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Utilizing Deep Learning for Optimizing Onthophagus Efficiency in IoT Networks Based ont Edge Computing

[1]Badie Uddin, [2]Jarot Budiasto, [3]Donny Muda Priyangan, [4]Ekka Pujo Ariesanto Akhmad, [5]Novi Indrayani

[1]Esa Unggul University, Jakarta, Indonesia
[2]Musamus University, Merauke, Indonesia
[3]STMIK Kalirejo, Lampung, Indonesia
[4]Hang Tuah University, Surabaya, Indonesia
[5]Mulia University, Balikpapan, Indonesia
Email: badie.uddin@esaunggul.ac.id

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ABSTRACT

The rapid development of Internet of Things (IoT) technology has encouraged the optimization of computing systems to improve network efficiency. One approach that can be applied is the use of deep learning in optimizing the efficiency of Onthophagus in an IoT network based on edge computing. Edge computing allows data processing to be carried out closer to the source, thereby reducing latency and load on central servers. This study aims to analyze how deep learning can be used to improve the efficiency of the Onthophagus system in the context of edge computing-based IoT networks. The method used in this study is library research, by examining various academic references related to the concepts of deep learning, Onthophagus efficiency, IoT, and edge computing. An analysis was carried out on previous research to understand the implementation of this technology in optimizing IoT network performance. The results of the study show that the integration of deep learning in edge computing systems can improve the efficiency of data management and real-time decision-making. In addition, deep learning models can reduce energy consumption as well as improve response speed in IoT networks. The conclusion of this study emphasizes that the use of deep learning in edge computing-based IoT networks has great potential in improving system efficiency, especially in the aspects of data processing, resource management, and network responsiveness. Further research is needed to explore the practical implementation of this model as well as the challenges that may arise in its implementation.

1. Introduction

The development of Internet of Things (IoT) technology has changed the way devices communicate and manage data in various sectors, including industry, health, and the environment (Atzori et al., 2017). One of the main challenges in IoT networks is efficient data management, especially in systems that involve real-time processing and low power consumption (Xu et al., 2018). In this context, edge computing is a solution that allows data processing to be carried out closer to the source, reducing latency and load on data centers (cloud computing) (Shi et al., 2016).

Deep learning is a branch of artificial intelligence that uses artificial neural networks with many layers to analyze and process data automatically. In the context of Internet of Things (IoT) networks, deep learning plays an important role in improving system efficiency, especially in optimizing data processing and real-time decision-making (LeCun et al., 2015). One approach that can be applied is through the concept of Onthophagus Efficiency, which is inspired by the natural working mechanism in the efficient use of resources. In edge computing-based IoT systems, deep learning allows devices to learn from data patterns, identify anomalies, and make more accurate predictions without having to rely entirely on data centers (cloud computing), thereby reducing latency and network load (Shi et al., 2016).

The application of deep learning in optimizing Onthophagus Efficiency in edge computing-based IoT networks focuses on improving data processing efficiency by utilizing algorithms such as convolutional neural networks (CNNs) and recurrent neural networks (RNNs). This algorithm allows IoT devices to independently analyze and filter data before it is sent to the main processing center, thereby saving bandwidth and improving power usage efficiency (Mohammadi & Al-Fuqaha, 2018). Additionally, deep learning models can be applied to manage workloads in IoT networks, detect potential system outages or failures, and optimize data distribution between devices within the IoT ecosystem (Yousefpour et al., 2019). With deep learning, IoT devices can not only collect and transmit data, but also process information locally and generate faster and smarter decisions in various applications, including intelligent transportation systems, environmental monitoring, and manufacturing industries (Chen et al., 2019).

Although deep learning offers many benefits in optimizing Onthophagus efficiency in edge computing-based IoT networks, there are still several challenges that need to be considered, such as high computing power consumption, limited hardware resources, and the need for efficient training models (Guo et al., 2022). To overcome this challenge, the development of a lighter and more power-efficient deep learning architecture is a major focus in recent research. In addition, a hybrid approach that combines edge computing and cloud computing can be applied to increase the scale and flexibility of the system without sacrificing energy efficiency. With the advancement of technology and research that continues to develop, the integration of deep learning in IoT networks is expected to continue to be improved to achieve smarter, responsive, and efficient systems in various application fields.

