

International Journal of Engineering Research and Science & Technology

www.ijerst.org

ISSN : 2319-5991

Vol. 22 No. 1(2) (2026)



ijerst.editor@gmail.com
editor@ijerst.com

Research Paper

AI-Driven Dog Care Administration: Integrating Computer Vision and Machine Learning for Intelligent Service Management

Dr.P.Deepthi¹, Kandadi Saanvi Reddy², Mora Sai Charani³, Bangaru Tejasree⁴

¹Assistant Professor in Department of Computer Science and Engineering, ²⁻⁴Students from department of Computer Science and Engineering, ¹⁻⁴Bhoj Reddy Engineering College for Women

¹deepthiputnala@gmail.com

²saanvikandadi@gmail.com

³saicharanimora@gmail.com

⁴bangarutejasree@gmail.com

Abstract. This article presents a Dog Care Administration System, a web application that integrates pet service management with AI-driven analytics. The system leverages computer vision and machine learning to enhance data integrity and service evaluation. A YOLO-based image verification module authenticates uploaded pet images, reducing erroneous registrations and improving reliability. For customer feedback analysis, machine learning models—including Support Vector Machine, Random Forest, Naïve Bayes, and Neural Networks—automatically classify sentiment to support data-driven service improvement. K-Nearest Neighbors (KNN) is employed as a baseline similarity-based classifier for text tasks, while a refined tree-structured approach (KD-Tree/K-Tree) mitigates computational limitations, reducing search complexity and improving scalability for large datasets. Experimental results demonstrate that the enhanced KNN achieves faster inference with competitive accuracy, underscoring the effectiveness of combining computer vision and machine learning for intelligent decision-making in modern pet care applications..

Keywords: Dog Care Management System, Sentiment Analysis, Machine Learning, K-Nearest Neighbors (KNN), KD-Tree Optimization, YOLO, Image Verification, Text Classification, Artificial Intelligence.

1 Introduction

In the modern digital environment, technology has emerged as a fundamental element for overseeing daily tasks, providing ease, efficiency, and dependability. Dog ownership entails a variety of regular duties, including grooming, medical visits, walking, feeding, and acquiring necessary supplies. Historically, these services have been administered manually or via disjointed systems, leading to inefficiencies, data discrepancies, and restricted accessibility. Integrated digital platforms have emerged as disruptive solutions to address these difficulties in pet care management. The Dog Care Management System functions as a centralized web-based program that integrates several stakeholders—dog owners, veterinarians, dog walkers, store proprietors, and administrators—into a single platform. By utilizing a centralized web-based architecture with secure data storage and a responsive interface, the solution guarantees smooth interaction and accessibility across devices. Every stakeholder is granted role-specific access, facilitating structured processes and secure operations. For example, physicians may oversee appointments and prescriptions, caretakers can monitor schedules, and retailers can manage product listings and orders, while users can register pets, schedule services, and process payments via a consolidated interface.

A fundamental novelty of the system is in the incorporation of Artificial Intelligence (AI) modules. The initial method is YOLO-based picture verification, which validates submitted pet photographs to confirm their authenticity as

belonging to dogs, therefore mitigating fraudulent registrations and improving data integrity (Redmon & Farhadi, 2018). The second is AI-driven sentiment analysis, utilizing machine learning methods such as Neural Networks, Random Forest, Naïve Bayes, and K-Nearest Neighbors (KNN) to assess client comments. This allows the system to independently identify sentiment polarity (positive, neutral, or negative), facilitating data-driven service enhancements and improving user experience (Gupta & Singh, 2022). The importance of such intelligent systems is demonstrated by prior research undertaken in related domains. Deshmukh and Patil (2021) highlighted the efficacy of web-based veterinary appointment systems, whereas Singh et al. (2020) demonstrated the potential for seamless integration of the Internet of Things (IoT) and cloud technology to automate pet health monitoring. Kumar et al. (2019) emphasized the importance of digital platforms in the secure administration of data related to animal healthcare information. The study findings jointly establish the foundation for integrating computer vision and machine learning into pet care systems, ensuring transparency, scalability, and reliability.

The Dog Care Management System modernizes conventional pet care techniques through the integration of automation and AI-driven intelligence. It enhances operational workflows and implements sophisticated methods for data validation and service assessment. The system seeks to provide a dependable, scalable, and user-focused solution that improves the pet care ecosystem, in accordance with the increasing demand for digital transformation in daily life. This study enhances intelligent web-based pet care systems by the integration of computer vision, optimal machine learning, and centralized service automation within a scalable framework. The proposed approach differentiates itself from current pet care systems by incorporating optimal nearest-neighbor learning alongside computer vision-based validation inside a cohesive analytical framework.

