International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 09 Issue: 02 | Feb - 2025 SJIF Rating: 8.448 ISSN: 2582-3930

Survey paper on Crop Classification using Convolutional Neural Network

Krish Bakshi[1], Sunil Bade[2], Mayur Bhand[3], Siddhesh Dhindale[4],

Guide Name: Dr.H.B.Jadhav

Department of Computer Engineering, Adsul's Technical Campus Chas.

---***---

Abstract - Crop Classification using CNN - A Multi-Model Approach for Crop Classification and Health Assessment Using Convolutional Neural Networks and GPT Integration. The integration of deep learning and natural language processing (NLP) in agriculture has gained significant attention for automating crop classification and disease diagnosis. This survey provides an extensive review of various deep learning models applied in crop classification, plant health assessment, and NLP-based report generation. The study explores the effectiveness of object detection models like YOLO, classification networks such as ResNet and EfficientNet, and NLP models like GPT for generating quality assessments. Additionally, this paper discusses the challenges and future research directions in this domain. The survey serves as a precursor to our research implementation, which integrates CNN-based models for crop identification, health assessment, and GPT-based NLP solutions for automated reporting.

***Key Words*:** Deep Learning in Agriculture, Convolutional Neural Networks (CNNs), Plant Disease Detection, Generative AI for Crop Analysis, Precision Agriculture.

1.INTRODUCTION

Agricultural advancements have increasingly relied on artificial intelligence to address key challenges in crop identification and disease diagnosis. Traditional approaches are often labor-intensive and prone to errors, necessitating the development of automated systems using deep learning techniques. This survey investigates the role of convolutional neural networks (CNNs) and NLP-based AI models in enhancing agricultural decision-making. Furthermore, it lays the foundation for our subsequent research, where we implement an end-to-end pipeline combining object detection, classification, and automated summary generation using GPT models.

2. LITERATURE REVIEW

Recent studies have explored the application of CNNs for crop classification and disease detection. Ferentinos (2018) utilized CNNs for plant disease detection, achieving high classification accuracy. Too et al. (2019) compared various deep learning models such as ResNet, VGG16, and EfficientNet, demonstrating their effectiveness in plant health assessment. Additionally, Zhang et al. (2021) provided a review of deep learning models applied to plant disease detection. In the NLP domain, Rezayi et al. (2023) explored GPT-based solutions for generating agricultural insights. Despite these advancements, no comprehensive system integrates CNNs for crop classification and NLP for automated report generation, a gap that our proposed system aims to bridge.

3. PROBLEM STATEMENT

Traditional methods for crop classification and disease detection rely heavily on manual observation, making them inefficient and error-prone. The lack of an automated system that combines real-time image analysis with NLP-based insights poses a challenge in precision agriculture. This study aims to address this gap by proposing a deep learning-based solution that integrates CNNs for image classification and GPT for automated reporting, thereby improving decision-making in farming practices.

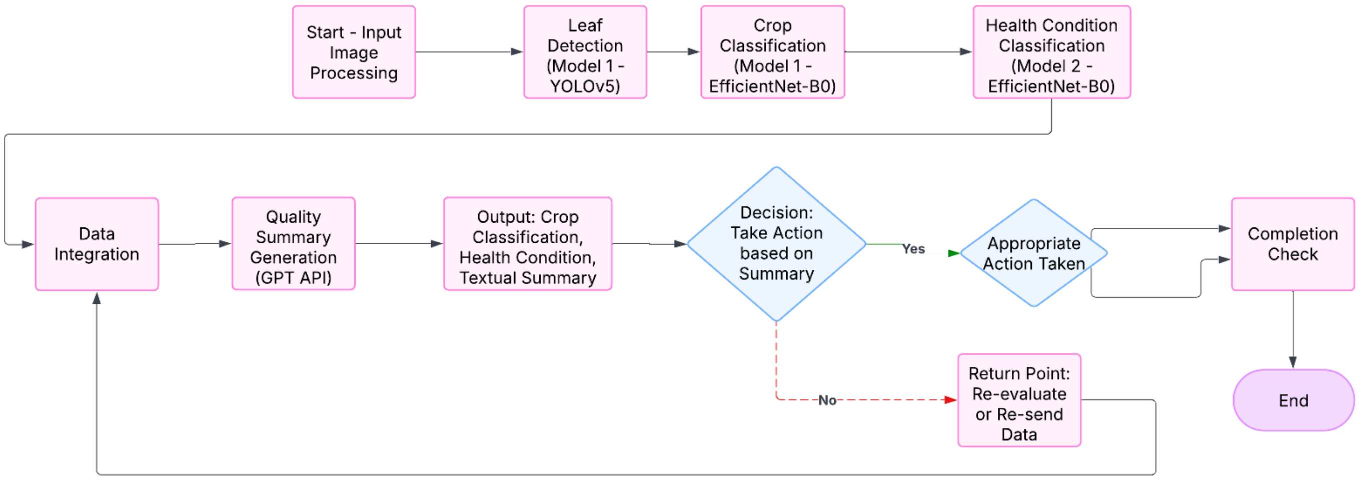
4. PROPOSED SYSTEM

The proposed system consists of three primary components:

