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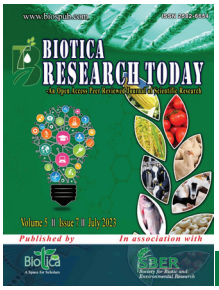

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Prospects for the Development of an Artificial Intelligence: Parasites Diagnosis System in Mithun and Allied Bovines

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Abstract

Parasites have detrimental effects on animal health and welfare, leading to clinical and subclinical parasitism. While parasitic infections may not always exhibit obvious disease symptoms, they result in reduced production, including slowed growth, decreased appetite and poor feed conversion. Microscopy is a commonly used method to diagnose livestock parasitic infections, but it presents challenges such as being time-consuming, labour-intensive, requiring specialized equipment and trained researchers. The NEH (North Eastern Hill) region of India faces additional difficulties in finding experts promptly due to limited resources and geographical constraints, resulting in economic losses for farmers, including reduced milk output, meat production and occasional animal mortality. To address this problem, a smart system utilizing AI (Artificial Intelligence) could offer a viable solution by accurately identifying and diagnosing parasitic infections. Such a system would mitigate the scarcity of professionals in the NEH region, providing effective identification and diagnostics of parasite management in livestock.

Keywords: Artificial intelligence, Machine learning, CNN, Parasites

Introduction

AI (Artificial Intelligence) is a multi-faceted field with many descriptions and interpretations. However, most experts agree that the heart of AI lies in the research theories, methods, technologies and applications that enable us to simulate, extend and expand human intelligence (Jiang *et al.*, 2022). Computer vision is a subfield of AI and computer science concerned with allowing computers to interpret and understand visual data, such as digital images and videos. The ultimate goal of computer vision is to replicate the sophisticated capabilities of human vision, including image recognition, object detection and scene understanding, among others (Bekhit, 2021). In the proposed project, computer vision will be used to detect the parasite egg/ adult parasites from the microscopic image of helminth parasites to identify the parasitic infections, which are typically done via human vision. While using computer vision, CNNs (Convolutional Neural Networks) will be used to classify the microscopic images for developing a user-friendly model to monitor parasitic infections in livestock of the North-Eastern region. Many image-understanding tasks have been accomplished by CNNs, surpassing the performance of human experts and establishing them as practical tools in this domain. CNN has numerous applications in image and signal processing, natural language processing and data analytics, but its major breakthrough came with Google Net's implementation for cancer detection, which achieved an impressive 89% accuracy rate, surpassing the 70% accuracy rate achieved by human pathologists (Sarvamangala and Kulkarni, 2022). This technique is usually trained on large datasets of labelled images to learn to recognize patterns and features within the images associated with specific categories. Further, the developed model can be made available to access through smartphones which will play an essential role in the ease of access of our model. Easy access to such a model definitely reduce the need for well-trained professionals.

Article History

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Knowledge/ Technology Gaps

Parasitic infections have detrimental effects on animal productivity, health and finances. Internal helminths, such as roundworms, tapeworms and flukes, cause morbidity and mortality. Cow parasite illnesses, for instance, lead to milk production reductions and organ condemnation, resulting in average annual losses of US$ 50.67 animal^{-1} and 17.94% in value. In Northeast India, limited resources and difficult terrain hinder access to experts, leading to economic losses. Strategic anthelmintic treatments can yield significant economic gains. To address the shortage of experts and improve disease identification and diagnosis, an alternative solution is required. AI offers the potential for accurate disease identification and management, reducing human errors. AI-based smart systems can effectively tackle the challenges faced by farmers in the region. The use of AI in disease identification provides timely and accurate diagnoses, mitigating economic losses. Implementing an AI-based smart system for identifying and diagnosing parasitic infections in livestock can enhance disease management, minimize losses and ensure profitable farming in the NEH region of India.

Key Questions

In past, numerous researchers applied AI to identify diseases as well as for their diagnosis in living beings and in plants. Thus, the hypothesis of the present study is that AI can be used for the identification of parasitic infections in animals of the NEH region as well as can be implemented for their diagnosis too. Thus, the present study is proposed to develop an artificial intelligence-based smart system to identify and diagnose parasitic infections in livestock.

1. Can the identification of parasite infections of animals in the NEH region be done accurately using artificial intelligence?

2. Can artificial intelligence efficiently diagnose prevalent parasite infections that have been recorded in the region?

3. Does artificial intelligence have the ability to replace experts in the identification and diagnosis of livestock's infections in remote locations of the NEH region?

