5438 – 5453, Oct. 2018.
[2] W. Lee, M. Kim, and D.-H. Cho, "Deep power control: Transmit power control scheme based on convolutional neural network," IEEE Commun. Lett., vol. 22, pp. 1276–1279, Apr. 2018.
[3] F. Liang, C. Shen, W. Yu, and F. Wu, "Towards optimal power control via ensembling deep neural networks," IEEE Trans. Commun., vol. 68, no. 3, pp. 1760–1776, 2020.
[4] Y. Shen, Y. Shi, J. Zhang, and K. B. Letaief, "LORM: Learning to optimize for resource management in wireless networks with few training samples," IEEE Trans. Wireless Commun., vol. 19, no. 1, pp. 665–679, 2020.
[5] Y. S. Nasir and D. Guo, "Multi-agent deep reinforcement learning for dynamic power allocation in wireless networks," IEEE J. Sel. Areas Commun., vol. 37, no. 10, pp. 2239–2250, 2019.
[6] L. Huang, S. Bi, and Y.-J. A. Zhang, "Deep reinforcement learning for online computation offloading in wireless powered mobile-edge computing networks," IEEE Trans. Mobile Comput., vol. 19, no. 11, pp. 2581–2593, 2019.
[7] Y. Shen, Y. Shi, J. Zhang, and K. B. Letaief, "Graph neural networks for scalable radio resource management: Architecture design and theoretical analysis," IEEE J. Sel. Areas Commun., Jan. 2021.
[8] T. Jiang, H. V. Cheng, and W. Yu, "Learning to beamform for intelligent reflecting surface with implicit hannel estimate," arXiv preprint arXiv:2009.14404, 2020.
[9] W. Cui, K. Shen, and W. Yu, "Spatial deep learning for wireless scheduling," IEEE J. Sel. Areas Commun., vol. 37, Jun. 2019.
[10] H. He, C.-K. Wen, S. Jin, and G. Y. Li, "Deep learning-based channel estimation for beamspacemmwave massive MIMO systems," IEEE Wireless Commun. Letters, vol. 7, no. 5, pp. 852–855, 2018.

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