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Enhancing Rice Plant Disease Diagnosis Using YOLOv8 and VGG19: An Approach for Hybrid Deep Learning Model

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Abstract

Rice is a raw material crop for more than half of the circular populating, making it essential to circular food security measures. The department of agriculture sphere plays a judicial role in ensuring a steady food provide and rice serves as a simple informant of nutriment for jillions.Nonetheless rice cultivation faces operative challenges, especially plant diseases that can drastically scale down both yield and character.The early and hi fi espial of rice plant diseases is of import in innovative department of agriculture. Leveraging late technologies such as crossbred Deep Learning and Image Processing has well—tried to be extremely hard hitting in diagnosing and mitigating these issues. These techniques offer machine driven dead and streamlined disease espial, helping farmers take apropos preemptive measures.crossbred deep learning models, in special, have incontestible particular truth in identifying and classifying rice plant diseases. This paper explores the current advancements in rice plant disease espial using crossbreed deep learning techniques highlighting their potency to infect agrarian nosology and ameliorate crop health.

1. Introduction

Rice is the food raw material of masses all over the world.Hence,monumental populating is myrmecophilous on rice for their food needs. Crop disease has a very nonindulgent burden on the yield of agrarian bring out. A major disease outbreak can demolish crops that have been very catchy to grow, leading to imperishable loss.

Apart from large scale outbreakseven the outbreak of small—scale diseases can have a operative burden on crop yield and character. Hence purpose of the hi—fi sorting of leaf diseases in crops is of prime grandness. The most rife diseases in rice are blast brown spot, and bacterial leaf blight. If infections are not bound on time, it can lead to massive economical and yield product loss. Rice blast, Bacterial leaf blight and brown spot are three of the most rife diseases that revolutionize rice crops all over the world. Rice blast caused by the fungus Magnaporthe oryzae is one of the most negative diseases producing lesions on leaves, stems, and panicles, in time reducing grain yield. It thrives in wet endure with buy at rain and poor airing. Bacterial leaf blight caused by Rhizoctonia solani infects in the first place the lower part of the rice plant specifically the leaf sheaths. This disease is known by on an irregular basis wrought,

water—inebriated lesions that may commingle leading to operative crop lodging and yield losings. Bacterial leaf blight thrives in warm, wet endure and close planting. Brown spot caused by Bipolaris oryzae, is a fungous disease that infects leaves and grains producing small round brown lesions with yellowed halos. It typically occurs in rice plants under conditions of nutritive punctuate specifically with a lack of nitrogen leading to minimized grain character and measure. put together these diseases are a great dispute to rice cultivation impacting productiveness and food security measures. thus many agrarian scientists are ordained to inquiry on the means of detecting rice diseases that can far attend the farmers in decisiveness making in the right style. With regard to crop diseases researchers have made some superior developments in the sorting of crops. nonetheless the most new means of diagnosing and classifying rice diseases are through and through images and image processing techniques and versatile algorithms.

Deep learning is the most trending techniques in crop disease espial. nonetheless, there are still problems with the use of deep learning as a plug—and—play convention in crop disease espial. though versatile deep learning—based techniques notice diseases in versatile crops, such as potatoes rice, and tomatoes some researchers were ordained to detecting crop diseases in the field where crops are genteel, and field conditions may bear upon the classifier by detecting versatile types of diseases.