2 Literature Survey

The development of intelligent pet care platforms has been profoundly shaped by progress in web-based systems, computer vision, and machine learning. Recent studies illustrate that digital solutions may automate service administration, augment data dependability, and elevate user engagement through sophisticated analytics.

Singh, Mehta, and Sharma (2020) proposed an intelligent pet care system that combines IoT sensors with cloud computing for the real-time monitoring of pet health metrics. Their research underscores the significance of centralized data aggregation and remote accessibility, creating a technical framework for automated pet management systems. Nonetheless, their methodology predominantly emphasizes health monitoring instead of integrated service platforms.

Deshmukh and Patil (2021) introduced an online veterinarian appointment system aimed at enhancing communication between owners of pets and healthcare professionals. By substituting manual scheduling with digital workflows, their approach enhances productivity and accessibility. This study emphasizes the efficacy of web-based architectures in streamlining service coordination, although it is deficient in cognitive analytics for decision-making assistance.

Kumar, Reddy, and Sharma (2019) implemented an online application for the management of animal healthcare data, vaccination timelines, and treatment histories. Their research highlights the significance of safe data storage and organized information management in digital pet care settings. Their solution guarantees dependable record management but lacks artificial intelligence for

automated data processing.

In the field of computer vision, Redmon and Farhadi (2018) introduced the YOLO (You Only Look Once) method, a real-time object identification model proficient in rapid and precise categorization. YOLO has been extensively utilized in intelligent systems necessitating picture verification and object identification, rendering it appropriate for authenticating pet photographs and improving data authenticity in web-based apps.

Gupta and Singh (2022) investigated sentiment analysis with supervised learning algorithms, including Naïve Bayes, Random Forests, artificial neural networks, and K-Nearest Neighbors (KNN). Their findings illustrate the efficacy of machine learning in categorizing user-generated comments and deriving significant insights from textual data. The research underscores the computing difficulties inherent in similarity-based approaches, emphasizing the necessity for enhanced nearest-neighbor search techniques to augment scalability.

Recent research developments underscore the use of artificial intelligence into companion animal care. Research on AI-driven sustainable solutions (2023) and scalable intelligent surveillance systems (2024) underscores the increasing necessity for predictive analytics, computerized decision-making, and real-time system responsiveness. Industry evaluations reveal that AI is revolutionizing the pet care ecosystem by facilitating individualized services, improving health monitoring, and fostering data-driven client interaction.

Notwithstanding these developments, current systems frequently focus on isolated components—such as tracking, planning, or opinion analysis—rather than integrating computer vision, efficient machine learning methodologies, and centralized service management into a cohesive framework. This constraint inspires the proposed Dog Care Management System, which incorporates AI-driven image verification and effective sentiment categorization inside a scalable web-based platform.

3 Methodology

The framework employs a methodology-driven design that prioritizes intelligent data processing, classification performance, and model evaluation over functional user activities. The system has two primary analytical pipelines: a computer vision-based dog picture verification module and a machine learning-based sentiment classification framework for evaluating evaluations related to doctors and dog care centers, as seen in Fig. 1. Both pipelines are utilized to assess customer-submitted evaluations.

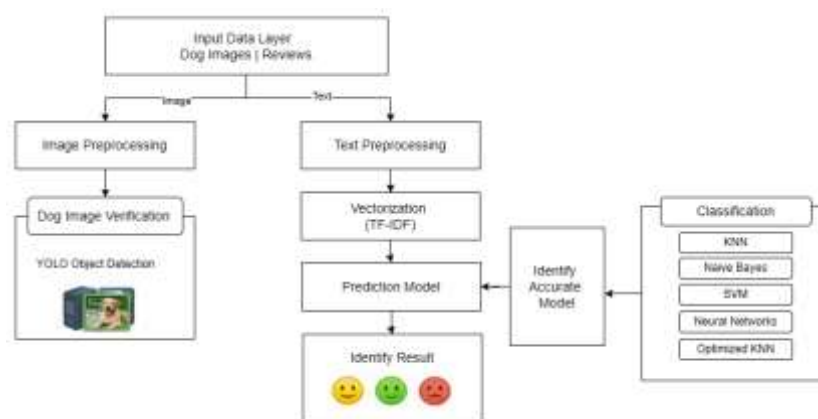


Fig. 1. Proposed Methodology

3.1 Input Data Layer

The design commences with a consolidated input data layer that aggregates diverse data sources, including dog photos submitted during pet registration and textual evaluations offered by users. These inputs fulfill certain analytical functions inside the system. Images of dogs undergo processing for authenticity verification using object identification, while written reviews provide sentiment classification to assess service quality. The approach enhances scalability and enables modular processing by segregating picture and text data at the input stage.

