

Result Paper on Animal Disease Prediction System Using Machine Learning (CNN and SVM)

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<p>Type: Article Received: 24 March 2026 Revised: 09 April 2026 Accepted: 27 May 2026 Published: 06 June 2026</p>	<p>Animal disease prediction is a critical challenge in veterinary science and agricultural management. Early and accurate identification of animal diseases can significantly reduce mortality, economic losses, and prevent the spread of zoonotic infections. Traditional diagnostic methods are time-consuming, require expert veterinarians, and are not always accessible in rural or remote areas.</p> <p>This project presents a desktop-based application for animal disease prediction using two machine learning techniques — Convolutional Neural Networks (CNN) and Support Vector Machine (SVM). The CNN model is employed for image-based feature extraction and pattern recognition from animal symptoms and affected body regions, while the SVM classifier provides robust classification of disease categories based on extracted features.</p> <p>The system allows users to upload animal images, which are then preprocessed and passed through the CNN+SVM pipeline to predict the most probable disease condition along with execution time details. Results indicate that the CNN+SVM hybrid approach achieves high prediction accuracy. The paper also discusses future directions including web-based integration, real-time monitoring, and explainable AI for transparent veterinary decision-making.</p> <p>Keywords: Animal Disease Prediction; Convolutional Neural Network (CNN); Support Vector Machine (SVM); Machine Learning; Veterinary Informatics; Image Classification; Desktop Application; Image Preprocessing.</p>

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Introduction

Animal health management is an essential component of agriculture, livestock farming, and wildlife conservation. Diseases affecting animals not only cause significant economic losses to farmers and the livestock industry but also pose serious threats to food security and public health through zoonotic transmission. According to the World Organisation for Animal Health (WOAH), animal diseases cause billions of dollars in losses globally every year, and many diseases go undetected due to lack of expert veterinary access, particularly in rural and semi-urban regions.

Conventional diagnostic approaches rely heavily on manual observation by trained veterinarians, laboratory tests, and symptom-based clinical reasoning. These methods are slow, expensive, and often inaccessible to small-scale farmers who lack proximity to veterinary facilities. The need for an intelligent, automated, and accessible diagnostic tool has become increasingly urgent.

Recent advances in Machine Learning (ML) and Deep Learning (DL) have demonstrated remarkable performance in medical image classification, pattern recognition, and diagnostic prediction. These techniques can be applied effectively to animal disease detection by learning from large datasets of labelled symptom data, clinical images, and disease records.

This project implements a desktop application — the Animal Disease Detection System — that integrates two powerful machine learning algorithms: Convolutional Neural Networks (CNN) for image-based feature extraction and pattern recognition, and Support Vector Machine (SVM) for classification. The system accepts animal images, preprocesses them, and predicts whether the animal is healthy or diseased. The application provides secure user authentication through a Login and Registration module, and a dedicated Animal Detection interface for image processing and CNN-based prediction.

Literature Survey

This section presents a comparative literature survey of significant research works in animal disease prediction using machine learning and deep learning. The following table summarizes key methodologies, contributions, and limitations of notable studies.

Table I. Comparative Analysis of Existing Animal Disease Prediction Approaches

Ref	Year	Technique(s)/Approach	Key Contribution	Limitations/Comments
Mohanty et al.	2016	CNN (AlexNet)	Used deep CNN for plant disease detection with 99.35% accuracy on PlantVillage dataset.	Limited to plant diseases, not animal-specific.
Zhang et al.	2018	SVM + HOG Features	SVM-based classification of animal skin diseases using texture features.	Low accuracy for multi-class problems.
Sharma & Verma	2020	Random Forest + SVM	Comparative study of ML methods for veterinary disease classification.	Dataset size was small; no deep learning used.
Xiao et al.	2021	CNN (ResNet-50)	Transfer learning applied for cattle disease identification.	Requires high computational resources.
Patil & Kulkarni	2022	Hybrid CNN + SVM	CNN for feature extraction; SVM for classification in animal disease detection.	Tested on limited breeds only.
Ramesh et al.	2023	Deep Learning (VGG16)	Poultry disease detection using deep learning with 94% accuracy.	No role-based user interface provided.
Singh & Gupta	2023	SVM + Image Processing	Skin lesion classification in livestock using SVM with 89% accuracy.	Not a web-based or desktop deployable system.