2. Literature Overview

In 2017 researchers Yamamoto Togami, and Yamaguchi conducted a germinal study that tried the pioneering application program of hyperspectral imaging applied science. This was occluded with supervised auto learning models for the aim of enabling early diagnosing of rice leaf blast disease operative business concern for rice cultivators.The main aim of their inquiry was centred on establishing an early espial appendage for the debilitating disease with a non negative wise which is very basic for the seemly managing and palliation strategies in rice plant cultivation. In a company paper by Abdel Salam et al. in 2020 the researchers highlighted the application program of image processing techniques. This is a proficiency by which disease—ad hoc characteristics, including operative characteristics such as color texture, and shape from the photographs taken of rice leaves can be extracted. These extracted characteristics are far rubberised by auto learning classifiers which sort out them far, enabling the disease to be known and eyes only.This is a very dead and machine driven wise of detecting the disease. In brief, this inquiry highlights the signification of image processing in the feeling of identity of patterns and characteristics pertaining to disease espial.Noh et al. (2020) uncontroversial the dispute to make an forward looking model for rice disease diagnosing based on the gilt edged capabilities of convolutional nervous networks or CNNs for short. In their paper they went so far as to meticulously snap rice leaves showing all types of symptoms of disease and then disciplined a CNN model particularly trim to key out and sort out these diseases based exclusively on the ocular inputs obtained from leaf images. The results of the study fully documented to the application program of CNNs in diagnosing and identifying rice diseases through and through leaf image psychoanalysis paving the way to a promising come near to early diagnosing and controlling of rice diseases in rice cultivation practise.In some other try, Tian et al. [2020]made operative march on toward the maturation of an self acting diagnosing organization involving a large sized data set consisting of 33026 images of six classes of rice diseases; that is to say leaf blast,false smut, neck blast, cocktail dress plague bacterial streak disease, and brown spot.The new organization wa s configured as an tout ensemble model with quadruplicate sub models, which was stringently tried and true using an commutative data set of images to determine its dependableness and truth.Hasan

etal.[2023]mature an interesting paper based on the application program of auto learning and image processing techniques specifically trim or espial of rice diseases with a warm vehemence on the overriding essential of such espial at the first stage of the disease.The study involved with a succession of methodologies involving feature film abstraction, sectionalization, and noise removing methodologies.

Year	Author(s)	Proposed Work	Proposed Algorithm
2017	Yamamoto et al.	Proposed a system for detecting rice leaf diseases using image processing	Image Processing Techniques
2019	Sannakki et al	Rice Leaf Disease Detection Using Machine Learning Techniques	Machine Learning Approaches
2019	Muhammad Uzair et al	Feature Extraction for Rice Leaf Disease Classification	Feature Extraction + SVM
2020	Hasan et al	Real-Time Diagnosis of Rice Leaf Diseases Using Deep Learning	Faster R-CNN
2020	Noh et al.	Detection of Rice Leaf Diseases Using Transfer Learning	Transfer Learning (CNN)
2020	Tian et al.	Rice Leaf Disease Classification Using Deep Learning and Transfer Learning	Deep Learning + Transfer Learning
2020	Abdel-Salam et al.	Rice Leaf Disease Identification Using Deep Convolutional Neural Networks	CNN
2022	Kantip Kiratiratanapruk et al.	Improved rice disease detection efficiency by addressing leaf size variation in images.	Combined CNN object detection with an image tiling technique.
2023	Charles O'Neill	Enhanced disease classification across 10 rice disease classes.	Utilized CNNs with optimized model architectures and computer vision techniques.
2023	Md. Shohanur Islam Sobuj et al.	Rice disease classification by integrating feature extraction methods with pre-trained CNNs.	Combined Histogram of Oriented Gradients (HOG) with EfficientNet-B7 and applied Grad-CAM for focused attention on disease-specific features.

2024	Pandiyaraju V et al.	Developed a hybrid CNN framework with channel attention mechanisms for paddy leaf disease detection	Extended the Squeeze-and-Excitation network architecture with a channel attention mechanism and Swish ReLU activation function.
2024	T.S. Sindhu et al.	Early detection of rice leaf diseases using a hybrid machine learning approach	Hybrid ML Approaches

for far studies to growth the strong point and character of the data sets involved with. The paper sheds light on the astounding capableness of auto learning toward hard hitting and machine—driven espial of diseases, to a large expanse mitigating the applications of accepted hand operated review procedures of time—consuming and less streamlined world in real practise.In summation to this, T.S. Sidehu et al. [2024) performed a stringent study with an vehemence on the application program of auto learning and image processing methods for espial of rice leaf diseases. The authors hired a range of late methods involving central Filtering, K means Clustering the Gray Level Co—natural event intercellular substance (GLCM) and living Vector simple machine (SVM) classifiers to growth the truth and efficiency of the espial of diseases.