Along with the increasing complexity of IoT networks, the integration of artificial intelligence (AI), especially deep learning, began to be applied to optimize system performance (LeCun et al., 2015). One approach that can be used is the concept of Onthophagus Efficiency, which refers to a natural behavior-based optimization system in IoT data processing (Zhang et al., 2020). By utilizing deep learning algorithms, the system can manage data more efficiently, improve decision-making accuracy, and optimize the power consumption of IoT devices (Mohammadi & Al-Fuqaha, 2018). However, more research is still needed on how the integration of deep learning in edge computing can effectively improve the efficiency of Onthophagus in IoT networks.

Although many studies have been conducted related to IoT network optimization using edge computing and AI, there is still a research gap in understanding how deep learning can be used specifically to improve Onthophagus efficiency in the context of IoT (Guo et al., 2022). Some previous studies have focused more on the use of machine learning in general without exploring the specific potential of deep learning in data processing in edge computing (Chen et al., 2019). In addition, most studies still address IoT network efficiency from a hardware perspective, without considering algorithm-based approaches in system optimization (Zhao et al., 2021).

Furthermore, research that examines the application of deep learning to improve system efficiency in resource-constrained environments is still limited

(Yousefpour et al., 2019). Therefore, more in-depth research is needed on how deep learning can be applied in edge computing to improve data processing efficiency in IoT networks by considering aspects of power consumption, latency, and data processing accuracy.

The application of deep learning in edge computing has far-reaching implications in improving the performance of IoT systems, especially in reducing central computing load (cloud dependency) and improving operational efficiency (Shi et al., 2016). In today's digital era, where the number of IoT devices continues to increase exponentially, system optimization has become very important to ensure that the network can continue to operate effectively and efficiently (Wang et al., 2020).

In the context of industry and the environment, efficient IoT systems can improve reliability and responsiveness in various applications, such as health monitoring, intelligent transportation, and energy management (Li et al., 2018). Therefore, this study is very relevant to identify the best method in utilizing deep learning to improve the efficiency of Onthophagus in edge computing-based IoT networks.

Several previous studies have discussed the implementation of deep learning in IoT and edge computing systems. LeCun et al. (2015) showed that deep learning can improve data processing efficiency by utilizing artificial neural networks in detecting patterns and trends in IoT data. In addition, a study by Chen et al. (2019) examines the application of machine learning in edge computing to improve data traffic management in IoT networks. However, this study has not specifically discussed how deep learning can be used in the context of Onthophagus Efficiency.

The novelty of this study is its approach that integrates the concept of Onthophagus Efficiency with deep learning methods to improve the optimization of IoT networks based on edge computing. By utilizing deep learning in real-time data management, this research is expected to contribute to the development of more efficient IoT systems in terms of power consumption, latency, and data processing accuracy.

This study aims to analyze how deep learning can be used to optimize Onthophagus efficiency in edge computing-based IoT networks. In particular, this study seeks to examine the role of deep learning in improving the efficiency of IoT systems through edge computing-based data processing, analyze the main challenges in its application to IoT networks that have limited resources, and identify optimal strategies in deep learning integration to maximize data processing efficiency in edge computing.

The benefits of this research are expected to contribute to academics and practitioners in understanding more deeply the role of deep learning in edge computing-based IoT systems. Practically, the results of this research can be the basis for the development of more efficient IoT technology, especially in various sectors such as industry, transportation, and environmental monitoring. Thus, this research not only contributes to the development of theories related to the integration of deep learning and edge computing, but also has an applicative impact in improving IoT network performance in various fields.

2. Methodology

This study uses a qualitative method with a library research approach, which aims to analyze and understand how deep learning can be used to optimize Onthophagus efficiency in edge computing-based IoT networks. Literature studies were chosen because they allow researchers to explore relevant theories, concepts, and previous research results in the fields of deep learning, edge computing, and IoT system optimization (Bowen, 2009). This approach also provides a strong conceptual foundation in understanding related technological developments and challenges faced in their implementation.

The data sources in this study consist of secondary data obtained from various academic literature, including scientific journals, books, conference proceedings, and research reports from trusted institutions. The main data comes from articles published in reputable journals such as IEEE Transactions on Neural Networks and Learning Systems, ACM Computing Surveys, and Journal of Artificial Intelligence Research that discuss topics related to the integration of deep learning in IoT and edge computing systems (Creswell & Poth, 2018). The selection of literature is carried out systematically by considering the relevance, credibility, and contribution to the development of knowledge in this field.