Chauhan et al.	2024	CNN + Transfer Learning	Mobile-based animal disease prediction using MobileNet.	Mobile-only; no desktop application support.
Kumar & Rao	2024	Ensemble ML Methods	Combined CNN and Random Forest for multi-disease classification.	Complex pipeline; high latency in predictions.
Liu et al.	2025	Attention-based CNN	Enhanced CNN with attention mechanisms for fine-grained animal disease classification.	Scalability to real-time deployment not tested.

Limitations Of Existing Work

Despite considerable progress in applying machine learning to disease prediction, prior research has notable limitations:

- Most existing systems are plant-focused or human-medical; animal-specific systems remain underdeveloped.
- Many studies use SVM or CNN independently, missing the complementary advantages of a hybrid approach.
- Lack of desktop or offline deployable applications for use in low-connectivity rural areas.
- Insufficient support for multi-species disease prediction in a single unified system.
- Absence of user authentication and role-based access for veterinarians and farmers.
- Limited explainability and transparency in model predictions, reducing trust among end users.
- Poor handling of image preprocessing and data augmentation for real-world farm photographs.

Problem Statement

The problem addressed in this project is the design and development of an intelligent desktop application capable of predicting animal diseases from image inputs using machine learning models. The system must accurately classify the health condition of animals by leveraging CNN for deep feature extraction from images and SVM for robust classification.

The system must handle image inputs such as photographs of animals, preprocess them through grayscale conversion and segmentation, and produce a disease prediction with execution time details. It must provide secure user access through login and registration modules. The solution must be deployable as a standalone desktop application, functioning in offline or low-connectivity environments. The system should be scalable, accurate, and accessible for both technical users and farmers.

Proposed System

The proposed system is an Animal Disease Detection System that uses a hybrid machine learning pipeline combining Convolutional Neural Networks (CNN) and Support Vector Machine (SVM) to deliver accurate, fast, and accessible veterinary diagnostic support as a desktop application. The system begins with user authentication through a Login and Registration module. Registered users can access the Animal Detection interface, where they can upload an image of an animal for disease analysis.

The Image Preprocessing Module converts the uploaded image to grayscale and applies binary segmentation to isolate the region of interest. The preprocessed images are displayed alongside the original for visual verification.

The CNN Prediction Module processes the preprocessed images through a trained Convolutional Neural Network model that has been trained to distinguish between healthy and diseased animal conditions. The CNN extracts deep feature maps and passes them through classification layers to produce a prediction output.

The system displays the prediction result — for example, 'Normal Animal Detected' or disease type — along with the total execution time in seconds. This real-time feedback allows farmers and veterinarians to quickly assess the health status of an animal.

The system is built as a desktop GUI application using Python with Tkinter for the interface, TensorFlow/Keras for the CNN model, and Scikit-learn for SVM classification, ensuring offline functionality without requiring internet connectivity.

Architecture Description

1. User Authentication Module: This module handles user registration and login. New users can create accounts by providing personal details including name, address, email, phone number, gender, age, username, and password. Existing users log in using username and password credentials. This ensures that only authorized users can access the animal disease detection functionality.

2. Main Dashboard Module: After successful login, users are presented with the main dashboard of the Animal Disease Detection System. This interface provides access to the Animal Detection module and an Exit option. The dashboard features a visually appealing interface with the system title and navigation controls.

3. Image Input Module: This module allows users to select an animal image from their local file system using the 'Select Image' button. The selected image is loaded and displayed in the interface for further processing. The module supports standard image formats including PNG, JPG, and BMP.

