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AgriSense: AI-Powered Disease Diagnosis and Fertilizer Recommendations

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ABSTRACT: Traditionally, both farmers and veterinarians rely on experience or manual observation to diagnose diseases in crops and animals, which often leads to delays or inaccuracies in treatment. Identifying diseases at an early stage remains a significant challenge, especially in rural areas with limited access to expert guidance. To address this issue, we propose AgriSense — an AI-driven system that predicts diseases in plants and animals based on observed symptoms and location-specific data. The system uses image analysis for detecting plant diseases and symptom-based classification for animal disease prediction. By leveraging machine learning algorithms, it accurately diagnoses issues and recommends suitable fertilizers or medicines. The goal of this system is to support farmers and veterinary professionals by providing early detection and effective treatment suggestions, ultimately improving agricultural productivity and animal health.

KEYWORDS: Animal disease, plant disease, classification, machine learning.

I. INTRODUCTION

Agriculture has always been a vital part of the Indian economy, with both crop cultivation and livestock farming forming the backbone of rural livelihoods. However, one of the persistent challenges faced by farmers is the timely and accurate identification of diseases in plants and animals. Without proper knowledge or access to experts, farmers often resort to guesswork or delayed actions, which can lead to serious losses in yield and health. This highlights the urgent need for a reliable, intelligent, and accessible solution to assist farmers in early disease detection.

Traditionally, disease diagnosis is done by visual inspection or manual analysis by agricultural officers or veterinary professionals. This approach can be time-consuming, inconsistent, and largely dependent on human expertise. Moreover, in remote or underdeveloped regions, the lack of skilled personnel often leads to untreated or wrongly treated cases. With the rise of AI technologies, there is a growing opportunity to bridge this gap and build automated systems that offer faster and more accurate disease prediction.

AgriSense is a smart solution designed to tackle this issue by using artificial intelligence to detect plant and animal diseases based on symptoms and image data. For plant diseases, the system uses Convolutional Neural Networks (CNN) to classify diseases from leaf images. For animals, it applies a Random Forest algorithm to analyze selected symptoms and predict the possible disease. Once the disease is identified, AgriSense recommends suitable fertilizers or medicines, empowering farmers to take timely and effective action.

AgriSense is implemented as a web application to ensure wide accessibility without the need to install any software. Farmers or veterinary assistants can simply access the platform through a browser, upload a leaf image for plant diagnosis or select symptoms from a predefined list for animal diagnosis. The system processes the input and generates a clear diagnosis along with the appropriate treatment suggestions in real time.

The web interface of the AgriSense system is designed to be intuitive and farmer-friendly, prioritizing ease of use and accessibility. It simplifies complex AI-driven processes into straightforward, guided steps, enabling users—especially farmers with little to no technical background—to navigate the system effortlessly. Features such as visual cues, localized language support, and minimal input requirements make the platform practical for rural users. By removing the barrier of technical expertise, the system encourages broader adoption of advanced digital tools in agriculture. This empowers farmers to make informed decisions regarding crop and animal health and supports the larger goal of digital transformation in the agricultural sector, promoting sustainability and improved productivity at the grassroots level.

II. LITERATURE SURVEY

The main aim of the AgriSense project is to provide an AI-powered solution for detecting plant and animal diseases and recommending appropriate fertilizers and medicines. This project uses Convolutional Neural Networks (CNN) for plant disease detection and Random Forest for animal disease detection. Based on the detection results, the system suggests suitable fertilizers for plants and medicines for animals. This approach ensures efficient and accurate support for farmers in managing crop and livestock health. By automating the diagnosis process, it reduces the reliance on manual inspections and expert intervention. The proposed survey gives us an idea to research on the same.

From paper [1], crop disease is identified as a critical issue in global agriculture, leading to significant yield losses. The proposed EfficientNet Convolutional Group-Wise Transformer (EGWT) model combines EfficientNet for local feature extraction with a group-wise transformer for enhanced feature attention. It achieves impressive accuracy—99.8% on the PlantVillage dataset, 86.9% on the Cassava dataset, and 99.4% on the Tomato dataset—while using only 23.04 million parameters. This allows it to outperform conventional CNNs, transformers, and hybrid models in both accuracy and efficiency.

From paper [2], a modified YOLOv5-based architecture is introduced for crop disease detection. This model integrates the Squeeze-and-Excitation (SE) module for improved feature discrimination, the CARAFE module for refined up-sampling, EIoU loss for better localization, and Ghost Convolution to reduce computational complexity. The system achieves 90.0% accuracy, 92.1% mAP@0.5, and significantly reduces parameters by 23.9% and computation by 31.2%, making it suitable for lightweight, real-time crop monitoring.

From paper [3], the LiteralKG model is presented to enhance animal disease diagnosis by combining structural and literal information from veterinary electronic medical records in a knowledge graph. A self-supervised learning task is used to uncover relational patterns, leading to improved performance in link prediction tasks compared to traditional graph embedding techniques.

