

## ARTIFICIAL INTELLIGENCE IN ZOOLOGY: USES IN ANIMAL HEALTH MONITORING AND DISEASE DIAGNOSIS

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### Abstract

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Artificial Intelligence (AI) is revolutionizing veterinary medicine by providing next-generation and scalable technologies for animal health surveillance and diagnostics. Conventional diagnostic techniques, relying on manual observation, laboratory analysis, and interpretation by experts, can be slow, subjective, and ineffective to deal with large data sets. By contrast, AI-based approaches, such as those involving machine and deep learning, computer vision, and sensor technologies, allow for fast, automatic

and precise detection of diseases in animals in different settings. This review gives an overall synthesis of the latest advancements in the use of AI in zoology, including livestock, poultry, companion animals, and wildlife health monitoring. It critically analyzes several important methodologies, such as convolutional neural networks, predictive modeling techniques, and Internet of Things (IoT) enabled systems, their diagnostic features, and their practical implementation. The results emphasize that AI technologies play a critical role in the early detection of diseases, the possibility of real-time monitoring, and the process of decision-making and can ultimately improve the welfare of animals and economic losses in animal production systems. Regardless of these innovations, there are a number of obstacles that still restrict the extensive use of AI in veterinary practice. These are the lack of high-quality annotated datasets, low interpretability of complicated models, ethical issues of data use and animal welfare, and constraints on infrastructures in resource-limited environments. These problems need to be tackled to guarantee the reliability and scalability of AI-based solutions.

Moreover, the growing trends of explainable AI, multimodal data integration, and real-time monitoring systems are seen as the potential future research directions. On the whole, this review highlights the high potential of AI to transform animal healthcare and the need to work interdisciplinary, develop standardized data formats, and create user-friendly technologies to implement changes in a sustainable manner.

**Keywords:** Artificial Intelligence in Zoology, Animal Health Monitoring, Disease Diagnosis, Machine Learning, Deep Learning (CNN), Computer Vision, Internet of Things (IoT)

### Introduction

The health of animals is very important in food security, economic stability and sustainability of the ecosystem around the world. Especially livestock diseases are associated with huge economic losses and pose threats to the animal as well as the human population due to zoonotic transmission. Traditional methods of diagnosis in veterinary medicine usually rely on clinical experience, laboratory, and manual examination, which may be time-consuming, expensive, and subject to variation. Access to veterinary services in most areas, more so in the developing world, is also a contributing factor to the problem of early disease detection and successful health treatment (Farooq et al., 2025).

Artificial Intelligence (AI) has become the buzzword over the past few years as a potent tool that can revolutionize healthcare systems, involving veterinary science. The machine learning (ML), deep learning (DL), and computer vision are AI technologies that can automatically analyse complex data sets, thereby making it possible to detect a disease rapidly and accurately (Mahmud et al., 2021).

As an example, deep learning algorithms have proven to be very accurate in predicting medical images like X-rays and ultrasound scans and help veterinarians detect anomalies and enhance the accuracy of diagnosis. Equally, sensor-driven AI-based livestock monitoring systems have been used more and more frequently to identify the first signs of disease and optimize the management of a herd of livestock based on AI data and predictive models (Neethirajan et., 2025).

The use of AI in animal health can be applied in various fields, such as diagnostic imaging, behavioral analysis, and disease prediction. Recent research states that AI-based tools can be used as decision-support systems, which can improve clinical outcomes, supplementing, but not substituting, human experience. Moreover, progress in explainable AI and interpretable machine learning has enhanced transparency, allowing stakeholders to have a clearer understanding of model predictions and trust AI-based systems better (Jana et al., 2025).

Although these innovations have occurred, there are a number of barriers to the use of AI in veterinary care. They are low access to high-quality annotated datasets, absence of standardized frameworks, ethical issues, and challenges of implementing AI systems in resource-constrained settings. In addition, the existing literature tends to concentrate on particular applications, e.g., imaging or livestock monitoring, but does not offer a synthesis of AI approaches in different areas of animal health (Obisa et al., 2025).