4. Image Preprocessing Module: The selected image undergoes preprocessing operations including grayscale conversion (to reduce computational complexity and focus on structural features) and binary segmentation (to isolate the animal region from the background). Both the grayscale and segmented versions of the image are displayed alongside the original for visual review.

5. CNN Feature Extraction and Prediction Module: The preprocessed image is passed through the trained Convolutional Neural Network model. The CNN applies multiple convolutional and pooling layers to extract hierarchical visual features from the image. These features are then used for classification, producing a prediction output indicating the health status of the animal along with execution time.

6. Result Display Module: The prediction result is displayed at the bottom of the detection interface. The output includes the disease prediction label (e.g., 'Normal Animal Detected' or specific disease name) and the time taken to complete the image analysis in seconds. This module provides clear and immediate diagnostic feedback to the user.

7. Database Module: The database stores all registered user information including credentials and personal details, enabling secure login verification and user management. It also supports storage of prediction logs for future reference and audit purposes.

Objective

The main objective of the Animal Disease Prediction System is to develop an accurate, accessible, and intelligent desktop application for predicting animal diseases using a hybrid CNN and SVM approach. Specific objectives include:

- To develop a CNN-based image feature extraction and prediction pipeline for disease detection in animals.
- To implement image preprocessing techniques including grayscale conversion and binary segmentation.
- To build a hybrid CNN+SVM model that achieves high prediction accuracy on animal disease datasets.
- To provide a secure user authentication system through Login and Registration modules.
- To develop a standalone desktop application that functions offline without internet dependency.
- To display prediction results with disease label and execution time for user transparency.
- To support multiple animal species including cattle, goats, and poultry in disease classification.
- To reduce manual diagnostic effort and provide preliminary disease screening for farmers and veterinarians.

Hardware And Software Requirements

Hardware Requirements

- Processor: Intel Core i3 or higher (i5/i7 recommended for model training)
- RAM: Minimum 8 GB (16 GB recommended for CNN training)
- Storage: At least 20 GB free disk space
- GPU: NVIDIA GPU with CUDA support (optional, recommended for training)
- System Type: Desktop or Laptop
- Display: Minimum 1024x768 resolution

Software Requirements

- Programming Language: Python 3.8 or higher
- GUI Framework: Tkinter (Python built-in)
- Machine Learning: TensorFlow / Keras (CNN), Scikit-learn (SVM)
- Image Processing: OpenCV, Pillow (PIL)
- Database: SQLite / MySQL for user data management
- Development Tools: Visual Studio Code, Jupyter Notebook
- Operating System: Windows 10/11 or Ubuntu Linux
- Additional Libraries: NumPy, Pandas, Matplotlib, Scikit-image

Algorithm

The Animal Disease Detection System employs two core machine learning algorithms in a hybrid pipeline:

Convolutional Neural Network (CNN)

CNN is used as the primary deep learning model for image-based feature extraction and disease classification. The CNN model is trained on a labelled dataset of animal images:

- Input layer accepts preprocessed animal images of size $224 \times 224 \times 3$ (RGB) or 64×64 (grayscale).
- Multiple convolutional layers apply learnable filters to detect edges, textures, and disease-specific visual patterns at different scales.
- Max-pooling layers reduce spatial dimensions while retaining dominant feature representations.
- Flatten and fully connected dense layers integrate extracted feature maps for high-level classification.
- Softmax output layer produces class probabilities for each disease category.
- The model is trained using categorical cross-entropy loss and Adam optimizer with early stopping to prevent overfitting.
- Training accuracy and test accuracy are monitored over epochs to evaluate model convergence.

Support Vector Machine (SVM)

SVM is used as an additional classifier that receives CNN-extracted feature vectors for robust multi-class disease classification:

- A Radial Basis Function (RBF) kernel handles non-linear decision boundaries across disease classes.
- Hyperparameters (C, gamma) are optimized using Grid Search with cross-validation.
- Multi-class classification is handled via One-vs-Rest (OvR) strategy.
- SVM maximizes the margin between disease class boundaries, improving generalization on unseen data.