From paper [4], various machine learning and deep learning techniques are explored for plant disease detection, with studies classified into image classification and object detection methods. Evaluations using the PlantDoc dataset reveal that YOLOv5 performs effectively for object detection, while ResNet50 and MobileNetV2 strike a good balance between accuracy and training time for classification tasks.

From paper [5], an early diagnosis framework for Bovine Respiratory Disease (BRD) is developed using IoT data and machine learning. The method introduces a cost-sensitive feature selection algorithm called Cost Optimization Worth (COW) and a heuristic approach named Cost-Aware Learning Feature (CALF). The model achieves 88% classification accuracy, predicts 70% of cases four days in advance, and detects 80% of persistent cases within five days.

From paper [6], a lightweight 2D CNN model is designed for the dual-crop classification of diseases in tomato and cotton crops across 14 classes. The model is deployed in a mobile application for real-time diagnosis, achieving 97.36 percent accuracy, 97% precision, and a 99.9% AUC score. Grad-CAM is utilized for visual interpretability, and the model offers an average inference time of 4.84 ms, making it efficient and interpretable for field use.

III. METHODOLOGY

The AgriSense system is designed to provide an intelligent and accessible solution for detecting plant and animal diseases and recommending suitable treatments. It integrates computer vision and machine learning techniques to deliver timely and accurate predictions through a user-friendly application interface.

1.Data Collection and Preprocessing : The crop disease detection module uses image datasets consisting of tomato, potato, and pepper leaves, covering both healthy and diseased classes. These images are preprocessed by resizing to a fixed resolution (224×224 pixels), normalizing pixel values, and applying augmentation techniques such as rotation, flipping, and brightness adjustment to enhance dataset diversity and model generalization. For the animal disease detection module, structured data is collected based on visible symptoms reported by users, such as coughing, nasal discharge, reduced appetite, and abnormal behavior. This symptom-based input is encoded and standardized to ensure consistency across predictions.

2.Crop Disease Prediction : A Convolutional Neural Network (CNN) architecture is employed for identifying diseases in tomato, potato, and pepper leaf images. The CNN model is trained to extract hierarchical features from the input images, enabling classification across multiple disease types. The model is optimized using categorical cross-entropy loss and validated using accuracy, precision, recall, and F1-score.

3.Animal Disease Diagnosis : Animal health prediction is based on user-provided symptoms. A Random Forest classifier is used to analyze these features and identify the most probable disease. The model benefits from the ensemble nature of Random Forest, improving robustness and interpretability. Upon classification, the system suggests appropriate medicines for treatment based on domain knowledge mapped to the identified disease.

4.Recommendation System : Following disease detection, AgriSense provides specific recommendations to assist the user in the next steps. For crops, suitable fertilizers are suggested depending on the diagnosed disease and plant type. For animals, a curated list of medicines is recommended according to the predicted illness and symptom severity.

5. Mathematical Model:

i. Crop Disease Prediction (using CNN)

Let the input image of a crop leaf be represented by:

$$I = \{i_1, i_2, \dots, i_n\},$$

where each i_j represents a pixel or feature vector from the image.

The CNN model is a function: $f_1: I \rightarrow D$

Where:

I is the input image space,

$D = \{d_1, d_2, \dots, d_k\}$ is the set of possible disease classes

So the prediction is: $\hat{d} = f_1(I)$

Where \hat{d} is the predicted disease.

ii. Animal Disease Prediction (using Random Forest)

Let the set of input symptoms be: $S = \{s_1, s_2, \dots, s_m\}$,

where each s_i is a binary or categorical feature (e.g., fever = yes/no, appetite = low/normal, etc.)

The Random Forest model is a function: $f_2: S \rightarrow A$

Where:

S is the symptom feature space,

$A = \{a_1, a_2, \dots, a_l\}$ is the set of possible animal diseases.

So the prediction is: $\hat{a} = f_2(S)$

Where \hat{a} is the predicted animal disease.

iii. Recommendation Systems

Let:

$M = \{m_1, m_2, \dots, m_u\}$ be the set of medicines.

$F = \{f_1, f_2, \dots, f_v\}$ be the set of fertilizers.

The recommendation functions can be defined as:

$g_1: D \rightarrow F \rightarrow$ recommends fertilizer for predicted crop disease.

$g_2: A \rightarrow M \rightarrow$ recommends medicine for predicted animal disease.

So:

Recommended Fertilizer = $g_1(\hat{d})$

Recommended Medicine = $g_2(\hat{a})$

Complete Functional Model

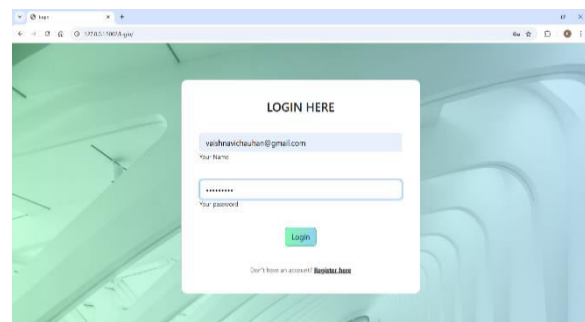
AgriSense System = $(I, S) \rightarrow (f_1(I), f_2(S)) \rightarrow (g_1(f_1(I)), g_2(f_2(S)))$