Thus, the purpose of the review is to conduct an extensive and critical evaluation of AI applications in animal health monitoring and disease diagnosis. It is a systematic review of existing methodologies, estimated their effectiveness in various animal industries, major constraints, and research perspectives. This paper aims to address the gaps in knowledge and contribute to the creation of more robust, scalable, and understandable AI-based veterinary healthcare systems by combining the results of recent research studies.

## Literature Review

### 1. Evolution of Artificial Intelligence in Zoology

Application of Artificial Intelligence in zoological sciences has brought a lot of changes in the conventional methods of monitoring animals and testing diseases. Traditionally, the process of animal health evaluation was based on the manual observation, telemetry, and laboratory-based diagnostics, which were labor-intensive and had a low scaling capacity. Recent breakthroughs in AI, especially in machine learning (ML) and deep learning (DL), have made possible automated and non-invasive monitoring systems with the capacity to analyze big data of biological and environmental data in real time.

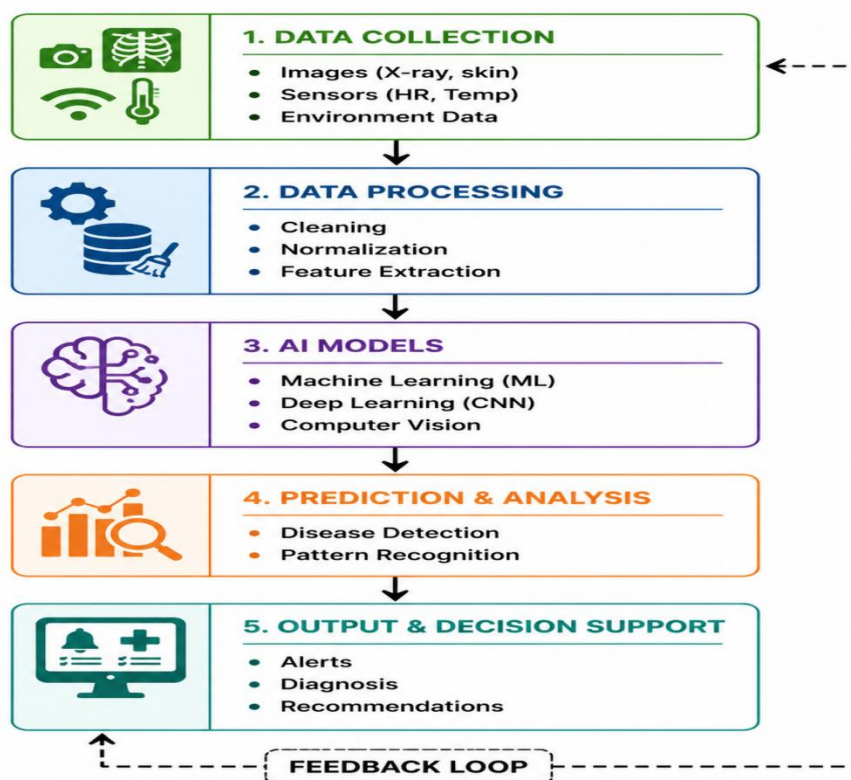
Computer vision and pattern recognition are AI-based methods that are becoming more actively used in wildlife conservation, livestock management, and veterinary diagnostics. As an illustration, deep-learning-based intelligent surveillance systems can detect, classify, track, and analyze animal behavior with great accuracy, which has greatly enhanced ecological monitoring and disease monitoring capacities (Brickson et al., 2023).

### 2. Deep Learning and Computer Vision in Animal Health Monitoring

Deep learning models, in particular the convolutional neural networks (CNNs), have dominated the animal health monitoring systems. The models have been used in disease detection, behavior recognition, and species classification (in images). According to a systematic review of deep learning methods by Rohan et al. (2023), numerous livestock behavior recognition tasks were successfully addressed, and behavioral patterns associated with health conditions.