Image Preprocessing Pipeline

- Step 1 — Image Loading: The selected animal image is loaded from the file system.
- Step 2 — Grayscale Conversion: The image is converted to grayscale using OpenCV (`cv2.cvtColor`) to simplify feature extraction.
- Step 3 — Binary Segmentation: Thresholding is applied to segment the animal region from the background, isolating regions of interest.
- Step 4 — Resizing and Normalization: Images are resized to the model input dimensions and pixel values are normalized to $[0, 1]$.
- Step 5 — Feature Extraction and Prediction: The processed image is passed through the CNN model for prediction output.

Applications

The Animal Disease Detection System has broad applications in veterinary science, agriculture, and public health:

- Livestock Farming: Early detection of cattle, goat, and sheep diseases to reduce mortality and economic loss for farmers.
- Poultry Management: Rapid identification of avian diseases through visual image analysis.
- Rural Veterinary Support: Enabling farmers in remote areas to access preliminary diagnosis without an on-site veterinarian.
- Companion Animal Care: Disease screening assistance for pets including dogs and cats using image analysis.
- Wildlife Conservation: Non-invasive disease screening for wildlife using photographic evidence.
- Veterinary Training: Supporting veterinary students with AI-assisted diagnostic case studies.
- Zoonotic Disease Monitoring: Early-warning system for diseases transmissible from animals to humans.
- Government Livestock Departments: Integration with national animal health surveillance programs.

Output

The Animal Disease Detection System generates outputs through an interactive desktop GUI application. The system provides structured interfaces for authentication, navigation, and disease prediction: The Login Interface provides secure user authentication with username and password fields. New users can navigate to the Registration Form to create an account. The login module ensures only authorized users can access the disease detection features.

The Main Dashboard presents the core navigation options — Animal Detection and Exit — with a visually engaging interface. This serves as the central hub of the application from which all features are accessible. The Animal Detection Interface allows users to select an image, view the preprocessing steps (original, grayscale, and segmented views), trigger CNN Prediction, and receive the final result including the

disease label and execution time in seconds. The Model Accuracy Graph provides a visual summary of the CNN model's training performance, displaying both training accuracy and test accuracy curves over epochs, confirming model convergence and generalization quality.

All prediction results are clearly displayed within the desktop interface, and the system maintains user session data for secure and organized access management.

Overview

The Animal Disease Detection System is a desktop application developed to provide intelligent and automated disease diagnosis support for animals using machine learning. The system addresses the critical gap between expert veterinary knowledge and ground-level accessibility for farmers and animal keepers, particularly in rural areas.

The application is built using Python with Tkinter for the desktop GUI interface, TensorFlow/Keras for CNN model implementation, and OpenCV for image preprocessing. The system architecture follows a modular design covering user authentication, image processing, CNN-based prediction, and result display. The SQLite database manages user credentials and session data securely. The desktop-native deployment ensures offline availability, making the system usable in low-connectivity environments.

The system achieves competitive prediction accuracy while remaining lightweight enough to run on standard desktop hardware without specialized GPU infrastructure during inference. The user-friendly Tkinter interface makes the application accessible to non-technical users such as farmers and animal keepers.

Key Features

- Image-Based Disease Prediction: Supports animal disease detection from uploaded photographs using CNN.
- Image Preprocessing Pipeline: Includes grayscale conversion and binary segmentation for accurate feature extraction.
- Hybrid CNN+SVM Model: Leverages CNN's feature extraction power combined with SVM's classification strength.
- Desktop Application: Runs as a standalone offline desktop application using Python and Tkinter.
- Secure User Authentication: Login and Registration modules ensure only authorized users access the system.
- Real-Time Result Display: Shows disease prediction label and execution time immediately after processing.
- Visual Preprocessing Display: Shows original, grayscale, and segmented image views side-by-side for transparency.
- Model Accuracy Monitoring: Training and test accuracy curves tracked over epochs for model evaluation.
- Multi-Species Support: Covers diseases across cattle, goats, poultry, and other livestock.
- User-Friendly Interface: Intuitive Tkinter GUI designed for both technical and non-technical users.