IV. EXPERIMENTAL RESULTS

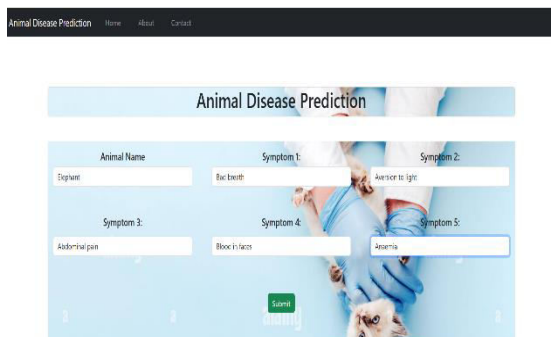
The AgriSense project delivers an effective AI-based solution to support farmers in identifying crop and animal diseases early. Using a CNN model, the system accurately detects diseases in tomato, potato, and pepper leaves and suggests suitable fertilizers. For animal health, a Random Forest model processes symptoms to predict illnesses and recommend medicines. This dual-module approach improves farm productivity and reduces losses by enabling timely action. The user-friendly interface, multilingual support, and reliable recommendations build user trust and promote technology adoption in rural areas. Overall, AgriSense enhances decision-making and supports efficient farm management.



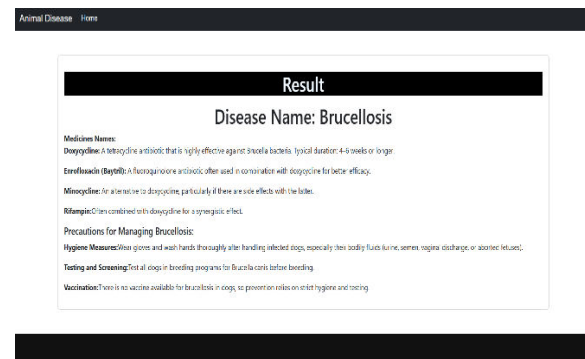
(a) Home Page



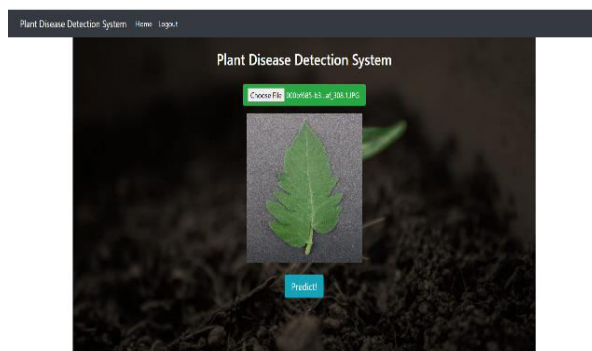
(b) Login Page



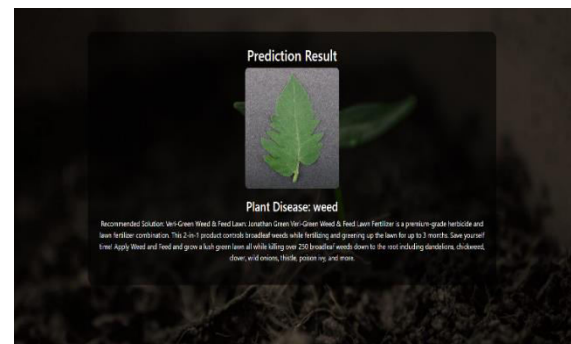
(c) Animal Input Page



(d) Animal Disease Prediction & Medicine Recommendation



(e) Crop Input Page



(f) Crop Disease Prediction & Fertilizer Recommendation

Crop Disease Detection	EGWT using ViT	CNN-based image classification for tomato, potato, peper
Animal Disease Detection	Not included	Symptom-based detection using Random Foresit model
Recommendations (Fertilizers/Medicines)	Not integrated	Suggests fertilizers & medicines
Model Complexity	High (transformers)	Moderate (CNN + RF)
Target Users	Researchers	Farmers/End-users
Interface Type	Not user-friendly	Easy-to-use UI (mobile/web)

(g) Comparison Graph

V. CONCLUSION

In conclusion, AgriSense offers a practical and efficient solution to a real-world problem by integrating artificial intelligence with a user-centric web platform. It supports farmers in making informed decisions, reducing crop and livestock losses, and improving overall agricultural outcomes. The system aims to be a reliable digital assistant in rural and semi-urban areas where access to expert help is limited.

VI. FUTURE SCOPE

In the future, AgriSense can be expanded to support a wider range of crops and animal species, making it useful for more farmers. The system can include multilingual support to help farmers in different regions understand and use the platform easily. By integrating real-time data from IoT sensors or satellite sources, AgriSense can provide early disease alerts and better recommendations. A chatbot feature can also be added to offer instant guidance. Additionally, connecting the system with live market prices and weather updates can help in giving smarter fertilizer and medicine suggestions. Finally, developing a mobile app with offline support will make it more accessible in rural areas with limited internet access.

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