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A Review of Recent Advancements in Machine Learning and Deep Learning Approaches for Pet Diseases Prediction

Priti Pal[1,*], Munish Saini[1]

Abstract

This systematic study assesses recent developments in Machine Learning (ML) and Deep Learning (DL) approaches to predict pet diseases. With the increasing role of Artificial Intelligence (AI) in pet healthcare, this study identifies recent research trends, limitations, and future directions. A comprehensive search was done using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines in selecting 20 relevant studies from over 300 articles published between 2020 and 2025. This analysis focuses on bacterial, viral, fungal, and zoonotic diseases in pets. The study covers real-world issues, model performance, dataset properties, and the interpretability of deployed AI systems. Future research is recommended to make use of sophisticated models like transformers, leveraging advanced models. This systematic study assesses recent developments in Machine Learning (ML) and Deep Learning (DL) approaches to predict pet diseases. With the increasing role of Artificial Intelligence (AI) in pet healthcare, this study identifies recent research trends, limitations, and future directions. A comprehensive search was done using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines in selecting 20 relevant studies from over 300 articles published between 2020 and 2025. This analysis focuses on bacterial, viral, fungal, and zoonotic diseases in pets. The study covers real-world issues, model performance, dataset properties, and the interpretability of deployed AI systems. Future research is recommended to make use of sophisticated models like transformers, leveraging advanced models with improved feature extraction and explainable AI frameworks. Moreover, integration of multimodal data, such as medical imaging, genomic information, and clinical records, can enhance disease prediction accuracy. This study highlights the need for standardized datasets, ethical considerations, and user-friendly AI tools for effective adoption in veterinary practice.

Keywords: Artificial intelligence, pet disease, prediction, PRISMA, infectious diseases

INTRODUCTION

Early detection of diseases in pets is important for effective treatment, disease management, and overall animal welfare. Animals have always played a major role in human development [1]. Since prehistoric times, humans have relied on animals for food, farming, protection, transportation, and agriculture [2]. Many people rely on pet animals for the mental and emotional health of people who own them in their homes. However, the increasing population of pets poses a public health concern due to the spread of infectious diseases [3]. Early detection of pet diseases reduces risk to both animal and human health. Moreover, conventional methods are time-consuming and dependent on specific veterinary knowledge [4].

***Author for Correspondence**
Priti Pal
E-mail: pritipal50735@gmail.com

[1]Student, Department of Computer Engineering and Technology, Guru Nanak Dev University, Amritsar, Punjab, India

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Recent developments in deep learning (DL) and machine learning (ML) are leading to growth in automated and intelligent disease detection in the field of veterinary diagnostics and in the classification of skin conditions like the prediction of respiratory infections, and the analysis of zoonotic issues in animals [1–3].

Although AI-based disease prediction in humans has been extensively studied, its applicability in animal healthcare is still poorly understood [5].

This study aims to evaluate existing machine learning (ML) and deep learning (DL) based approaches for pet disease prediction. To direct future research, evaluate the scope, strengths, and limitations of current studies and identify gaps to guide future research.

RELATED WORK

This section discusses and explores the existing research on pet animal disease prediction using ML and DL. Various studies (Table 1) have been conducted for the early detection of disease in animals. This section focuses on important contributions, underlying techniques, and gaps in existing literature.

Table 1. Summary of related studies using ML/DL techniques for pet diseases.

Study	ML/DL Techniques	Diseases Studied	Dataset Size	Accuracy
[2]	CNN	Skin	1047 images	91.3%
[3]	AI Score	Multisystem in pets' body	550 dogs	89.5%
[5]	Rando m Forest	Zoonotic	Multi sources	87.2%

Several recent studies have examined AI techniques in animal healthcare. Ahsan et al. (2022) [1] provide an overview of ML for animal and human disease diagnosis, highlighting model performance but not veterinary accuracy. Hwang et al. [2] for dog skin disease classification, implementing a CNN model using multispectral imaging, and showing the importance of advanced imaging techniques [6]. Concentrated on zoonotic disease AI models and how they contribute to pandemic preparedness. The relevance of AI in improving animal comfort was also recognized by Zhang et al. (2023) [7]. A recent study by Zhang (2020) [8] integrated various multifaceted data and presented a dog health ranking system based on AI algorithms.

