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Image Based Animal Type Classification for Cattle and Buffaloes

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ABSTRACT- ***Image-based Animal Classification has become an important application of Artificial Intelligence in agriculture and dairy farming. The project, Image Based Animal Type Classification for Cattles and Buffaloes, aims to automatically identify whether an uploaded animal image belongs to cattle or a buffalo using Deep Learning techniques. Manual identification often becomes difficult due to similar qualities, especially for new farmers, veterinary staff, and animal management organizations. Incorrect classification may lead to improper data recording, breeding decisions, and health monitoring. To overcome these challenges, this project utilizes Convolutional Neural Networks (CNN) for feature extraction and image classification. The system is developed using Python and Flask as the backend framework, while HTML, CSS, and Javascript provide an interactive web interface. Image preprocessing methods, including resizing, normalization, and data augmentation, enhance the model's robustness and improve its ability to handle variations in input images. The trained CNN model learns distinguishing visual features such as horn structure, skin texture, body shape, and facial features to accurately classify animals. The system provides fast, accurate, and automated classification with minimal human intervention. It reduces manual effort, improves livestock record management, and supports smart dairy farming practices. The developed web application allows users to upload images and instantly obtain prediction results.***

KEYWORDS: ***Artificial Intelligence, Deep Learning, Image Classification, Convolutional Neural Network (CNN), Computer Vision, Livestock Identification, Flask Web Application, Image Processing, Cattle Classification.***

INTRODUCTION

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The animal farming sector plays a significant role in agriculture and the dairy industry by supporting milk production, breeding activities, transportation, and rural economic development. Among various domestic animals, cattle and buffaloes are extensively reared worldwide due to their importance in dairy production, farming activities, and rural livelihoods. Due to their similar physical characteristics, distinguishing cattle from buffaloes accurately remains a challenging task, yet it is crucial for effective animal management, healthcare monitoring, breeding control, insurance validation, and smart farming applications. Traditional identification methods rely heavily on human expertise, making the process time-consuming and tending to errors.

With recent advancements in Artificial Intelligence and Computer Vision, automated image classification has become a reliable solution for animal identification. Deep Learning algorithms, particularly Convolutional Neural Networks, have demonstrated excellent performance in extracting complex visual features from animal images. These models automatically learn features such as facial structure, body shape, skin colour, and texture.

The Image Based Classification for Cattles and Buffaloes system provides an intelligent web-based platform that allows users to upload animal images and instantly receive classification results. The application is developed using Python, Flask, tensorflow, OpenCV, HTML, CSS, and javascript. The model is trained on a labelled animal image dataset to achieve high classification accuracy. This project promotes digital agriculture by enabling faster identification, reducing manual effort, and improving animal management.

RELATED WORK

The rapid growth of Deep Learning has significantly improved image classification tasks across multiple domains, including agriculture and animal management. Earlier studies primarily employed traditional Machine Learning algorithms such as Support Vector Machine (SVM), Random Forest, Decision Tree, and K-Nearest Neighbors using handcrafted image features. Although these approaches achieved moderate accuracy, their performance largely depended on manually extracted features and image quality.

Recent studies have increasingly focused on Convolutional Neural Networks (CNNs) due to their capability to automatically extract multi-level visual features from images without manual feature engineering Various deep learning approaches have

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shown promising results in animal recognition tasks by improving feature extraction and classification accuracy through automated learning techniques. Several researchers have applied CNN-based techniques for cattle face recognition, animal head counting, breed identification, disease detection. Transfer learning has also become popular because pretrained models reduce training time while improving classification performance.

Despite these advancements, many existing systems focus only on breed classification or individual animal identification. Furthermore, some applications are limited to offline processing and lack user-friendly interfaces for farmers. The system addressed these limitations by developing a CNN-based web application capable of accurately classifying cattle and buffalo images in real time through an browser interface.

LITERATURE SURVEY

Several researchers have explored Artificial Intelligence for animal identification. Hansen et al. proposed a CNN-based face recognition model achieving high accuracy for identifying individual animals using facial images. Their work demonstrated the effectiveness of deep feature extraction but required extensive training datasets. Several researchers have explored deep learning-based approaches for animal image classification. Previous studies have demonstrated that Convolutional Neural Networks (CNNs) can effectively identify animals by automatically extracting important visual features such as shape, texture, and appearance patterns. These approaches have shown better performance compared to traditional machine learning techniques that depend on manually designed features.

These studies confirm that CNN-based approaches outperform conventional machine learning algorithms. However, many systems focus on multiple animal categories instead of specifically distinguishing cattle from buffaloes. The work develops a customized CNN model optimized for animal classification with a lightweight Flask-based web application that offers fast prediction.

EXISTING METHOD

Animal classification systems commonly employ pretrained deep learning architectures. These models classify multiple animal species by learning visual features from large datasets. Although they produce high accuracy, several practical limitations. Many existing methods require computational resources, making difficult

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on low-cost agricultural systems. Most existing models are sensitive to variations in image quality, lighting conditions, and complex backgrounds, which can reduce classification accuracy. Although several studies have explored animal classification and breed recognition, the accurate differentiation of visually similar species, particularly cattle and buffaloes, remains an important research challenge. Traditional machine learning approaches require feature extraction, which reduces robustness under varying environmental conditions. Another limitation is the lack of user-friendly interfaces for farmers. Most research implementations remain experimental and cannot be directly used by non-technical users. Image quality variations caused by lighting, background clutter, and camera angle further reduce classification performance.