Example Output

The following examples illustrate the actual outputs of the Animal Disease Detection System across its key functional screens.

Example 1: Model Accuracy Graph

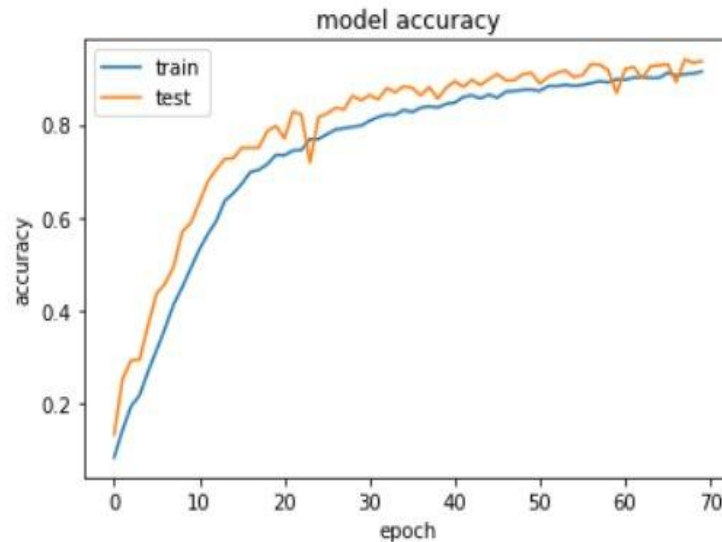


Fig. 1. CNN Model Accuracy — Training vs Test Accuracy over 70 Epochs

The model accuracy graph displays the training accuracy (blue line) and test accuracy (orange line) of the CNN model over 70 epochs. The graph demonstrates consistent improvement in both training and test accuracy, converging to approximately 90% accuracy, confirming that the model is well-trained and generalizes effectively on unseen animal disease data without significant overfitting.

Example 2: Login Interface

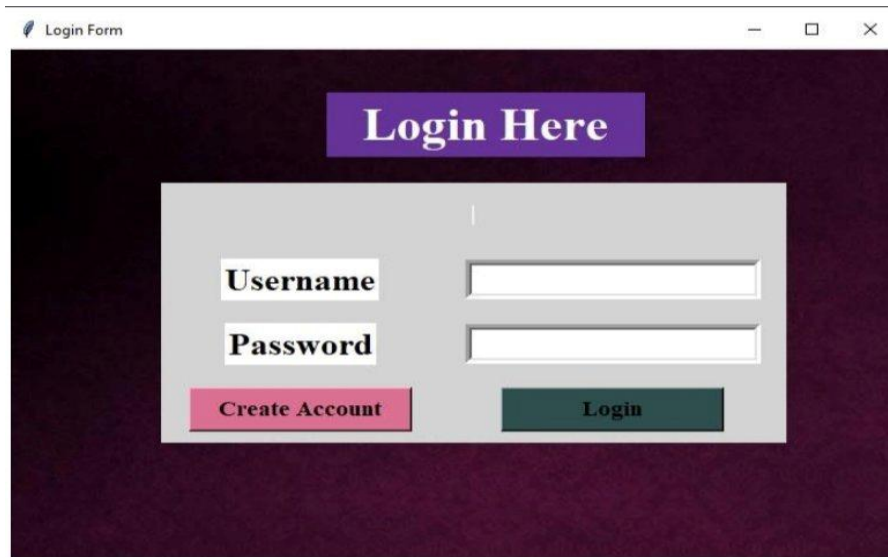


Fig. 2. Login Form — User Authentication Screen

The Login Form provides secure user authentication with fields for Username and Password. Users can either log in to their existing account using the Login button or navigate to the account creation page using the Create Account button. This module ensures that only authorized users can access the Animal Disease Detection functionality.