AI developing involvement in microbiology was examined by Alzubaidi et al. (2020) and Das et al. (2024) [9, 10], provided insights relevant to animal diagnostics. In a thorough analysis of DL in veterinary diagnostic Xiao et al. (2025) [11] recommended for greater transparency and standard in AI models. The broader use of CNNs in identifying bacteria that could be modified to veterinary pathogens was covered by Rani et al. (2021) [6].

Despite this advancement, a gap in the systematic literature focused on pet disease prediction still exists. Most of the studies do not require a detailed model comparison or real-world implementation issue. To fill this gap by analyzing technical depth, dataset quality, and real-world implications of AI models in veterinary contexts is shown in Table 2.

A summary of related studies using ML/DL techniques for pet disease analysis is shown in Table 3.

Table 2. Limitations and prospects.

Challenge	Description	Proposed solution
Dataset quality	Small, private datasets	Open-access repositories.
Interpretability	Black-box DL models	Use of explainable AI(XAI).
Clinical integration	Lack of trials	Partner with vet clinics.

METHODOLOGY

According to the preferred reporting items for research systematic reviews and meta-analyses (PRISMA) criteria, the study conducted a comprehensive review of the studies using machine learning

and deep learning techniques for Pet infectious disease prediction (Figure 1). The method includes database searches, the application of inclusion and exclusion criteria, and the extraction of scientific data.

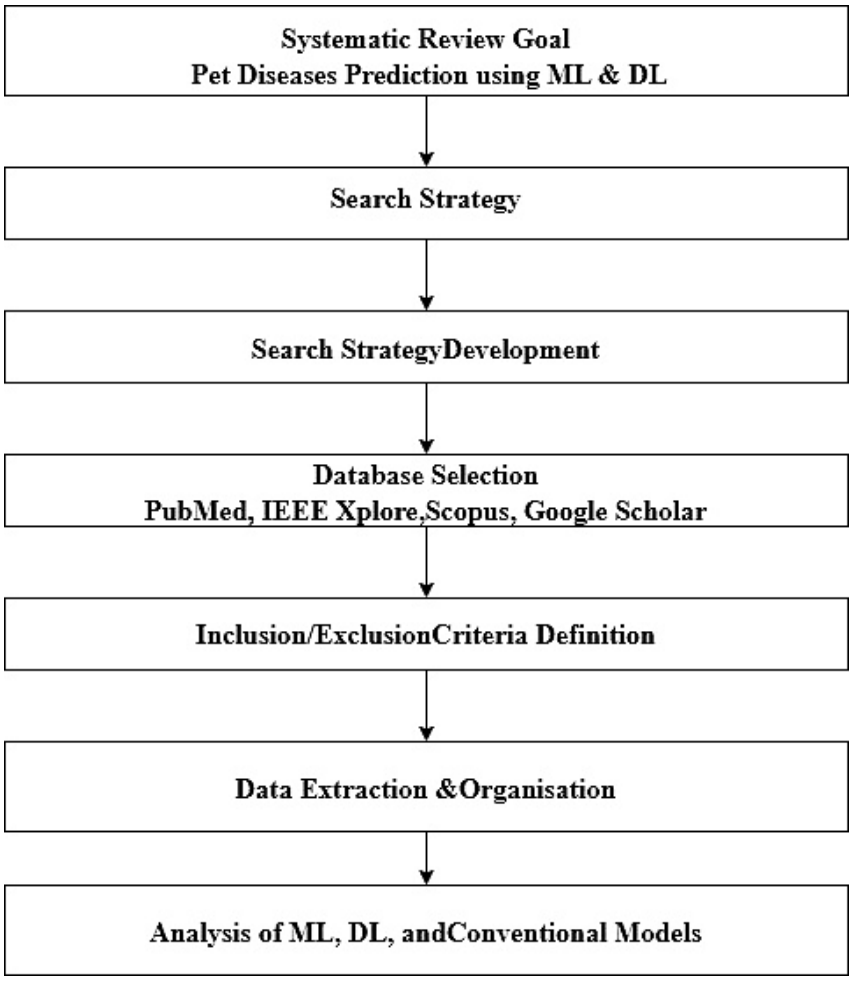

Figure 1. Flow graph for systematic.