Likewise, vision-based monitoring systems facilitate the real-time monitoring of animals in controlled and natural settings. Computer vision methods enable the real time detection of abnormalities like impaired mobility, abnormal posture and abnormal feeding habits which are some of the initial signs of illness. Recent research demonstrates that deep learning algorithms like YOLO, Faster R-CNN, and ResNet are effective in detecting and classifying animal health conditions across species (Scott et al., 2024).

*Figure 1: AI Workflow in Animal Health Monitoring*



### 3. AI Applications in Livestock Disease Detection

The use of artificial intelligence is vital in precision livestock farming where it can be used to prevent diseases at an earlier stage and to monitor health in real time. With the help of IoT-based sensor tools and AI algorithms, physiological parameters (heart rate, respiration and movement pattern) can be continuously monitored. The systems produce predictive information, which can be used to detect the onset of diseases before clinical manifestations are observed (Neethirajan et., 2025).

Moreover, RGB camera and thermal camera machine vision systems have also exhibited great possibilities in identifying signs of disease in animals. As an example, RGB imaging

may detect visible changes, like lesions, inflammation, and abnormal posture, whereas thermal imaging may detect fever and inflammation related to infections (Karam et al., 2025).

Another non-invasive diagnostic method which has been extensively studied in the detection of lameness and hoof diseases in cattle is infra-red thermography. Research indicates that changes in temperature of certain parts of the body can be used to detect diseases, which offers a sure way of diagnosing early (Bobic et al., 2025).

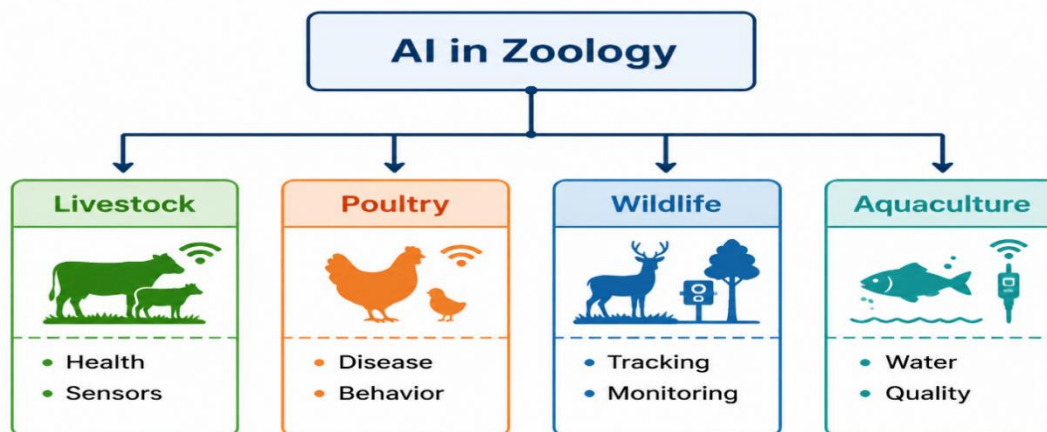
#### 4. AI in Poultry, Aquaculture, and Multi-Species Monitoring

In addition to livestock, AI has been used more in the poultry and aquaculture systems. In poultry farming, AI technologies are used to analyze behavioral patterns, including movement, feeding behavior, and vocalization to identify diseases early and enhance productivity. Such systems are used to minimize mortality and maximize farm management practices (Kalita et al., 2024).

In fish farming, AI-powered systems can measure the water quality parameters of temperature, pH, and dissolved oxygen, which are essential to the health of the fish. An analysis of environmental and biological data by machine learning models can help forecast disease outbreaks in time and apply suitable interventions to mitigate the economic losses (Nawaz et al., 2025).