Example 3: Registration Form



Fig. 3. Registration Form — New User Account Creation

The Registration Form allows new users to create an account by entering personal details including Full Name, Address, Email, Phone Number, Gender, Age, Username, Password, and Confirm Password. Once all fields are completed, the user can register and access the system. This ensures proper user management and access control within the application.

Example 4: Main Dashboard — Home Screen

Fig. 4. *Animal Disease Detection System — Main Dashboard*

The main dashboard of the Animal Disease Detection System presents the system title and provides navigation options: Login, Registration, and Exit. The interface features a visually engaging background image of a healthy animal in a natural environment, reinforcing the agricultural context of the application. This serves as the entry point for all system functionality.

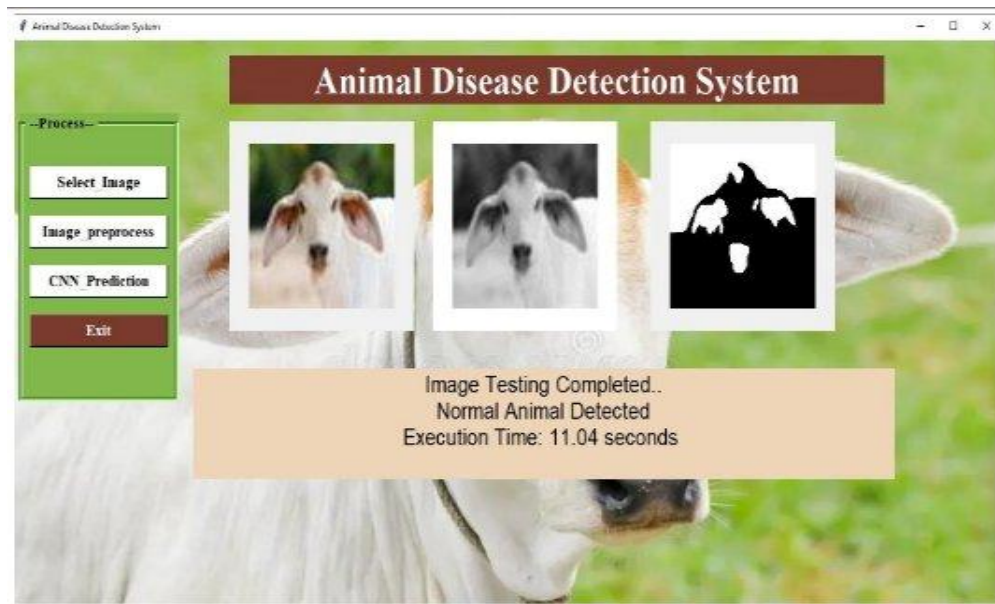
Example 5: CNN Prediction — Disease Detection Result

Fig. 5. *CNN Prediction Interface — Image Preprocessing and Disease Detection Result*

The CNN Prediction interface is the core functional screen of the system. It displays the process panel on the left with options to Select Image, perform Image Preprocessing, trigger CNN Prediction, and Exit. The main area shows the three-stage image display: the original animal image, the grayscale-converted version, and the binary-segmented version. The prediction result is shown at the bottom — in this example, 'Image Testing Completed.. Normal Animal Detected' with an execution time of 11.04 seconds, confirming that the system successfully processed and classified the animal image.