Selection Strategy

A comprehensive literature search was conducted across multiple electronic databases, including PubMed, Scopus, Web of Science, Google Scholar, and IEEE Xplore, which were searched systematically for relevant research. The following were the main search terms: "AI in pet health," "machine learning in veterinary medicine," "pet disease prediction," and "animal health analytics." "Additional search terms", like smart devices in "predictive analytics for pets" and "veterinary care", were used to broaden the search parameters [12].

Inclusion and Exclusion Criteria

Inclusion and exclusion criteria for research have been established to avoid publication bias and separate all pertinent papers. The inclusion criteria include studies that are using Machine Learning (ML) and Deep Learning (DL) approaches to developing predictive models for diseases in pets, like dogs and cats. To represent an extensive range of modeling methodologies, the review focused on research that addresses temporal, physical, or risk-based disease prediction frameworks. The studies examining diseases in livestock, exotic pets, or non-domestic animals were not included in the selection process as the present study is restricted to considering domestic pets only. The studies not using ML or DL techniques are not considered; studies considering conventional statistical methods (such as regression models, etc.) are also excluded.

Data Extraction

According to the prediction tasks, the machine learning (ML) and deep learning (DL) models found in the reviewed literature were divided into the following broad categories

- *Predictive Risk Models:* Predictive risk models analyze the interaction between various factors related to the risk of disease and those factors. Predictive risk models aim to find the risk factors for the disease incidence that are related to time and space.
- *Temporal Predictive Models:* These are the time series forecasting models that predict future disease occurrence by using the previous year's disease data. The main goal of this model is to use pattern analysis of historical data to predict when the next disease outbreaks or epidemics will take place.
- *Predictive Mapping Models:* These are the spatial models that predict the geographic pattern of medical conditions based on historical disease data. This model's primary goal is to use modeled disease occurrence data to predict where the next disease pandemic will develop.

Table 3. Database, keywords, inclusion, and exclusion criteria.

Database	Keywords Used	Inclusion Criteria	Exclusion Criteria
Google Scholar	"Veterinary disease prediction," "artificial intelligence in pet health	studies from diverse disciplines, including conference papers	Low-impact journals, non-peer reviewed materials.
Scopus	"AI in pet health," "deep learning for animal disease"	Studies on ML/DL applications in pet diseases	Studies not focused on pet animals.
Web of Science	"AI in veterinary medicine," "pet disease forecasting"	High-impact journals, peer reviewed research	Grey literature, non-peer-reviewed sources.
ScienceDirect	"Pet disease detection," "Computational approaches in science"	Studies from reputable journals, experimental results	Opinion articles, studies without proper validation.

RESULTS

Following the PRISMA rules (Figure 2), 300 research papers published between 2021 and 2025 were collected. For the final consideration, only 20 publications were chosen after duplicate records were eliminated and using inclusion and exclusion criteria.