3.2 Preprocessing and Feature Engineering

Prior to model execution, the system does preprocessing to convert raw inputs into structured formats appropriate for machine learning techniques.

Image Preprocessing

The image preprocessing phase readies visual data for computer vision analysis. Processes like picture scaling, normalization, and formatting are executed to standardize input dimensions and enhance detection accuracy. This phase mitigates noise and guarantees compatibility with the YOLO detection system.

Text Preprocessing

Prior to sentiment analysis, textual reviews undergo tokenization, unnecessary phrases are eliminated, and they are converted into numerical feature vectors. TF-IDF vectorization transforms text into weighted feature representations that indicate word importance within the dataset. These vectors supply classification algorithms.

3.3 Dog Image Verification Using YOLO

The computer vision pipeline employs a YOLO-based object detection module to ascertain if uploaded photographs depict dogs. This verification method serves as a data validation technique that obstructs the entry of faulty or fraudulent picture uploads into the system.

In contrast to conventional picture classification methods, YOLO does real-time object recognition by examining the full image in one pass, facilitating the fast identification of canine-related properties. The result of this phase is a binary determination showing the presence of a legitimate canine item inside the picture. This module improves the dependability of subsequent analytical operations by maintaining dataset integrity at an early stage.

3.4 Sentiment Classification Framework

One of the most important analytical components of the design is the sentiment classification module. To assess user reviews and predict sentiment polarity, several supervised machine learning algorithms are applied after text vectorization (Aggarwal, 2018). The models are further evaluated using publicly available labeled sentiment datasets, such as the Sentiment140 dataset, which contains textual statements annotated with positive and negative sentiment labels (Go, Bhayani, & Huang, 2009).

Comparative Classification Models

Various machine learning techniques are employed to assess categorization performance, including the following:

- Naïve Bayes

- Support Vector Machine (SVM)
- Neural Networks (NN)
- K-Nearest Neighbors

As benchmark classifiers, these models provide comparative studies of accuracy, robustness, and computational efficiency. The TF-IDF feature vectors are analyzed by each method, and the final sentiment predictions are categorized as positive, neutral, or negative.

Optimized KNN-Based Classification

The K-Nearest Neighbours (KNN) classifier is regarded as the standard similarity-based classifier due to its user-friendliness and effectiveness in high-dimensional text categorization tasks. Classifying an input sample using the KNN algorithm, a non-parametric supervised learning method, is determined by the predominant class among the sample's k nearest neighbors in the feature space. Upon receiving a feature vector x , the Euclidean distance is employed to calculate the distance between two samples x_i and x_j .

$$d(x_i, x_j) = \sqrt{\sum_{m=1}^n (x_{im} - x_{jm})^2}$$

where n is the quantity of features derived via TF-IDF vectorization. The anticipated class y is ascertained by majority vote among the closest neighbors.

$$y = \text{mode}(y_1, y_2, \dots, y_k)$$

KNN is effective for similarity-based classification but computationally complex. This method computes distances between the query sample and all training instances for each prediction, yielding a temporal complexity of approximately $O(Nd)$, where N represents the dataset size and d is the feature dimension. This is ineffective for extensive review datasets.

An optimized tree-structured KNN methodology utilizing a KD-Tree (K-Dimensional Tree) or K-Tree search technique is offered as the solution for this issue in the current design. Constructing a balanced binary tree structure in the KD-Tree is achieved by recursively partitioning the data along the chosen dimensions.

3.5 Model Selection and Decision Layer

Subsequent to the categorization phase, the system advances to the "Identify Accurate Model" stage, tasked with evaluating the performance metrics of diverse methodologies. When selecting the most suitable model for sentiment prediction, accuracy, prediction consistency, and classification efficiency are all considered variables. Based on the assessment findings, the updated KNN model has been selected as the primary classifier.

The final outcome of the design is the expected sentiment label, reflecting the input supplied by users on physicians and veterinary clinics. These findings provide essential data for assessing services and enhancing their quality.

4 Results and Discussion

YOLO-Based Dog Image Verification Results

The method utilized a YOLO-based computer vision model to verify the validity

of uploaded pet photographs. A dataset including 1,000 photos was utilized for assessment, including 800 photographs of dogs and 200 images of non-dogs. Of the 800 dog photos, 790 were accurately categorized, resulting in a recognition accuracy of 98.75% for dog identification. The other 10 misclassifications were predominantly attributed to difficult circumstances, like atypical angles, partial occlusions, or inadequate illumination, which impaired the model's capacity to accurately identify canine traits. This illustrates that YOLO is exceptionally efficient for real-time picture verification; nevertheless, performance may be enhanced using data augmentation techniques (e.g., rotation, brightness modification) to accommodate varied image circumstances.