These shortcomings motivate the development of an efficient web-based classification system that combines CNN-based feature learning with an interactive Flask application capable of providing fast, accurate, and practical identification.

PROPOSED METHOD

The system introduces an intelligent image classification framework that automatically describes cattle and buffaloes using Convolutional Neural Networks. The model receives an uploaded image through a Flask-based web application and performs preprocessing operations including resizing, normalization, and pixel scaling.

The processed image is then passed through multiple convolutional layers where visual features such as shape, body texture, facial structure, and skin colour are extracted. Pooling layers reduce computational complexity while fully connected layers perform final classification. The trained CNN model predicts whether the uploaded image belongs to a cattle or buffalo with high confidence.

The proposed system overcomes several limitations of existing methods by utilizing a CNN-based image classification approach that automatically learns visual features. Through image preprocessing and deep learning, the system achieves reliable classification of cattle and buffaloes under different imaging conditions. A Flask-based web interface enables convenient image upload and instant prediction, making the application accessible to users with limited technical expertise. The developed system supports animal record management and informed decision-making in modern agricultural practices.

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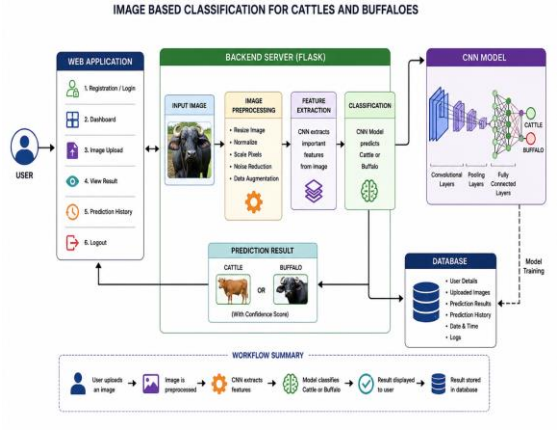

Fig 1: Classification of cattle and buffaloes by images

MODULE DESCRIPTION

1.User Authentication Module

This module provides secure registration and logins for authorized users. User credentials are stored securely in the database to ensure authenticated access to the animal classification system.

2.Image Upload Module

Users upload cattle or buffalo images through the web interface. The module validates image format and size before forwarding the image for preprocessing.

3.Image Preprocessing Module

Uploaded images undergo resizing, normalization, and noise reduction to improve image quality. Preprocessing ensures consistent input dimensions for CNN prediction.

4.CNN Classification Module

The deep learning model extracts important visual features and classifies the uploaded image into cattle or buffalo categories with high prediction accuracy.

5.Result Display Module

After processing the uploaded image, the system displays the predicted animal category through the Flask web interface. This module provides a simple and user-friendly output that helps users easily interpret the classification result.

6.Database Management Module

Stores user information, uploaded images, prediction history and system logs for future analysis.

RESULTS AND DISCUSSION

Output 1: Home Page

The home page provides a simple and user-friendly interface with navigation options for users and administrators. It serves as the main entry point to the animal classification application.

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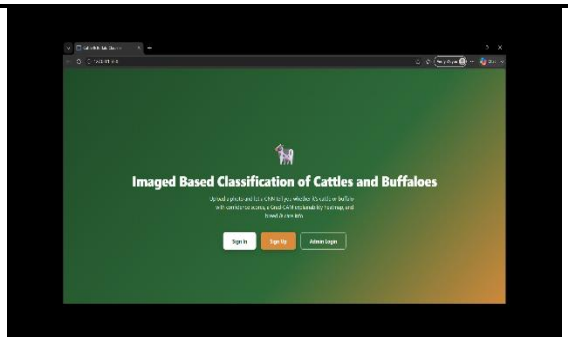
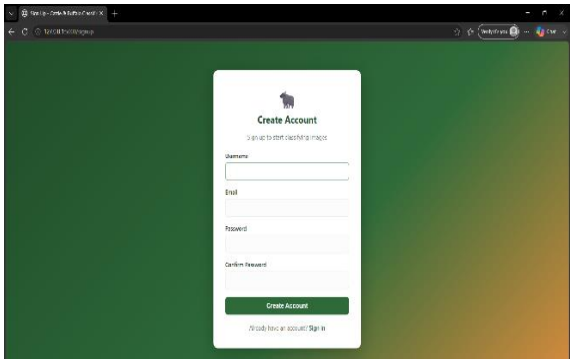


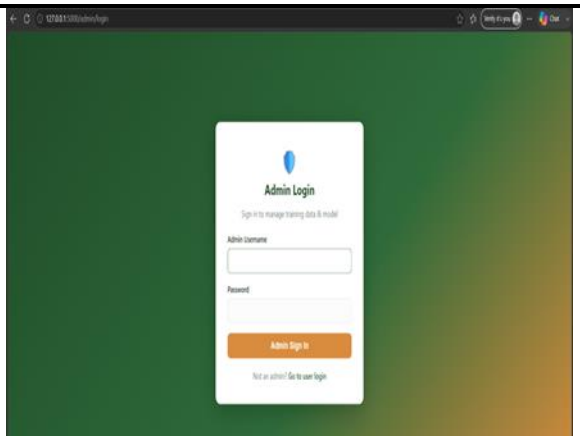
Output 2: User Sign Up

The sign-up page allows new users to register by entering their personal details and creating a secure account to access the system.