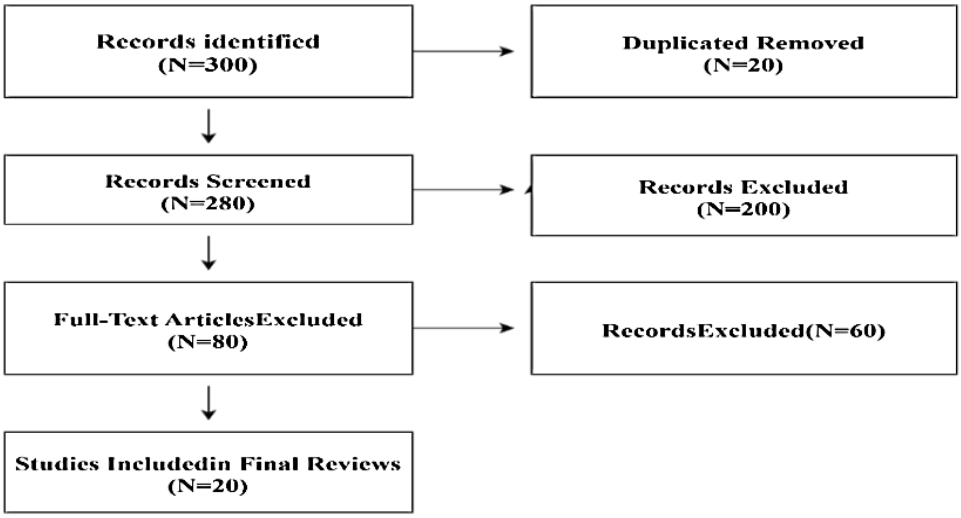

Figure 2. PRISMA flow diagram that illustrates the overall selection criteria.

These 20 studies were used to predict infectious diseases in pet animals using ML and DL. Most of the studies focused on image and behavioral patterns to detect diseases early and improve outcomes. Specifically, algorithms, like SVM, NB, RF, and K-NNC, are widely utilized. While NB classifies data based on the independence assumptions between the features and the Bayes theorem, SVM can be used

to determine the most efficient way to divide multidimensional space data into two groups. Multiple randomized decision trees up RF, which makes predictions by averaging the results from various trees. K-NNC uses the sample's similarity to neighboring data points to classify the data [1, 13]. Overall, there are benefits and drawbacks to DL as compared to traditional ML methods. Which method is used in practice primarily depends on the amount of data and the goal that needs to be accomplished, like ML models were used in small datasets due to their simplicity, DL models, like CNN, achieved higher accuracy on image-based pet disease detection [12].

Furthermore, it is found from the considered studies that animals may contract a variety of diseases due to bacterial, viral, fungal, and zoonotic infections. Each group represents significant veterinary health issues and is a critical area for disease prediction research due to the potential public health impacts and their effects on animal welfare [7]. Bacterial diseases can cause serious infections in pets that affect multiple organ systems. Common vectors of transmission for these diseases include contaminated food, water, or close contact with sick animals. Identify high-risk regions and potential trial epidemics and prediction models of bacterial infections using clinical and environmental data. It is these models that enable early detection and timely action [2]. Viral diseases represent serious risks to pets because they can spread quickly and produce widespread outbreaks. Immediate or chronic health issues may result from these diseases, which are transmitted by direct contact, vectors, or environmental exposure. Prediction systems for viral infections focus on identifying susceptible individuals, assessing vaccination coverage, and forecasting outbreaks to lower the risk of transmission [7, 8]. Fungal infections in pets are frequently influenced by environmental factors such as temperature and humidity. These infections can result in anything from minor skin diseases to serious systemic disorders, depending on the host and fungus species to detect high-risk areas and pets and enable proactive disease prevention, prediction algorithms in this field merge host and environmental data [6]. Zoonotic diseases are an essential threat to public health because they can be transmitted from animals to humans. Data from ecological, veterinary, and medical fields must be integrated in a multifaceted manner to predict these diseases. Hotspots of high risk are identified by zoonotic disease prediction systems to assist in direct preventative measures in pet dogs and people [5].

DISCUSSION AND CONCLUSIONS

This systematic review shows how ML and DL may change veterinary diagnostics by highlighting their important role in pet animal disease prediction. Strengths and limits are identified in the existing research by the review through analysis of different predictive models, dataset sources, and performance indicators. Numerous obstacles still exist, such as a lack of clinical validation, limited dataset availability, and worries about model interpretability, even though AI-driven methods have demonstrated encouraging outcomes in disease categorization and early detection. To close these gaps and create reliable, intelligible, and clinically useful models, veterinary specialists and AI researchers must work together. Larger, higher-quality dataset integration, hybrid AI technique exploration, and a focus on refining models and developing better real-world and user-friendly applications in veterinary clinics should be the main goals of future studies. With further development, ML and DL have the potential to greatly improve pet healthcare by enabling early diagnosis and timely treatment, ultimately improving the well-being of animals, resulting in improved disease avoidance, prompt corrections, and enhanced companion animal health in general. Future research can significantly improve the accuracy, dependability, and practical use of AI-driven disease prediction models, ultimately benefiting pet health and veterinary care.