Present Status of the AI Technology in Health Applications at International Levels

AI research in disease diagnosis has made significant advancements in the global scenario. The use of AI techniques, such as machine learning and deep learning, has shown promise in improving disease detection, diagnosis and treatment across various medical fields. Here are some notable developments and applications.

Medical Imaging

AI has been extensively applied to medical imaging, including radiology, pathology and dermatology. AI algorithms can analyze medical images, such as X-rays, MRIs and histopathology slides, to aid in the detection and diagnosis of diseases like cancer, cardiovascular conditions and neurological disorders.

Clinical Decision Support Systems

AI-powered decision support systems aid healthcare professionals in achieving precise and prompt diagnoses by utilizing patient data, electronic health records and medical literature. These systems rely on evidence-based guidelines to offer recommendations and treatment strategies.

Precision Medicine

AI plays a crucial role in personalized medicine by analyzing large-scale genomic and molecular data. It helps identify genetic markers, predict disease risks and tailor treatments to individual patients, enhancing precision and effectiveness.

Infectious Disease Detection

AI algorithms have been deployed for early detection and tracking of infectious diseases. By analyzing data from various sources like social media, internet searches and healthcare records, AI can identify patterns and predict outbreaks, aiding in proactive public health measures.

Remote Monitoring and Telemedicine

AI-enabled remote monitoring systems and telemedicine platforms allow continuous monitoring of patient's health parameters, such as vital signs or symptoms. AI algorithms can analyze the collected data to detect abnormalities and provide real-time alerts to healthcare providers, facilitating timely interventions.

Drug Discovery and Development

The drug discovery process is undergoing a transformation with the help of AI, which speeds up the identification of potential drug candidates, forecasts drug-target interactions and enhances the optimization of clinical trials. This holds promise for expediting the advancement of new treatments and enhancing therapeutic outcomes.

Li *et al.* (2020) applied the AI technique in veterinary medicine, an AI technique employing thoracic radiographs is utilized to identify left atrial enlargement in canines and its results are compared with interpretations made by veterinary radiologists. While the accuracy of the accuracy-driven convolutional neural network algorithm and veterinary radiologists was the same overall, there was an 85.19% agreement between the two approaches. This study serves as evidence of the feasibility of employing deep learning techniques for computer-aided diagnosis in veterinary medicine.

Fuentes *et al.* (2020) proposed a system based on artificial intelligence (AI) is implemented to decrease heat stress and enhance or sustain a desired level of milk quality in a traditional dairy farm with minimal technological modifications. Although research on AI has demonstrated encouraging outcomes, there remain obstacles to surmount, such as ensuring data quality, addressing privacy concerns, establishing regulatory frameworks and guaranteeing the transparent and ethical utilization of AI in healthcare. It is imperative for AI experts, healthcare professionals and regulatory bodies to collaborate closely to fully leverage the potential of AI in disease diagnosis and enhance healthcare outcomes worldwide.

Present Status of the AI Technology Health Application at National Levels

The ICAR-National Institute of Veterinary Epidemiology

and Disease Informatics (ICAR-NIVEDI) has devised an AI-based system called NADRES (National Animal Disease Referral Expert System). NADRES acts as a platform that integrates and coordinates alert and response mechanisms among stakeholders involved in predicting, preventing and managing animal disease threats, including zoonotic diseases. This system enables the exchange of data, epidemiological studies and field missions to evaluate and forestall outbreaks when necessary. With the aid of AI, NADRES can effectively analyze and interpret vast amounts of data, offering valuable insights for disease surveillance and control.

The system's use of AI enables the processing and analysis of complex data sets, allowing for the identification of patterns, trends and risk factors associated with animal diseases. By leveraging advanced technologies, NADRES contributes to the overall goal of minimizing the impact of animal diseases on livestock health, public health and the economy.

AI Model in Animal Science Research

AI models have been increasingly used in animal science research to analyze complex data, make predictions and assist in decision-making. Here are some areas where AI models have been applied in animal science.

Animal Behavior Analysis

AI models can analyze video footage or sensor data to automatically identify and track animals, understand their behaviour patterns and detect abnormal behaviour. This can help researchers study animal welfare, social interactions and responses to various environmental factors.

Disease Diagnosis and Monitoring

AI models can be trained on large datasets of animal health records, genetic information and diagnostic images to identify diseases or conditions in animals. For example, machine learning algorithms can analyze veterinary diagnostic images, such as X-rays or ultrasound scans, to detect abnormalities or specific diseases in livestock or companion animals.