Also, monitoring systems based on IoT can combine multi-sensor data to offer a holistic perspective of the health of animals of various species. Such systems have been used in beekeeping, fish farming and wildlife monitoring, and illustrate the applicability of AI in zoological applications (Selvarajan et al., 2025).

*Figure 2: CNN-Based Disease Detection Framework*



## 5. AI in Wildlife Monitoring and Conservation

AI has also revolutionized wildlife surveillance to enable population of animals to be observed at a big scale in an uninvasive manner. Camera traps, drones and acoustic sensors using AI algorithms can acquire and process ecological data in large amounts in an efficient way. These systems contribute to the conservation of biodiversity in the sense that they recognize species, track their movement trends, and abnormal behaviors that may be associated with illness or stress (Amonga, 2025).

AI in wildlife conservation has been successfully used to monitor endangered species such as the elephants where machine learning models analyze sensor and imaging data to track movement, threats, and prevent human-animal conflict (Brickson *et al.*, 2023). In addition, AI surveillance will be capable of detecting the entry of animals into human settlements and reduce conflicts and improve safety. In these systems, they use edge computing and deep learning models to provide real-time alerts, and decision support (Krishnan *et al.*, 2026).

## 6. Explainable AI and Decision Support Systems

Despite the effectiveness of AI models, their "black-box" nature has raised concerns regarding transparency and trust in veterinary applications. To address this issue, explainable AI (XAI) techniques have been developed to interpret model predictions and improve decision-making.

Recent studies demonstrate that XAI frameworks, such as SHAP (Shapley Additive Explanations), can identify key features influencing model outputs, enabling veterinarians and farmers to understand the reasoning behind predictions (Janaa *et al.*, 2025).

AI-based decision support systems are increasingly used to assist veterinarians in diagnosing diseases, recommending treatments, and optimizing animal management strategies. These systems integrate data from multiple sources, including sensors, imaging systems, and historical records, to provide actionable insights and improve clinical outcomes. Although AI models can be effective, their black-box nature has cast doubt on the transparency and trust in veterinary use. To solve this problem, explainable AI (XAI) methods have been created to explain model predictions and enhance decision-making.

Recent research shows that XAI models, including SHAPley Additive Explanations, have the ability to tell important features that affect model outputs, allowing veterinarians and farmers to grasp the logic behind predictions.

The use of AI-based decision support systems to support veterinarians in diagnosing diseases, prescribing, and selecting optimal animal management strategies is on the rise.

Such systems combine the information of various sources, such as sensors, imaging systems, and historical records to offer actionable insights and enhance the clinical outcomes.

## 7. Challenges and Research Gaps

Despite significant advancements, several challenges hinder the widespread adoption of AI in zoology and veterinary science. One of the primary limitations is the lack of high-quality, annotated datasets required for training robust AI models. Data variability across species, environments, and farming conditions further complicates model generalization (Nawaz et al., 2025).

Technical challenges such as occlusion, environmental noise, and varying lighting conditions also affect the accuracy of computer vision systems in real-world settings (Rohan et al., 2023). Moreover, ethical concerns related to data privacy, animal welfare, and the use of surveillance technologies must be addressed to ensure responsible implementation. Infrastructure limitations, particularly in developing countries, also pose barriers to the deployment of AI-based systems in veterinary practice.

Even though there has been a massive development, there are a number of obstacles that prevent the use of AI in zoology and veterinary science. The lack of high-quality, annotated datasets to train strong AI models is one of the main limitations. The variability of data in species, environments and farming conditions also complicate the generalization of models.

Computer vision systems should be used in the real world where technical problems like occlusion, environmental noise and other varying lighting conditions also influence the accuracy of the computer vision system.

Also, data privacy, animal welfare, and surveillance technologies are the ethical issues that should be considered to implement them responsibly. Another challenge to the implementation of AI-based systems in veterinary practice is infrastructure constraints, especially in developing nations.