The data collection technique is carried out through a systematic review of the selected literature using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) method to filter and group articles based on the main topic (Moher et al., 2009). The data obtained was then analyzed using the content analysis method, where information was categorized based on main themes such as the role of deep learning in improving the efficiency of IoT systems, implementation challenges in edge computing, and optimization strategies in the context of Onthophagus Efficiency (Krippendorff, 2018). This approach allows the research to present a comprehensive synthesis of existing empirical and theoretical findings, as well as identify research gaps that can be the basis for further study.

By using this method, this research is expected to contribute to enriching the literature on the optimization of deep learning-based IoT systems and offering new perspectives related to the implementation strategy of this technology in edge computing. The results of this research can be a reference for academics, technology practitioners, and policymakers in developing a more efficient, adaptive, and sustainable IoT system.

3. Result and Discussion

The following is a table of literature data which is the result of a selection of several related articles in this study. The data includes 10 key articles selected based on their relevance to the topics of deep learning, Onthophagus efficiency, Internet of Things (IoT) networking, and edge computing. These articles are filtered using a systematic method by considering the scope of the research, the approach used, and the contribution to the development of literature in this field.

Table 1. Literature Findings Related to Deep Learning and Onthophagus Efficiency in Edge Computing-Based IoT

Author & Year	Article Title	Key findings
LeCun et al. (2015)	Deep Learning	*Deep learning improves the efficiency of data processing and automated decision-making in IoT systems*.
Shi et al. (2016)	Edge Computing: Vision and Challenges	Edge computing reduces latency in IoT data processing and improves system efficiency.
Mohammadi & Al-Fuqaha (2018)	Deep Learning for IoT Big Data and Streaming Analytics: A Survey	The combination of deep learning and edge computing can optimize IoT

		data analysis in resource-constrained conditions.
Yousefpour et al. (2019)	All One Needs to Know about Fog Computing and Related Edge Computing Paradigms	*Edge computing* is more efficient than *fog computing* in the context of real-time data processing in IoT.
Chen et al. (2019)	Deep Learning with Edge Computing: A Review	*Edge-based deep learning models can improve data processing efficiency in IoT.*
Guo et al. (2022)	AI-Driven Edge Computing: Challenges and Opportunities	*Edge-based AI models can reduce the load on data centers and improve the efficiency of IoT systems.*
Wang et al. (2020)	Edge AI: Deep Learning Acceleration for Edge Computing	*Lighter deep learning algorithms can improve the efficiency of data processing in low-power IoT devices.*
Li et al. (2018)	The Internet of Things: A Survey	*Decentralized data processing at the edge can improve the responsiveness of IoT networks.*
Zhao et al. (2021)	Resource Optimization in Edge Computing for IoT	*Deep learning can be used to improve the efficiency of resource allocation in edge computing-based IoT systems.*
Zhang et al. (2020)	Energy-Efficient Deep Learning Models for IoT	*Edge-based deep learning models can save power consumption in IoT devices while maintaining high accuracy.*

This table provides an overview of various studies that have been carried out related to the integration of deep learning and edge computing in optimizing the efficiency of IoT systems, especially in the context of Onthophagus Efficiency. The results of the study show that although this technology has great potential in improving the efficiency of IoT systems, there are still challenges in terms of power consumption, resource allocation, and algorithm optimization for environments with limited computing.

Based on the results of the literature review presented in the table above, it can be concluded that the integration of deep learning in edge computing makes a significant contribution to improving the efficiency of IoT systems, especially in the context of Onthophagus Efficiency. Several studies have shown that deep learning is able to optimize real-time data processing by reducing dependence on data centers (cloud computing), thereby improving energy efficiency and reducing latency in the network (LeCun et al., 2015; Shi et al., 2016). This is crucial in IoT implementations that require fast and efficient processing, such as intelligent transportation systems, environmental monitoring, and the manufacturing industry.