Precision Livestock Farming

AI models can be used to optimize livestock production by monitoring individual animals' health, growth and behaviour. Sensors and wearable devices can collect data on parameters such as feed intake, body temperature, activity levels and rumination patterns. AI models can then analyze these data to provide real-time insights for early disease detection, optimal feeding strategies and improved overall animal management.

Genetics and Breeding

AI models can aid in animal breeding programs by predicting genetic traits and selecting animals with desirable traits. Machine learning algorithms can analyze large genomic datasets to identify genetic markers associated with specific traits, such as disease resistance, milk production, or meat quality. This information can be used to guide breeding decisions and improve the efficiency of animal breeding programs.

Environmental Impact Assessment

AI models can analyze the environmental impact of animal farming practices. By integrating data on animal nutrition, waste management and emissions, AI models can help assess and optimize the sustainability of animal production systems. This includes predicting and mitigating the environmental impact of livestock farming on air quality, water resources and greenhouse gas emissions.

Wildlife Conservation

AI models can assist in wildlife conservation efforts by analyzing large-scale ecological data, such as camera trap images or acoustic recordings. These models can help identify and track endangered species, monitor population dynamics, detect poaching activities and assess habitat suitability for conservation planning.

These are just a few examples of how AI models are being used in animal science research. The application of AI in this field continues to evolve, opening up new opportunities for improving animal welfare, production efficiency and environmental sustainability.

Expected Benefit of AI in Parasitic Disease Diagnosis

An AI-powered computer vision system can analyze microscopic images of parasites in livestock samples, automatically detecting and classifying them accurately. This system eliminates the need for manual intervention and reduces human error, improving diagnosis efficiency. It goes beyond identification, providing recommendations for treatment, prevention and management based on image analysis. Implementing this system in the NEH region offers accessibility to accurate and timely diagnosis, especially in remote areas. It enhances efficiency by processing images rapidly, enabling quick decision-making and potentially minimizing losses. The system's AI algorithms and CNN models ensure precise and consistent results, contributing to capacity building and local expertise development. However, human experts should still play a crucial role in validating and overseeing the system's analysis to ensure the best outcomes. Overall, implementing an intelligent computer vision system using CNN for diagnosing parasitic infections in livestock has the potential to benefit farmers, reduce economic losses and improve animal health and productivity in the NEH region of India.

Conclusion

Parasites negatively impact animal health, causing clinical and subclinical parasitism. Although parasitic infections may not exhibit apparent disease symptoms, they result in production loss, including growth depression, reduced appetite and poor feed conversion. Microscopy is commonly used for diagnosis, but it is challenging, time-consuming and requires trained researchers and equipment. In the NEH region, accessing experts is difficult due to limited resources and geography, leading to economic losses in milk output, meat production and animal mortality. Therefore, an alternative system is needed for identifying and diagnosing parasitic infections. An AI-based smart system could be a viable solution to the lack of professionals in the NEH region,

effectively identifying and diagnosing parasite infections in livestock.

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References

Bekhit, A.F., 2021. Introduction to Computer Vision. In: *Computer Vision and Augmented Reality in iOS: OpenCV and ARKit Applications*. (Ed.) Bekhit, A.F. Apress publisher. pp. 1-20.

Fuentes, S., Viejo, C.G., Cullen, B., Tongson, E., Chauhan, S.S., Dunshea, F.R., 2020. Artificial intelligence applied to a robotic dairy farm to model milk productivity and quality based on cow data and daily environmental parameters. *Sensors* 20(10), 2975. DOI: https://doi.org/10.3390/s20102975.

Jiang, Y., Li, X., Luo, H., Yin, S., Kaynak, O., 2022. Quo vadis artificial intelligence. *Discover Artificial Intelligence* 2, 4. DOI: https://doi.org/10.1007/s44163-022-00022-8.

Li, S., Wang, Z., Visser, L.C., Wisner, E.R., Cheng, H., 2020. Pilot study: Application of artificial intelligence for detecting left atrial enlargement on canine thoracic radiographs. *Vet Radiol Ultrasound* 61(6), 611-618. DOI: https://doi.org/10.1111/vru.12901.

Sarvamangala, D.R., Kulkarni, R.V., 2022. Convolutional neural networks in medical image understanding: a survey. *Evolutionary Intelligence* 15(1), 1-22. DOI: https://doi.org/10.1007/s12065-020-00540-3.