## 8. Future Directions

New developments in AI studies suggest the transition to more complex and integrated animal health-monitoring systems. Multimodal AI solutions that involve visual, behavioral, and physiological data are likely to enhance the accuracy and reliability in diagnosis.

IoT, edge computing, and cloud-based platforms integration will allow real-time monitoring and decision-making and make livestock farming precise and wildlife conservation simple. Also, versions of explainable AI and federated learning will solve the issue of transparency and data sharing.

Future studies must attempt to create standardized datasets, enhance model interpretability, and create scalable AI systems that are able to be deployed in a variety of settings. The interdisciplinary cooperation between zoologists, veterinarians and AI researchers will play the crucial role in further development of this area and the realization of the successful application of AI-based solutions in the healthcare of animals.

### Methodology

In this research, the systematic literature review approach will be applied to critically analyze Artificial Intelligence (AI) role in zoology, and more specifically its usage in animal health monitoring and disease diagnosis. The systematic review design was chosen to provide a well-structured, transparent, and reproducible synthesis of existing research results. Since the study of the topic is interdisciplinary (covering veterinary science, zoology, and artificial intelligence), such a method allows uniting various scientific approaches without sacrificing the methodological rigor of the study. Systematic reviews have become a highly accepted tool in generalizing the scattered pieces of research and pinpointing the trends in fast-paced areas like AI-powered healthcare (Xiao et al., 2025; Hossein-Zadeh, 2025).

A search plan was followed, which included a detailed search in the most relevant academic databases, including Google Scholar, PubMed, Scopus, Web of Science, IEEE Xplore and Science Direct. These platforms are selected on the basis of the fact that they index a vast amount of peer-reviewed literature in the life sciences and computational research. The search was done to exploit the key words and the Boolean operators in such a way that it would enable the search to be as accurate and wide as possible. The keywords included Artificial Intelligence in Zoology, animal health monitoring, machine learning in veterinary diagnosis, deep learning in livestock disease detection, and computer vision in wildlife monitoring, as well as IoT-based animal health systems. The publications of 2020-2026 were searched to ensure that the review is premised on the recent advances in the field of AI technologies and the application thereof. (Mahmud et al., 2021; Neethirajan, 2023).

Inclusion and exclusion criteria were well stipulated to make sure that the literature was of quality and relevant. The studies were selected based on the fact that they concerned the use of AI methods, including machine learning, deep learning, computer vision, and Internet of Things (IoT)-based systems, in the context of animal health monitoring or disease diagnosis. Studies on livestock, poultry, companion and wildlife and aquaculture species were deemed to give a rounded zoological view. Peer-reviewed journal articles, conference papers, and high-quality preprints in English were

only included, especially those that provide empirical findings, validated models, or systematic reviews. On the other hand, the studies were not included when they were not methodologically clear, when they did not offer experimental validation, or were not related to animals health applications. Other non-academic sources, duplicate records and purely theoretical studies with no practical implications were also skipped out of the analysis (Ahmed et al., 2025).

Recruitment of the study was carried out in a systematic manner based on the Preferred Reporting Items of Systematic Reviews and Meta-Analyses (PRISMA) guidelines. To begin with, a massive amount of articles has been determined by searching databases. During the screening stage, titles and abstracts were screened to eliminate irrelevant studies. The full-text articles were then assessed based on the inclusion criteria to exclude irrelevant articles. This multi-stage screening procedure led to the narrowing down of around 30-50 quality studies that were considered the most relevant to the aims of this review. This kind of systematic filtering has been used extensively in recent AI-based veterinary studies in order to guarantee reliability and reproducibility of results. (Rohan et al., 2023; Scott et al., 2024).