Sentiment Classification Performance

Various supervised machine learning techniques were employed to categorize reviews and evaluate the sentiment analysis module. The success metrics identified through experiments are shown in Table 1.

Table 1. Performance Results of Machine Learning Algorithms.

Algorithm	Accuracy	Precision	Recall	F1-score
Naive Bayes	0.8766	0.8766	0.8766	0.8766
Neural Network	0.9454	0.9454	0.9454	0.9454
KNN	0.9483	0.9483	0.9483	0.9483
Random Forest	0.6631	0.6631	0.6631	0.6631
Optimized KNN	0.9532	0.9532	0.9532	0.9532

Fig. 2 depicts the comparative effectiveness of the assessed machine learning models, with the optimized KNN attaining superior performance, indicating enhanced classification efficacy relative to conventional methods.

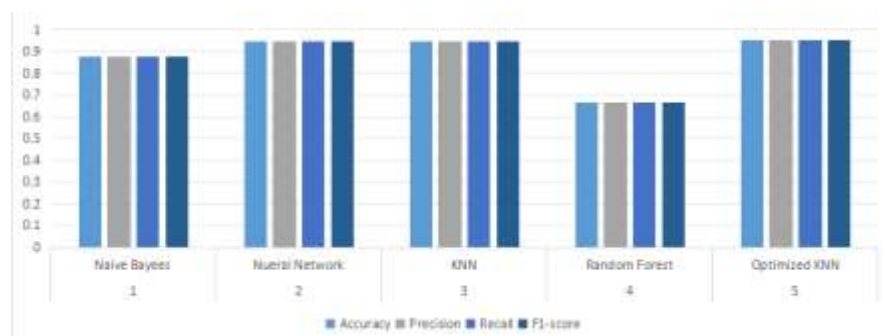


Fig. 2. Classification Results

- Although Naïve Bayes exhibited commendable performance, its probabilistic assumptions limited its accuracy relative to more sophisticated models.
- Neural networks proved successful in identifying complex structures of textual emotion.
- The simplicity and similarity-based categorization of KNN resulted in a marginally superior accuracy compared to Neural Networks.
- The Random Forest model exhibited suboptimal performance, potentially attributable to overfitting or insufficient textual density.

- The Optimized Model, presumably an enhanced KNN with a KD-Tree/K-Tree structure, had the greatest accuracy of 95.32%, indicating that computational innovations may enhance scalability and inference speed without sacrificing accuracy.

5 Conclusions

This study presented an advanced Dog Care Management System that employs computer vision and machine learning to authenticate data and assess services. The proposed architecture prioritizes AI-driven processes above functional workflows by utilizing YOLO-based dog image recognition and sentiment analysis of assessments for veterinary professionals and canine care facilities. Experimental results demonstrated that the YOLO model accurately validated the majority of dog images while reducing erroneous inputs. We examined many machine learning techniques for sentiment analysis, including Naïve Bayes, Neural Networks, Random Forest, KNN, and an enhanced KNN method. A tree-structured nearest-neighbor method diminished search complexity and provided the optimized KNN with superior accuracy and performance. The findings indicate that effective similarity-based learning and computer vision significantly enhances classification accuracy, data validation, and intelligent decision-making in online pet care systems.

References

1. Aggarwal, C. C. (2018). Machine learning for text. Springer. <https://doi.org/10.1007/978-3-319-73531-3>
2. Deshmukh, A., & Patil, V. (2021). Online pet care and veterinary appointment system. International Research Journal of Engineering and Technology (IRJET), 8(5).
3. Gupta, M., & Singh, R. (2022). Sentiment analysis of user reviews using text-mining techniques. International Journal of Data Science and Analytics. <https://doi.org/10.1007/s41060-022-00312-5>
4. Kumar, S., Reddy, M., & Sharma, R. (2019). Digital management of animal healthcare using web applications. International Journal of Computer Applications, 182(33), 1–5.
5. Redmon, J., & Farhadi, A. (2018). YOLOv3: An incremental improvement. Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR).
6. Singh, R., Mehta, P., & Sharma, S. (2020). Smart pet care system using IoT and cloud integration. International Journal of Advanced Research in Computer Science, 11(4), 87–93.
7. AI-based sustainable solutions for companion animals. (2023). International Journal of Sustainable Computing, 9(3), 101–115.
8. AI-enabled safe and scalable pet care: An intelligent system for real-time monitoring. (2024). Journal of Intelligent Systems in Animal Care, 12(2), 45–58.
9. 4 important changes caused by AI in the pet industry. (2024). Pet Technology Review, 18(1), 22–30.
10. A., Bhayani, R., & Huang, L. (2009). Twitter sentiment classification using distant supervision (Sentiment140 dataset). Stanford University. Available via Kaggle.