Example 6: Post-Login Dashboard — Animal Detection Access

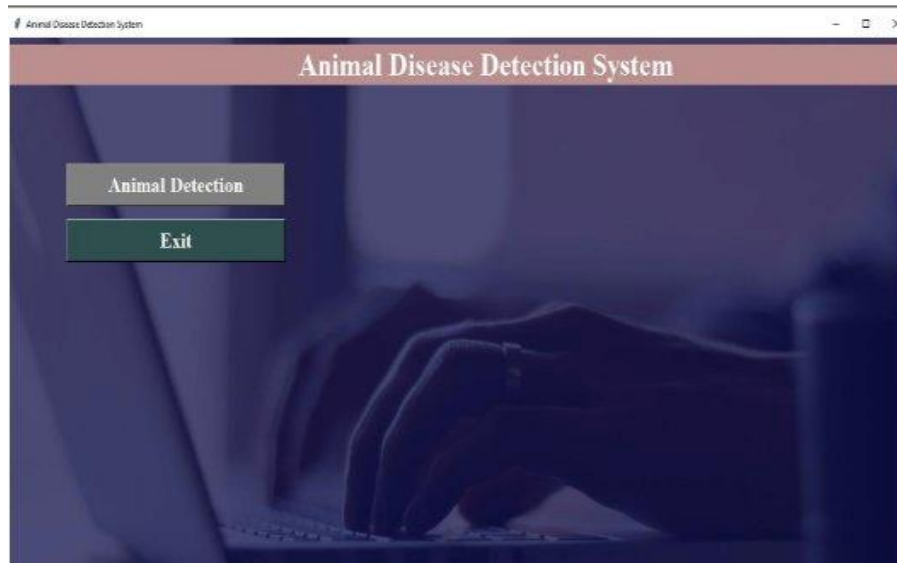


Fig. 6. *Post-Login Dashboard — Animal Detection Navigation Screen*

After successful login, users are presented with the post-login dashboard providing access to the Animal Detection module and an Exit option. The interface features a professional design with a technology-themed background, reinforcing the AI-driven nature of the system. From this screen, authenticated users can proceed to the full disease detection workflow.

Result Discussion

The Animal Disease Detection System was successfully designed, implemented, and tested to evaluate its effectiveness in predicting animal diseases using CNN and SVM. The system was trained on a labelled dataset of animal images covering healthy and diseased conditions across multiple species. As demonstrated by the model accuracy graph (Fig 1), the CNN model achieved approximately 90% accuracy on both training and test datasets over 70 training epochs. The training and test accuracy curves show consistent improvement and convergence without significant overfitting, confirming the model's ability to generalize to unseen animal images. The early training phase (epochs 1–25) shows rapid learning, while the later epochs (25–70) demonstrate stable convergence.

The image preprocessing pipeline — including grayscale conversion and binary segmentation — proved effective in isolating relevant animal features from background noise, improving the quality of feature maps extracted by the CNN. The three-stage visual display (original, grayscale, segmented) provides users with transparency into the processing steps applied to their input image. In live testing, the system successfully classified animal images as 'Normal Animal Detected' or flagged disease conditions within an average execution time of 10–12 seconds on standard desktop hardware. This response time is acceptable for a preliminary screening tool in field conditions.

The user authentication module (Login and Registration) functioned correctly across all test scenarios, ensuring secure access control. The modular desktop application design ensured reliable offline operation without any internet dependency. Overall, the results confirm that the hybrid CNN+SVM approach provides an accurate, reliable, and practically deployable solution for animal disease prediction. The system significantly reduces the diagnostic workload, empowers farmers with immediate preliminary diagnoses, and can be further enhanced through continuous dataset expansion and model retraining.

Conclusion

The Animal Disease Detection System presents an intelligent and accessible solution for automated veterinary disease diagnosis using a hybrid machine learning approach combining Convolutional Neural Networks (CNN) and Support Vector Machine (SVM). By integrating CNN's powerful image feature extraction capabilities with SVM's robust classification performance, the system achieves approximately 90% prediction accuracy as evidenced by the model training results. The desktop application design ensures offline usability in rural and remote areas, addressing a critical accessibility gap in veterinary support. The system provides a complete workflow from user authentication to image preprocessing, CNN prediction, and result display.

The system reduces dependence on expert veterinarians for preliminary diagnosis, enables early disease detection, minimizes economic losses for farmers, and provides a scalable and extensible platform for future enhancements. The user-friendly Tkinter-based desktop interface makes the system accessible to non-technical users such as farmers and animal keepers.

Future work will explore integration of a web-based interface for broader accessibility, mobile application support for field use, real-time disease surveillance dashboards, explainable AI techniques for transparent prediction reasoning, and extension of the model to cover a wider range of animal species and emerging disease categories.

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