Data were systematically retrieved and sorted into important analysing categories after identifying appropriate studies. They included the type of AI procedures adhered to (e.g. machine learning, deep learning, convolutional neural networks, IoT systems, and explainable AI), application area (livestock, poultry, wildlife, and aquaculture), data type (image-based, sensor-based, behavioral or environmental), and performance metrics (accuracy, precision, recall and F1-score). In addition, the key findings along with the limitations of each study and their implications were reported. A qualitative synthesis methodology was then used to compare the methodologies to identify patterns across studies. The approach is particularly suitable in the interdisciplinary research, in which the quantitative meta-analysis may be limited by the heterogeneity of data sets and study designs (Nawaz et al., 2025; Selvarajan et al., 2025).

In order to be more analytical, a thematic framework was developed to categorize the selected researches into major areas, which include AI in livestock health monitoring, AI in poultry and aquaculture systems, AI in wildlife conservation and zoological research, AI-based diagnostic imaging, and explainable AI in decision support. The use of such thematic classification helped to make a systematic comparison of different AI methods and their effectiveness in different zoological tasks. A case in point is deep learning-based models such as convolutional neural networks (CNNs) that have proven to be more effective in detecting an illness through images, though the IoT-

based systems are more effective in real-time tracking of physiological and environmental measurements (Mahmud et al., 2021; Neethirajan, 2023).

The quality and reliability of the selected studies were also assessed with the assistance of multiple evaluation criteria, including methodological rigor, dataset size and quality, how the model is validated, or how reproducible the results are. In the analysis, emphasis was given to the studies that employed strong experimental designs, huge and heterogeneous data and validated performance measures. By doing this quality assessment process, it is possible to ensure that the findings based on this review are grounded on evidence that is credible and scientifically significant (Burti *et al.*, 2024; Janaa *et al.*, 2025).

Though this study is carried out in a systematic way, several limitations are to be mentioned. Perhaps the use of published literature will lead to a publication bias whereby articles with positive results are more likely to be published. In addition, the majority of research done with AI is based on proprietary datasets, which are not publicly accessible, limiting their ability to reproducibility and comparative analysis. The issue that preprints are not only necessary but also must reflect recent developments can result in uncertainties as well due to the absence of official peer review. Besides, AI technologies change extremely rapidly, and, consequently, new changes may take place after the time frame of this review, which may also influence the thoroughness of the findings (Nawaz et al., 2025).

In conclusion, the methodology employed in the study provides a solid and systematic framework to investigate AI application in zoology. By conducting systematic identification, reviews, and syntheses of relevant studies, this review may be of value in knowing the most recent technological advances and how it can be applied to animal health surveillance and disease diagnosis. The interdisciplinary approach, in combination with a systematic analytical framework, ensures applicability and credibility of the findings to further research and the implementation of the results in the veterinary and zoological sciences.

### Results and Discussion

The systematic analysis of selected studies reveals that Artificial Intelligence (AI) has significantly enhanced the accuracy, efficiency, and scalability of animal health monitoring and disease diagnosis across diverse zoological domains. The findings demonstrate that AI-driven approaches particularly machine learning (ML), deep learning (DL), computer vision, and Internet of Things (IoT)-based systems consistently outperform traditional diagnostic methods in terms of early detection, automation, and real-time decision-making (Mahmud et al., 2021; Hossein-Zadeh, 2025).

## 1. Performance of AI Techniques in Disease Detection

One of the most prominent findings of this review is the superior performance of deep learning models, especially convolutional neural networks (CNNs), in image-based disease diagnosis. Studies indicate that CNN-based systems can achieve high accuracy in detecting diseases such as lumpy skin disease, mastitis, and skin infections in livestock (Senthilkumar et al., 2024; Girmaw et al., 2025). These models leverage large datasets of animal images to automatically extract relevant features, thereby reducing dependence on manual interpretation and minimizing diagnostic errors.

