



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 13, Issue 4, April 2024

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.423

 9940 572 462

 6381 907 438

 ijirset@gmail.com

 www.ijirset.com

Potato Disease Detection Using Machine Learning Technique: Survey

Sayali Chaudhari, Prof. Balaji A. Chaugule

P. G Student, Department of Computer Engineering, Zeal College of Engineering and Research, Pune,
Maharashtra, India

Professor, Department of Computer Engineering, Zeal College of Engineering and Research, Pune,
Maharashtra, India

ABSTRACT: Among the most extensively farmed and frequently used foods worldwide is a potato. They provide vital nutrients and nourishment, making them an integral diet in numerous countries. Yet, a number of illnesses can affect potato crops, which can cause owners to suffer large financial losses. Many kinds of pathogens, particularly viruses, bacteria, fungi, and nematodes, are responsible for these illnesses. To ensure a profitable potato crop, quick identification and efficient handling of these pests are essential. The application of machine learning approaches to agricultural tasks, particularly disease identification, has garnered growing curiosity in the past few years. Machine learning strategies are perfect for discovering agricultural illnesses because they can analyse huge data sets and find trends. As a result, numerous machine learning-based algorithms for detecting potato diseases have been developed. Convolutional Neural Networks (CNNs), a deep learning technique, is used by multiple systems to diagnose problems in potato crops. The programme can detect infections in actual time has a success rate of over 90%. It was trained on a collection of photos of both normal and diseased potato crops. The efficacy of machine learning in detecting potato diseases constitutes one of its main advantages. Conventional disease detection methods frequently call on skilled individuals to personally inspect crops that can prove costly and costly. Machine learning makes it possible to swiftly and correctly identify diseases, enabling owners to make the appropriate precautions to avoid spreading of illness and reduce the loss of crops. Machine learning (ML) approaches provide a rapid, precise, and economical way to identify illnesses in potato crops promptly, enabling prompt and efficient control.

KEYWORDS: Leaf blight, late blight, early blight, potato scab, bacterial wilt, powdery scab, Convolutional Neural Networks (CNNs).

I. INTRODUCTION

Among the oldest and most frequently eaten and well-liked root veggies worldwide is the sweet potato. It is not only used in various culinary dishes but also serves as a major source of nutrition for many. However, like any other crop, potatoes are vulnerable to diseases caused by fungi, bacteria, and viruses. [1][2] These diseases can significantly reduce crop yield and quality, resulting in massive economic losses for farmers. Traditionally, potato diseases were identified and diagnosed by inspecting the leaves, stems, and tubers manually. In addition to taking a long time, this procedure was highly susceptible to error by humans, which could have resulted in inaccurate diagnosis and inadequate solutions. But as innovation has developed, deep learning and machine learning have shown promise as diagnostic tools for accurately identifying and diagnosing potato problems early on.[3]

Artificial intelligence's machine learning field gives machines the capacity to acquire knowledge and make judgements without explicit programming. Conversely, deep learning is an element of machine learning that handles and analyses massive volumes of data via artificial neural networks. [4] With the use of these cutting-edge methods, enormous volumes of agricultural info, such as pictures and sensor readings, may be analysed to find trends for early identification of disease. Insect and disease detection represent one of the main uses of deep learning and machine learning in farming. With the help of high-resolution cameras and sensors, images of plants can be captured and fed into machine learning algorithms for analysis. These algorithms can learn to differentiate between healthy and infected plants, and even identify specific diseases based on their visual symptoms.[5]

The application of machine learning and deep learning to potato detection of diseases has yielded positive outcomes. A recent study by researchers from Michigan State University showed that deep learning algorithms could identify and classify six major potato diseases with an accuracy of over 95%. These diseases included late blight, early blight, blackleg, pink rot, brown spot, and powdery scab. This technique may substantially decrease the amount of time and energy needed to perform physical diagnosis, allowing farmers to conduct swiftly and efficiently disease-control actions.[6]

The sensor information gathered from potato farms is also suitable for machine learning and deep learning as well as to picture analytics. These devices monitor a range of climatic parameters, including soil moisture, temperatures, and relative humidity, all of that have an impact upon the development and propagation of infection. Algorithms that use machine learning can forecast the probability of pest epidemics by evaluating this information, which enables farmers to come to well-informed decisions regarding crop care and preventive strategies. The capacity of machine learning and deep learning to consistently improve and become better is an additional advantage of employing them to identify potato diseases.[7]

As more data is fed into the algorithms, they can adapt and refine their predictions, leading to more accurate and reliable results over time. Moreover, these techniques are cost-effective and easy to implement, making them suitable for small-scale farmers as well.[8] Potato detection and diagnosis of diseases has showed great promise for machine learning and deep learning. Because of the rapid and precise handling of vast volumes of information, computers can assist farmer in early detection of diseases, which improves crop care and increases productivity. This type of equipment has the power to completely change how we track and treat diseases of plants, improving the productivity and sustainability of farming as it develops and becomes more widely available.[9][10]