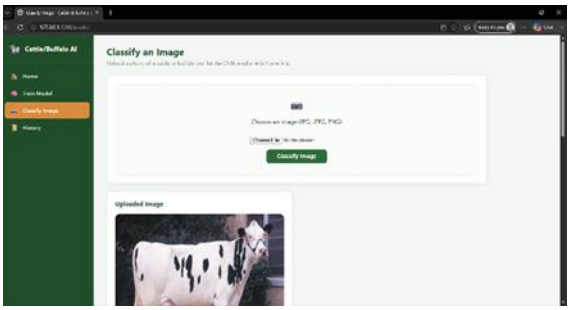
Output 3: User Sign In

The sign-in page enables registered users to securely log in using their valid username and password before accessing the application features.



Output 4: Admin Login

The admin login page provides secure authentication for administrators, allowing them to manage the system and perform model training operations.



Output 5: Model Training

The model training module allows the administrator to train the Convolutional Neural Network (CNN) using the available cattle and buffalo image dataset. The trained model is then saved for future predictions.

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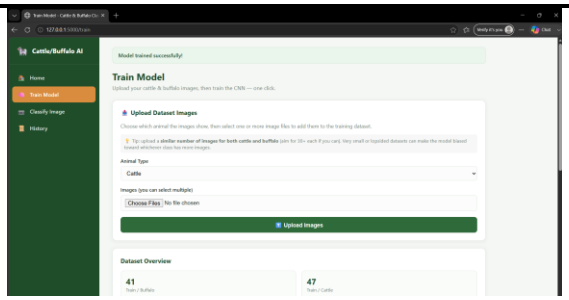
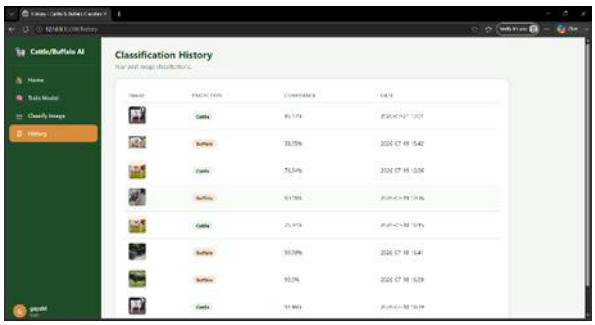


Output 6: Image Prediction

Users can upload an image of a cattle or buffalo through the web interface. The trained CNN model processes the uploaded image and predicts the corresponding animal type.

Output 7: Prediction Result

After image analysis, the application displays the predicted animal category along with the prediction confidence, providing users with an accurate classification result.



Output 8: Prediction History

The prediction history module stores previously classified images, prediction results, and timestamps. Users can review their past predictions for future reference and analysis.

CONCLUSION

The Image Based Animal Type Classification for Cattle and Buffaloes system successfully demonstrates the effective application of Deep Learning and Computer Vision for automated animal identification. The developed CNN-based classification model accurately distinguishes between cattle and buffaloes from uploaded images, reducing the dependency on manual identification methods. The Flask-based web application offers a simple, secure, and user-friendly interface that enables users to perform image classification in real time with minimal technical knowledge.

The proposed system not only improves classification accuracy and simplifies record management but also supports faster and more reliable decision-making in animal husbandry. By integrating Artificial Intelligence into agricultural practices, the system contributes to the advancement of smart farming and digital livestock management. In the future, this solution can

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serve as a valuable tool for farmers, veterinary professionals, researchers, and livestock organizations by reducing human effort, saving time, and improving the efficiency of animal monitoring. As AI technologies continue to evolve, such intelligent systems have the potential to support future generations of farmers by promoting sustainable agriculture, increasing productivity, and enabling data-driven livestock management for improved farming outcomes.

FUTURE SCOPE

The proposed Image Based Animal Type Classification for Cattle and Buffaloes system can be further enhanced by expanding its capabilities to identify multiple animal species and different breeds using larger and more diverse datasets. Incorporating advanced Deep Learning techniques, such as transfer learning models can further improve classification accuracy while reducing computational complexity and training time.

Future developments may also include the creation of a mobile application, enabling farmers to classify animals directly from smartphones in remote farming locations. The system can be extended to support real-time video-based animal classification for continuous monitoring on farms. Additionally, integrating animal disease detection and health monitoring using image analysis, along with IoT technologies such as RFID tags, GPS tracking, and smart sensors, can provide comprehensive management solutions.

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