Similarly, computer vision techniques have been widely applied in monitoring animal behavior and identifying early signs of illness. For example, abnormal movement patterns, reduced feeding activity, and changes in posture can be detected through AI-based video analysis systems, enabling early intervention and improved animal welfare (Rohan et al., 2023; Scott et al., 2024). Compared to traditional observation methods, these automated systems provide continuous monitoring and reduce human bias, making them particularly valuable in large-scale farming environments.

**Table 1:** *Comparative analysis of AI techniques used in animal health monitoring and disease diagnosis*

AI Technique	Application Area	Data Type	Advantages	Limitations
Machine Learning (ML)	Disease prediction	Structured data	Simple, interpretable	Lower accuracy than DL
Deep Learning (CNN)	Image-based diagnosis	Images, videos	High accuracy, automation	Requires large datasets
Computer Vision	Behavior monitoring	Video/image	Real-time detection	Sensitive to environment
IoT-Based Systems	Continuous monitoring	Sensor data	Real-time insights	Infrastructure dependent
Explainable (XAI)	AI Decision support	Multi-source	Transparency	Computational complexity

## 2. Role of IoT and Sensor-Based Systems

The integration of AI with IoT technologies has further enhanced the capabilities of animal health monitoring systems. Wearable sensors and environmental monitoring devices generate real-time data on physiological parameters such as body temperature, heart rate, and activity levels. AI algorithms analyze these data streams to detect anomalies and predict disease outbreaks before clinical symptoms appear (Neethirajan, 2023; Selvarajan et al., 2025).

In aquaculture and poultry systems, sensor-based AI models have demonstrated effectiveness in monitoring environmental conditions, including water quality, temperature, and humidity. These parameters are critical for animal health, and their real-time analysis enables proactive disease management (Nawaz et al., 2025). The results suggest that IoT-enabled AI systems not only improve disease detection but also optimize overall farm management practices, leading to increased productivity and reduced economic losses.

### 3. Cross-Species Applications and Zoological Impact

Another key outcome of this review is the versatility of AI applications across multiple animal domains, including livestock, poultry, wildlife, and aquaculture. In wildlife conservation, AI-based systems utilizing camera traps, drones, and acoustic sensors have enabled large-scale monitoring of animal populations and detection of disease-related behavioral changes (Amonga, 2025; Brickson et al., 2023). These technologies facilitate non-invasive observation and provide valuable insights into ecosystem health and biodiversity conservation.

In veterinary diagnostic imaging, AI models have shown promising results in analyzing radiographs, ultrasound images, and other diagnostic data. These systems function as decision-support tools, assisting veterinarians in identifying abnormalities with higher precision and consistency (Burti et al., 2024; Xiao et al., 2025). The ability of AI to process complex and high-dimensional data makes it particularly suitable for applications requiring detailed analysis and interpretation.

### 4. Explainable AI and Decision Support

Despite the high performance of AI models, the lack of interpretability remains a significant concern in veterinary applications. Recent studies highlight the growing importance of explainable AI (XAI) techniques in addressing this issue. Methods such as SHAP (Shapley Additive Explanations) enable the interpretation of model predictions by identifying the most influential features, thereby improving transparency and trust in AI systems (Janaa et al., 2025).

AI-based decision support systems are increasingly being integrated into veterinary practice to assist in diagnosis, treatment planning, and disease management. These systems combine data from multiple sources, including imaging, sensors, and historical records, to provide comprehensive insights and support informed decision-making. The findings suggest that AI should be viewed as a complementary tool that enhances, rather than replaces, human expertise.

## 5. Challenges and Limitations

Despite the promising results, several challenges were identified that limit the widespread adoption of AI in zoology. One of the primary issues is the lack of high-quality, annotated datasets required for training robust AI models. Data variability across species, environments, and management practices further complicates model generalization and reduces performance in real-world scenarios (Nawaz et al., 2025).

Technical challenges such as occlusion, poor lighting conditions, and environmental noise also affect the accuracy of computer vision systems (Rohan et al., 2023). Additionally, the reliance on advanced infrastructure, including high-performance computing and reliable internet connectivity, poses significant barriers in resource-limited settings, particularly in developing countries.