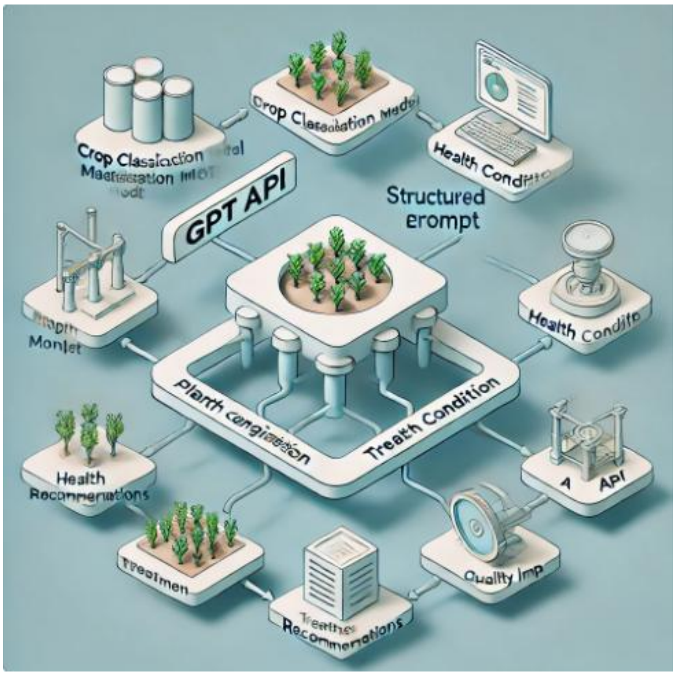
1. **Leaf Detection and Crop Classification:**
    - Uses YOLOv5 for object detection to identify leaf regions.
    - Applies EfficientNet-B0 for crop classification.
2. **Health Condition Classification:**
    - Employs EfficientNet-B0 to diagnose plant health conditions such as early blight and late blight.
3. **NLP-Based Report Generation:**
    - Utilizes GPT-based NLP models to generate structured reports containing disease diagnosis, treatment recommendations, and yield impact analysis.

This system has been implemented and validated in our research, demonstrating significant improvements in accuracy and usability compared to traditional methods.

Fig 1 - Proposed model pipeline design



5. BENEFITS OF PROPOSED SYSTEM



Automation: Reduces reliance on manual observation by leveraging AI-based classification.

Accuracy: Uses state-of-the-art CNNs, improving classification performance.

Efficiency: Provides real-time analysis, facilitating quick decision-making.

Actionable Insights: Generates detailed textual summaries with GPT, assisting farmers in implementing corrective measures.

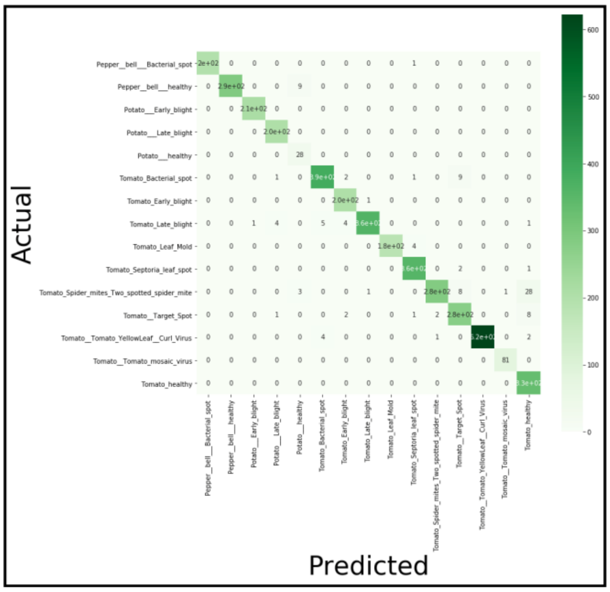
Scalability: Adaptable to different crop types and health conditions.

6. OUTPUT

The system provides the following outputs:

- **Crop Type Classification**: Identifies the plant type (e.g., tomato, potato).

- **Health Status Analysis**: Determines whether the plant is healthy or affected by disease.



- **Automated Reports**: Generates structured summaries with disease insights and treatment suggestions.

7. CONCLUSIONS

This survey highlights the growing role of deep learning in crop classification and plant health assessment, alongside NLP's potential for generating automated reports. The combination of CNNs and large language models presents a promising avenue for precision agriculture. However, challenges such as dataset availability and real-world deployment must be addressed for widespread adoption. Our research has implemented an end-to-end system that integrates

REFERENCES

1. 1. Ferentinos, K. P. (2018). Deep learning models for plant disease detection. *Computers and Electronics in Agriculture*, 145, 311-318.
2. Too, E. C., Yujian, L., Njuki, S., & Yingchun, L. (2019). A comparative study of fine-tuning deep learning models for plant disease identification. *Computers and Electronics in Agriculture*, 161, 272-279.
3. Zhang, S., Huang, W., & Zhang, C. (2021). Plant disease detection based on deep learning: A review. *Plant Methods*, 17(1), 22.
4. Rezayi, S., Liu, Z., Wu, Z., & Dhakal, C. (2023). Investigating the Potential of Large Language Models for Food Applications. *arXiv preprint arXiv:2306.11892*.