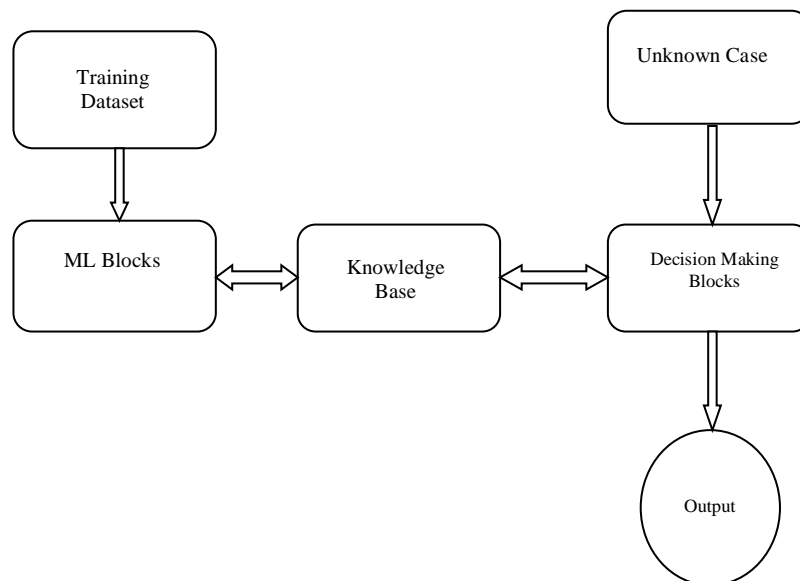


Figure 1. Structure of Machine Learning

II. RELATED WORK

The detection of flaws in farm products—especially in potatoes—largely depends on the application of computer vision and image processing techniques. Studies continues to be conducted in this area, however the processing of images and AI are being used more and more in farming to detect and categorise diseases and pests that affect crops and fruits. This research examines five types of potato infections using neural network convolution (CNN) approaches. A spreadsheet with 5,000 photos of potatoes was employed. We contrasted the outcomes obtained from our potato flaw method for classification with those of various others including transfers learning, R-CNN, VGG, Alexnet, and Googlenet. The outcomes demonstrate that the reinforcement learning technique's suggested reliability is greater than

that of previous research. In certain classifications, we achieve rates of precision of 100% and 99%, correspondingly. [1]

The progress of agricultural output is critical to a nation's economic development. Yet, the biggest obstacle to agricultural output as well as quality is plant diseases. Early detection of diseases of plants is essential to the good health and welfare of the entire world. During trips to the site, an analyst visually evaluates each plant as part of the standard evaluation approach. Yet, due to a lack of precision and limited human resource connectivity, inspection by hand for pests in agriculture is limited. In order to address these problems, robotic techniques that can accurately identify and classify a wide range of diseases of plants are needed. Accurately identifying and categorising plant illnesses is a laborious task due to low-impact data present in both the foreground and background of the picture, the striking colour similarity between unaffected and infected plant regions, noise that exists in the specimens, and variations in the location, chrominance, framework, and overall dimensions of plant leaves. The three stages in the process are as followed. Labels are created first in order to identify the area of interests. Subsequently, a refined version of CenterNet is presented, suggesting DenseNet-77 for the extraction of deep keypoints. Lastly, a number of plant diseases are detected and categorised using the one-stage detection CenterNet. [2] Among the most widely grown and consumed foods in the globe is the potato. It is a vital source of nourishment and meals for thousands of humans worldwide. Yet, a number of illnesses that can drastically lower crop productivity and quality are a common threat to potato farming. In the past, skilled experts have carried out the labour- and time-intensive manual method of detecting potato diseases. Advances in technology have led to the exploration of deep learning and machine learning algorithms as viable solutions for efficient and systematic potato disease diagnosis. [3][4]

"Machine intelligence oriented identification of potato diseases" classified potato infections according to their signs by combining machine learning methods such as vector machines, decision trees, and k-nearest neighbors. The outcomes demonstrated a high degree of infection detection accuracy, demonstrating the possibilities of machine learning within this field.[5] In the study "Identification of early blight infection in potatoes utilizing deep learning methods," Convolutional Neural Networks (CNNs), a type of deep learning model, were utilised to identify early blight diseases in crops of potatoes. The machines attained a 93.33% accuracy rate after being trained on pictures of both good and unhealthy potato leaf.[6] "Potato disease diagnosis with machine learning models centered on leaf image identification" - This study classified several potato illnesses relying on leaf images by combining artificial neural networks (ANNs) and transfer learning techniques. High precision as well as rapid illness detection capability were demonstrated by the results.[7]