Ethical concerns related to data privacy, animal welfare, and the use of surveillance technologies must also be addressed. The integration of AI into animal health systems requires careful consideration of these issues to ensure responsible and sustainable implementation.

## 6. Comparative Analysis with Traditional Methods

When compared to conventional diagnostic approaches, AI-based systems offer several advantages, including faster processing, higher accuracy, and the ability to analyze large datasets. Traditional methods, which rely heavily on manual observation and laboratory testing, are often time-consuming and subject to human error. In contrast, AI systems provide automated and objective analysis, enabling early detection and timely intervention (Mahmud et al., 2021; Hossein-Zadeh, 2025).

However, it is important to note that AI systems are not without limitations. The effectiveness of these systems depends on the quality and diversity of training data, as well as the robustness of the underlying algorithms. Therefore, a hybrid approach that combines AI technologies with traditional veterinary expertise is likely to yield the best outcomes.

**Table 2:** *Performance comparison of selected AI models in animal disease detection across different domains*

Study	AI Model	Application	Accuracy (%)	Key Findings
Mahmud et al. (2021)	CNN	Livestock monitoring	90–95%	High performance in image classification
Senthilkumar et al. (2024)	DL Model	Lumpy skin disease	~92%	Early detection improved

Ahmed et al. (2025)	ML Model	Cattle disease prediction	~85%	Effective for structured data
Nawaz et al. (2025)	ML + IoT	Aquaculture	~88%	Predicts disease via environment
Rohan et al. (2023)	DL	Behavior analysis	~87%	Detects abnormal activity

**7. Future Implications**

The results of this review indicate that AI has the potential to revolutionize animal health monitoring and disease diagnosis in zoology. Emerging trends such as multimodal data integration, real-time monitoring, and federated learning are expected to further enhance the capabilities of AI systems. These advancements will enable more accurate and scalable solutions, addressing current limitations and expanding the scope of AI applications.

Future research should focus on developing standardized datasets, improving model interpretability, and designing cost-effective solutions that can be implemented in diverse environments. Interdisciplinary collaboration between zoologists, veterinarians, and AI researchers will be essential for advancing this field and ensuring the successful integration of AI technologies into animal healthcare systems.

**8. Conclusion**

Machine learning, deep learning, computer vision, and IoT have been significantly used in animal health monitoring and disease diagnosis to detect diseases at an early stage, monitor them continuously, and make important decisions. It is the transition of the old system to automated, data-driven systems, enhancing animal welfare, livestock productivity, and wildlife conservation. Nevertheless, there are still issues such as limited datasets, model transparency, and infrastructure limitations as well as ethical issues. In general, the future prospects of AI are promising, and the improvement of explainable AI, multimodal data, and collaboration should lead to a better application of AI in the sustainable management of animal health.

**9. Future Recommendations**

- Develop large and generalized datasets in order to improve the accuracy of AI.
- Focus on explainable AI to promote trust and decision-making.
- Use multimodal data (images, sensors, behavior) to achieve the correct diagnosis.
- Develop inexpensive scalable AI solutions to developing regions.
- Make the interdisciplinary work encouraged to be practical.
- Establish ethical and regulatory frameworks of responsible AI use.

The future of AI in zoology has to be founded on better data, transparency, access and collaboration toward the well-being and sustainability of animals.

1. Develop large, standardized datasets for better AI accuracy.
2. Focus on explainable AI to improve trust and decision-making.
3. Use multimodal data (images, sensors, behavior) for precise diagnosis.
4. Create low-cost, scalable AI solutions for developing regions.
5. Promote interdisciplinary collaboration for practical implementation.
6. Establish ethical and regulatory frameworks for responsible AI use.

Future AI in zoology depends on better data, transparency, accessibility, and collaboration to improve animal health and sustainability.

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