Strength of Current Research

ML and DL algorithms are used to improve prediction accuracy to an unexpected level to evaluate large and complex datasets, revealing patterns and relationships that traditional methods can detect in pet animal diseases [6]. While spatial models are used to pinpoint disease hotspots, temporal models are the most accurate in predicting disease outbreaks across time. Using prediction models, more information has been achieved, which can identify essential variables affecting the prevalence of diseases and allow for focused treatment. These advancements have improved the monitoring of

diseases and enabled more personalized treatment by personalizing interventions to specific risk factors and environmental conditions [2].

Limitations and Challenges

Many models are based on limited data, focused on specific breeds and regions, which makes them hard to apply everywhere. There are concerns about data privacy and understanding of the model because deep learning models can be complex and hard to use in veterinary.

Trends and Gaps Identified

The most recent advancements include the use of IoT devices for the real-time gathering and observation of data as the integration of environmental and genetic data to provide a greater understanding of the development of pet diseases. The prediction of rare diseases and the development of models that apply to under-represented species still have significant gaps. Additionally, ensuring that the use of different pet populations and environments can be challenging. Also, additional research is required to enable the responsible application of algorithmic fairness and ethical issues.

REFERENCES

1. Ahsan MM, Luna SA, Siddique Z. Machine-learning based disease diagnosis: A comprehensive review. Healthcare. 2022;10(3):541. doi:10.3390/healthcare10030541.
2. Hwang S, Shin HK, Park JM, Kwon B, Kang M-G. Classification of dog skin diseases using deep learning with images captured from multispectral imaging devices. Mol Cell Toxicol. 2022;18. doi:10.1007/s13273-022-00249-7.
3. Kim S-C, Kim S. Development of a dog health score using an artificial intelligence disease prediction algorithm based on multifaceted data. Animals. 2024;14(2):256. doi:10.3390/ani14020256.
4. Mohseni P, Ghorbani A. Exploring the synergy of artificial intelligence in microbiology: Advancements, challenges, and future prospects. Comput Struct Biotechnol J. 2024;1:100005. doi:10.1016/j.csbr.2024.100005.
5. Pillai N, Ramkumar M, Nanduri B. Artificial intelligence models for zoonotic pathogens: A survey. Microorganisms. 2022;10(10):1911. doi:10.3390/microorganisms10101911.
6. Rani P, Kotwal S, Manhas J, Sharma V, Sharma S. Machine learning and deep learning-based computational approaches in automatic microorganisms image recognition: Methodologies, challenges, and developments. Arch Comput Methods Eng. 2021;2(1). doi:10.1007/s11831-021-09639-x.
7. Zhang L, Guo W, Lv C, Guo M, Yang M, Fu Q, et al. Advancements in artificial intelligence technology for improving animal welfare: Current applications and research progress. Anim Res One Health. 2023;2(1). doi:10.1002/aro2.442.
8. Zhang S, Su Q, Chen Q. Application of machine learning in animal disease analysis and prediction. Curr Bioinform. 2020;16(7):972–82.
9. Alzubaidi L, Al-Sabaawi MA, Zhang J, Santamaría AJ. Towards a better understanding of transfer learning for medical imaging: A case study. Appl Sci. 2020;10(13):4523.
10. Das S, Roy RK, Bezboruah T. Machine learning in animal healthcare: A comprehensive review. Int J Recent Eng Sci. 2024;11(3):89–93.
11. Xiao S, Chen L, Wang H, Zhao Y. Review of applications of deep learning in veterinary diagnostics and animal health. Front Vet Sci. 2025;8. doi:10.3389/fvets.2025.1511522.
12. Roobini S, Kavitha MS, Karthik S. A systematic review on machine learning and neural network based models for disease prediction. J Integr Sci Technol. 2024;12(4).
13. Lu H, Uddin S. Unsupervised machine learning for disease prediction: A comparative performance analysis using multiple datasets. Health Technol. 2024;14:141–54. doi:10.1007/s12553-023-00805-8.