In "The term "real- identification of potato infections utilizing deep neural networks and IoT-based platforms," the late blight infection in potatoes was identified through the use of actual time image analysis and a deep learning model. The pictures were taken with a camera that was linked to an Internet of Things system, which made it possible to identify the illness early and treat it quickly. [8] In the article titled "Potato infections categorization utilizing deep learning methods: A comparison research," the effectiveness of several deep learning models—including adversarial generative networks (GANs), CNNs, and long short-term memory (LSTM) networks—in the categorization of potato diseases was examined. CNNs outperformed all other models, as seen by their accuracy of 98.43%. [9][10]

III. CONCLUSION

An additional reliable approach to classifying diseases is provided by deep learning techniques. The system is less susceptible to biases and human mistake because it was trained on an extensive collection of photos. This may produce more reliable and precise findings, giving farms the trustworthy data they need to choose their crops. Deep learning has yielded encouraging results in a number of studies that have classified and detected potato diseases. In one study, a deep convolutional neural network was utilised to identify four prevalent potato disorders with above 90% accuracy. An additional study conducted in India identified and categorised six common potato illnesses with a 94% accuracy rate. In summary, deep learning techniques have demonstrated significant promise for the identification and categorization of potato diseases. They provide a quicker, more precise, and impartial method for detecting and categorising illnesses, which in the end can support agriculture in making wise decisions and reducing losses to crops. Deep learning has the potential to significantly improve potato output and availability in the future with additional developments and agreements.

REFERENCES

- [1] Arshaghi, A., Ashourian, M., & Ghabeli, L. (2022). Potato diseases detection and classification using deep learning methods. *Multimedia Tools and Applications*, 82(4), 5725–5742. <https://doi.org/10.1007/s11042-022-13390-1>
- [2] Albattah, W., Nawaz, M., Javed, A., Masood, M., & Albahli, S. (2021). A novel deep learning method for detection and classification of plant diseases. *Complex & Intelligent Systems*, 8(1), 507–524. <https://doi.org/10.1007/s40747-021-00536-1>
- [3] Arsenović, M., Karanovic, M., Sladojević, S., Anderla, A., & Stefanović, D. (2019). Solving current limitations of deep learning based approaches for plant disease detection. *Symmetry*, 11(7), 939. <https://doi.org/10.3390/sym11070939>
- [4] Arsenović, M., Karanovic, M., Sladojević, S., Anderla, A., & Stefanović, D. (2019b). Solving current limitations of deep learning based approaches for plant disease detection. *Symmetry*, 11(7), 939. <https://doi.org/10.3390/sym11070939>
- [5] Pantazi XE, Moshou D, Tamouridou AA (2019) Automated leaf disease detection in different crop species through image features analysis and One Class Classifiers. *Comput Electron Agric* 156:96–104
- [6] Barman, U., Sahu, D., Barman, G. G., & Das, J. (2020). Comparative Assessment of Deep Learning to Detect the Leaf Diseases of Potato based on Data Augmentation. 2020 International Conference on Computational Performance Evaluation (ComPE). <https://doi.org/10.1109/compe49325.2020.9200015>
- [7] Singh, A., & Kaur, H. (2021). Potato Plant Leaves Disease Detection and Classification using Machine Learning Methodologies. *IOP Conference Series. Materials Science and Engineering*, 1022(1), 012121. <https://doi.org/10.1088/1757-899x/1022/1/012121>
- [8] Raigonda, M. R., Terdal, S. P., & Raigond, B. (2022). Detection of the viral disease on the potato foliar and tubers using a machine learning approach. *International Journal of Health Sciences (IJHS) (En LíNea)*, 9336–9354. <https://doi.org/10.53730/ijhs.v6ns4.10740>
- [9] Rashid, J., Khan, I., Ali, G., Almotiri, S. H., Alghamdi, M., & Masood, K. (2021). Multi-Level Deep learning model for potato leaf disease recognition. *Electronics*, 10(17), 2064. <https://doi.org/10.3390/electronics10172064>
- [10] Griffel, L., Delparte, D., & Edwards, J. (2018). Using Support Vector Machines classification to differentiate spectral signatures of potato plants infected with Potato Virus Y. *Computers and Electronics in Agriculture*, 153, 318–324. <https://doi.org/10.1016/j.compag.2018.08.027>
- [11] Mahum, R., Munir, H., Mughal, Z., Awais, M., Khan, F., Saqlain, M., Mahamad, S., & Tlili, I. (2022). A novel framework for potato leaf disease detection using an efficient deep learning model. *Human and Ecological Risk Assessment*, 29(2), 303–326. <https://doi.org/10.1080/10807039.2022.2064814>



INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  ijirset@gmail.com



www.ijirset.com

Scan to save the contact details