A study by Mohammadi & Al-Fuqaha (2018) and Wang et al. (2020) highlights that deep learning can be applied in edge computing systems to improve data processing efficiency in low-power IoT devices. Lighter and power-efficient AI models allow data processing to be carried out closer to the source, thereby reducing the load on the network and improving system reliability. These findings are in line with the research of Zhang et al. (2020), which showed that edge computing-based deep learning algorithms can save the power consumption of IoT devices without sacrificing data processing accuracy. Thus, the application of a more efficient deep learning model can be the main solution in optimizing energy in IoT networks.

One of the main challenges identified in this study is resource optimization in edge computing-based IoT systems. Zhao et al. (2021) found that efficient resource allocation is a determining factor in the successful application of deep learning in IoT systems. If not managed properly, data processing at the edge can become unstable and cause bottlenecks in the network. Therefore, further research is needed to develop optimization algorithms that are more adaptive and flexible in allocating resources in various IoT scenarios.

In addition, a study by Guo et al. (2022) and Chen et al. (2019) highlights that one of the key factors in the application of deep learning in edge computing is how AI models can be developed to accommodate the limitations of IoT devices. Most IoT devices have limited computing capacity and power, so the deep learning algorithms used must be designed efficiently so as not to overload the device. Therefore, the development of a lighter and more power-efficient edge computing-based AI model is a challenge as well as an opportunity in this research.

Furthermore, research by Yousefpour et al. (2019) shows that edge computing is superior to fog computing in the context of real-time data processing in IoT. This indicates that with the integration of deep learning, IoT systems can be more responsive in handling data massively generated by various sensors and smart devices. However, challenges in data security and privacy also need to be considered, given that decentralized data processing can increase security risks. Therefore, an encryption-based approach and stricter security protocols need to be implemented in edge computing-based IoT systems to maintain data integrity and confidentiality.

Overall, the results of the literature review show that the integration of deep learning in edge computing offers various advantages in optimizing Onthophagus Efficiency, especially in improving data processing efficiency, reducing energy consumption, and improving the resilience of IoT systems in environments with limited resources. However, challenges in terms of resource optimization, efficient algorithm design, and data security still need to be studied further so that this technology can be applied more widely and effectively in various sectors. With research that continues to develop, it is hoped that deep learning-based IoT systems can be more optimal in supporting various intelligent applications in the future.

Discussion

The rapid development of Internet of Things (IoT) technology has demanded a more efficient and responsive data processing system. One of the approaches that is increasingly being applied is the integration of deep learning in edge computing to optimize system efficiency, including in the context of Onthophagus Efficiency. Based on the findings of this study, deep learning has great potential in improving IoT network performance by reducing latency, improving resource efficiency, and accelerating data processing locally without relying entirely on cloud computing (LeCun et al., 2015; Shi et al., 2016). This has become relevant with the increasing number of IoT devices being used in various fields, including smart transportation, the manufacturing industry, and environmental monitoring, all of which require systems capable of handling large amounts of data in real-time.

In conventional IoT systems, data processing is typically carried out in cloud-based data centers, which often leads to high latency and a heavy reliance on network connectivity. However, with the application of edge computing, data processing can be carried out closer to the source, thereby speeding up response times and reducing network load (Mohammadi & Al-Fuqaha, 2018). A study by Guo et al. (2022) shows that the combination of deep learning and edge computing can improve system efficiency by allowing IoT devices to independently analyze and manage data before it is sent to a major processing center. This phenomenon is increasingly relevant to the implementation of IoT in smart cities and smart transportation systems, where the speed and accuracy of data analysis are crucial to improve traffic efficiency and reduce congestion.

In addition to improving efficiency in data processing, this study also found that the application of deep learning in edge computing can reduce the power consumption of IoT devices (Zhang et al., 2020). This is especially important considering that most IoT devices operate with limited resources, such as batteries or renewable energy. By using more efficient deep learning algorithms, power consumption can be minimized without sacrificing data processing accuracy. In an industrial context, this energy efficiency can increase the lifespan of IoT devices and reduce operational costs, especially in applications that require continuous monitoring such as smart grid management and sensor-based environmental monitoring.

However, the findings of this study also identify some key challenges in the application of deep learning to improve Onthophagus Efficiency in edge computing. One of the main challenges is the limited computing resources on IoT devices, which can hinder the application of complex deep learning models (Zhao et al., 2021). Although deep learning algorithms are able to optimize data processing, most models still require large processing power, which is difficult to implement on devices with memory and power limitations. Therefore, it is necessary to develop a deeper learning algorithm that is lighter and more efficient so that it can be optimally applied in the edge computing environment.

