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FarmLens: Cattle Breed Recognition and Disease Detection

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Abstract. *While conducting our research on this topic, we found out that conventional cattle monitoring systems, such as visual inspection and laboratory examination, are inefficient and hard to implement on farms. These processes are very time-consuming and may postpone decision-making. To solve this problem, our approach involved using machine learning and computer vision for breed classification and disease detection through images. We have examined various models, both simple algorithms such as the SVM and k-NN models and more advanced deep learning algorithms such as CNN, ResNet, EfficientNet, and YOLO. In our analysis, YOLO was more effective in real-time detection due to its speed whereas CNN-based models were effective in disease classification accuracy. Although, we had a few limitations such as a lack of data, different environmental factors, and the inability to use these models in actual farm scenarios. To a certain extent, this publication represents both advantages and practical constraints of the application of AI to the monitoring of livestock.*

Keywords: Emotion Recognition, Multimodal Learning, Computer Vision, NLP, Speech Processing, Deep Learning, Python.

Introduction

Cattle are quite useful in agriculture since they supply milk, meat and even facilitate the improvement of soil fertility. But it is not an easy task having a large number of cattle, particularly in such countries as India where the number of cattle is very high. Lack of access to veterinary assistance is a major issue that can cause farmers to have difficulties with proper breed identification and the ability to detect diseases at the earliest stages. While working on this topic, we found that manual monitoring is not suitable for large farms. It is too lengthy and exhausting and crucial matters are overlooked. As a result, there is a growing need for automated and cost-effective solutions. Machine learning and computer vision help by analyzing the images of cows and discovering the patterns. There are usually two types of cattle; indigenous and exotic. Local breeds such as Sahiwal and Gir are less sensitive to local conditions and they are immune to diseases, as compared to exotic breeds such as Holstein Friesian that produce more milk and demand higher attention. Identifying diseases such as Lumpy Skin Disease (LSD) remains a key issue, as it can

negatively affect productivity. In our research we have noted that image analysis with the help of deep learning can be used to assist in early detection that can minimize losses and lead to better livestock health.

2. Related Work

In recent years, machine learning and deep learning methods have been applied to monitor and breed identify cattle. The earlier methods used traditional algorithms, such as Random Forests, which provided satisfactory results but were unable to solve problems associated with complex images and big data [5], [1]. Along with development in computer vision technology, the emergence of convolutional neural networks has provided better results in breed identification [8], [3]. These techniques are helpful since they can automatically detect features from images and do not require significant human intervention. Current research focuses on making these models applicable in practice through lightweight architectures and transfer learning, reducing computation time and enabling the deployment of these solutions in a real-life environment, such as farms [6], [9]. Additionally, there is ongoing work on disease detection by implementing similar convolutional neural network structures, which provide accurate results and can be used to detect Lumpy Skin Disease [12], [11]. Breed identification in conjunction with disease detection can positively contribute to livestock monitoring [2], [10]. Nonetheless, several problems such as small datasets and practical applications must be addressed.

Table 1: Literature Review

Ref No.	Author / Year	Domain	Approach / Method	Key Observation / Finding
[1]	Bezsonov et al. (2021)	Breed Identification & Weight Estimation	ML + Computer Vision using image features	This work shows that both breed and body weight can be estimated together from images, reducing the need for manual measurement.
[2]	Chowdhury et al. (2026)	Cattle Identification (Review)	Review of ML, CNN, Transformer models	The study explains how methods have improved over time and points out issues like limited datasets and variations within the same breed.
[3]	Gupta et al. (2022)	Dairy Cow Breed Detection	Computer vision with color, texture, and shape features	The results indicate that proper image preprocessing is important, especially when breeds look similar.
[4]	KS Yadhav	Indigenous Breed Identification	Image-based classification	This study highlights that many models struggle with Indian cattle breeds due to differences in their features.
[5]	Kasarda et al. (2023)	Breed Classification	Random Forest using phenotypic & genomic	The method works well with different types of data and also makes it easier to

Ref No.	Author / Year	Domain	Approach / Method	Key Observation / Finding
			data	understand results compared to deep learning.
[6]	Arya et al. (2025)	Indigenous Breed Classification	Lightweight CNN model	The model is designed for practical use and can run on mobile devices, which is useful in rural areas.
[7]	Duraiswami et al. (2022)	Breed Detection & Categorization	Image segmentation + ML classifiers	Combining preprocessing with classification improves accuracy and ensures reliable performance across different cattle breeds.
[8]	Manoj et al. (2021)	Breed Identification	CNN-based approach	This study shows that deep learning outperforms traditional methods in cattle breed identification.
[9]	Mahadev (2023)	Indigenous Breed Identification	Transfer Learning with CNN	Fine-tuning pre-trained models helps achieve good accuracy even when data is limited.
[10]	Tikarya et al. (2023)	Breed + Disease Detection (Review)	Multi-task deep learning models	The study suggests that combining breed and disease detection in one model can improve efficiency.