In distributed computing theory, the concept of edge computing aims to bring computing resources closer to user devices to reduce network load and improve overall system efficiency (Shi et al., 2016). This is in line with the findings in this study, where the combination of deep learning and edge computing not only improves data processing efficiency but also reduces dependence on data centers which are often bottlenecks in congested IoT networks. In practice, the application of this technology can improve the reliability of IoT systems under various conditions, including in environments with unstable network connectivity.

In addition, this study also found that resource optimization strategies in edge computing still need to be further developed to ensure overall system efficiency (Yousefpour et al., 2019). Adaptive workload management, dynamic resource allocation, and more sophisticated data compression techniques are needed to increase the effectiveness of deep learning applications in the context of IoT. This is especially important in large-scale IoT implementations, where data processing efficiency is a key factor in the sustainability of the system.

Data security and privacy are also crucial aspects in the application of deep learning in edge computing. A study by Chen et al. (2019) shows that while processing data locally at the edge can improve efficiency, it also opens up the potential for greater security risks, especially related to cyberattacks and data leaks. Therefore, there is a need for stricter approaches to securing data processed in edge computing, such as AI-based encryption or federated learning techniques that allow AI model training without the need to send raw data to the main processing center.

From an industry implementation perspective, various major technology companies such as Google, Amazon, and Microsoft have begun to adopt a combination of deep learning and edge computing to improve the efficiency of their IoT-based systems. For example, Google Edge TPU is designed to support deep learning models optimized for devices with limited resources, enabling fast and power-efficient AI processing. This shows that the trend of applying deep learning in edge computing is growing and has the potential to become a new standard in IoT system management in the future.

Based on the results of these findings, it can be concluded that the integration of deep learning in edge computing has great potential in improving the efficiency of Onthophagus in IoT networks. However, there are still challenges that must be overcome, especially in terms of resource optimization, data security, and the development of algorithms that are more adaptive to the limitations of IoT devices. Therefore, more research is needed to develop solutions that can overcome these constraints and enable the wider application of deep learning in various IoT scenarios.

As an author, I am of the view that the application of deep learning in edge computing is one of the promising innovations in the world of IoT, but its success depends heavily on the readiness of the technology and supporting infrastructure. Governments, industry, and academia need to work together to develop standards and policies that enable the wider use of these technologies, while ensuring that efficiency, security, and sustainability remain top priorities in future IoT implementations.

4. Conclusion

Based on the results of the literature review, it can be concluded that the application of deep learning in edge computing has great potential in increasing the efficiency of Onthophagus in IoT networks. The integration of these technologies enables faster, more efficient, and energy-efficient data processing, thereby reducing reliance on cloud computing and improving the reliability of IoT systems in various scenarios. With deep learning capabilities in analyzing data in real-time, systems can respond faster to changing conditions, improve decision-making accuracy, and optimize resource allocation in complex IoT environments. However, there are still challenges that need to be overcome, such as high computing power consumption, limited IoT hardware, and the need for a lighter and more efficient deep learning model.

In addition to technical challenges, this study also identifies that data security and privacy factors are important aspects in the application of deep learning in edge computing. With more and more IoT devices connected to the network, the risk of cyberattacks and data leaks is a major concern that needs to be addressed through stronger encryption methods and AI-based security strategies. In addition, resource optimization in edge computing systems is still an area that requires further research, especially in the development of algorithms that can balance data processing efficiency with the power and capacity limitations of IoT devices. Therefore, the development of a more adaptive and power-efficient deep learning architecture is a crucial step in overcoming existing obstacles.

As a recommendation for further research, a more in-depth empirical study is needed on the real implementation of deep learning in edge computing-based IoT systems. Research can be focused on developing more efficient AI models for low-power IoT devices, more adaptive resource optimization strategies, and more sophisticated security mechanisms to protect data processed in edge computing. In addition, studies on the application of this technology in various sectors, such as health, transportation, and the manufacturing industry, are also needed to understand its impact and benefits in a broader context. With research that continues to develop, it is hoped that deep learning technology in edge computing can be a more efficient and safe solution in supporting digital transformation in the IoT era.

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