3. Theoretical Background

A. Cattle Breeds

Cattle breeds can be categorized as:

Breed	Type	Key Features
Sahiwal	Indigenous	Produces a good amount of milk and can handle hot weather conditions well.
Red Sindhi	Indigenous	Known for its ability to resist diseases and maintain steady milk production.
Gir	Indigenous	Has a unique body structure and is considered highly productive.
Tharparkar	Indigenous	Suited for dry areas and can survive in harsh environmental conditions.
Holstein Friesian	Exotic	Widely used in dairy farming due to its very high milk production.
Jersey	Exotic	Gives moderate milk output and can adapt easily to different environments.

B. Cattle Diseases

Common cattle diseases include:

Disease	Type	Cause
Lumpy Skin Disease	Viral	Caused by the Capripoxvirus, which leads to skin lumps and affects overall productivity.
Ringworm	Fungal	Occurs due to dermatophyte fungi, mainly affecting the skin and hair of cattle.
Mange	Parasitic	Happens when mites infect the skin, causing irritation and loss of hair.
Dermatophilosis	Bacterial	Caused by D. congolensis, usually seen in moist or humid conditions.
FMD (Foot and Mouth Disease)	Viral	Caused by the Aphthovirus; it spreads quickly and affects different livestock animals.

C. Symptoms of Lumpy Skin Disease

Symptom	Description
Skin nodules	Visible lumps form on different parts of the animal's body.
Fever	The animal shows a rise in body temperature, which indicates illness.
Nasal discharge	Fluid is released from the nose and sometimes the eyes during infection.
Reduced milk	There is a noticeable drop in milk production.
Weight loss	The animal becomes weaker over time and starts losing body weight.

D. Role of Machine Learning and Deep Learning

As we know, machine learning algorithms such as CNNs have proven to be quite efficient in classification problems based on images. These models have the capability to automatically detect significant characteristics in images, such as color, textures, and shapes. Therefore, they can prove to be very useful in various scenarios, such as the recognition of cattle breeds and identifying diseases. We noticed in our study that CNNs can detect even the minor difference in images, which contributes to the increased accuracy of classification. But labeling such models typically takes a lot of data and computational power to train them. These problems can be handled by using transfer learning. With the pre-trained models that are already trained on general features with extensive dataset, we can reuse those models to apply to our problem with minimal data and training effort. This technique is not only effective in enhancing performance, as well as making the model more realistic to real-world problems where data is scarce.

4. Results

Our study shows that modern AI models have significantly improved in terms of efficiency with cattle monitoring systems. The CNN, ResNet, EfficientNet, and YOLO techniques allow determining the breed of cattle and detecting diseases with the help of image data automatically. During our analysis, we have noticed that YOLO is especially effective in real-time detection tasks due to its fast performance, whereas CNN-based models are effective at solving classification problems. We also discovered that transfer learning can be used to facilitate good results even with limited dataset at hand.

The performance of the model could change because of variation in lighting and weather conditions, which could lead to variation in the quality of images. Moreover, the properly labeled datasets are not available, and it may be challenging to implement these models in real farm settings. Additionally, there may be a lack of datasets as well as issues associated with deploying these algorithms to practical use on real-world farms. Despite this, AI-powered solutions ensure less need for manual work and allow farmers to make more effective decisions.

Table 2: Model Comparison

Model Name	Key Strengths	Limitations
SVM	Performs well on smaller datasets and can achieve good accuracy.	Highly dependent on proper parameter tuning.
k-NN	Simple to use and does not require a separate training phase.	Can become slow when handling large amounts of data.
Random Forest	Works well with varied data and helps reduce overfitting.	Outputs are less interpretable compared to simpler models.
CNN	Very effective for image-related tasks as it learns features automatically.	Needs a large dataset and higher computational resources.
ResNet	Addresses the vanishing gradient issue in deep neural networks.	Requires significant computational power.
EfficientNet	Provides better performance through efficient scaling of the model.	Needs proper tuning to achieve optimal results.

5. Conclusion

From our analysis, we have established that the use of AI methods can make the process of livestock monitoring more effective by making it easier and faster when compared to the manual process. CNN and YOLO have proved to perform efficiently in the identification of breeds and disease detection and thus proving the feasibility of using image-based methods in this sector. Moreover, we have learned that data quality, proper training, and their capability to operate under realistic conditions determine their effectiveness. The outcome from the analysis seems promising, however, large and diverse datasets need to be created for better performance.

Implementation of these technologies can be quite convenient, and the development of efficient and practical applications can help the farmers, especially those in rural areas, where professional services are not accessible. Improving the effectiveness of these models will be vital in the future.

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