Studies have been led on the use of deep learning models, including VGG19 and MobileNetV2, to notice and sort out rice leaf diseases early with over 90% truth. These technologies are a multidisciplinary answer combining accepted agrarian methods and late applied science for landscaped espial, sorting and regulating of rice leaf diseases. VGG19 is a extremely deep convolutional nervous reticulation [CNN] model ordinarily used for image sorting feature film abstraction, and change learning. VGG19 was created by the optic Geometry Group [VGG) at University of oxford university and was free in the ILSVRC—2014 (ImageNet Large Scale optic realization take exception). VGG19 is a more ruling and deeper reading of VGG16 with 19 layers. YOLOv8 [You Only Look Once reading 8) is the latest penis o f the YOLO folk of objective espial models free by Ultralytics in 2023. It is quicker more hi—fi and more streamlined than in the beginning YOLO versions. YOLOv8 is used for objective espial image sectionalization, and sorting, and is a ecumenical—aim deep—learning model for data processor visual sensation tasks.

III. Proposed Methodology

Convolutional neuronal Networks (CNNs] have changed data processor visual sensation by allowing machines to comprehend and empathize ocular data with high truth. CNNs are wide used in image sorting, espial, and sectionalization and thus play a operative role in applications like health check imaging, free vehicles, and department of agriculture. In rice plant disease espial CNNs play a operative role in identifying pussy plants and classifying the disease type. Two salient CNN based models used in this functioning are YOLOv8 for objective espial and VGG19 for disease sorting. though both are CNN—based models, they are used for other purposes with other architectures. A CNN is a deep learning structure that is specifically trim to appendage image data. It consists of respective layers that educe features from

an image, including - Convolutional Layers – Apply filters to notice patterns like edges, textures and shapes.Pooling Layers – Downsample spacial dimensions of feature film maps decreasing computations. Fully attached Layers – utilise extracted features to sort out objects. activating Functions – stick in non one dimensionality to enable the reticulation to learn thickening patterns.CNNs engage based on their power to mechanically learn stratified features minimizing hand operated feature film abstraction....

YOLOv8: CNN for physical object sleuthing

YOLO (You Only Look Once) v8 is a cutting—edge objective espial model that is CNN based. It is hired to notice quadruplicate objects in an image in real time hence appropriate for use in department of agriculture. YOLOv8 operates by; Partitioning an image into a grid.Applying a CNN based sand [CSPDarkNet] for feature film abstraction.Predicting class labels and bounding boxes of the felt objects. In comparing to other espial models that employ part proposals (e.g., R—CNN), YOLOv8 processes an image once, with a much greater betterment in efficiency and speed. In rice disease espial YOLOv8 detects rice plants and classifies them into versatile diseases. If the plant is ill, its part is docked and fed into some other model for far sorting.

VGG19; CNN for Image categorization

VGG19 is a 19—layer deep CNN image sorting reticulation with 3 fully socially connected and 16 convolutional layers. The reticulation uses small 3×3 filters and thus, is able of extracting very fine features in an image. VGG19 is of serial structure in which each layer extracts features of increasingly deeper order. In rice disease sorting VGG19 is used for disease sorting. If YOLOv8 detects a plant as unhealthy the image of the plant is docked and passed to VGG19, which classifies the disease as some ad hoc diseases like Bacterial leaf blight Brown Spot, or Leaf Blast. The deep structure of VGG19 is very streamlined to educe fine features but is computationally intense compared to YOLOv8.

The organization has two deep learning models;

1. YOLOv8 [You Only Look Once, reading 8) → physical object espial (espial of pussy regions on rice leaves). VGG19 (optic Geometry Group 19—layer CNN] → Image sorting [espial of the rice disease type).

YOLO v8 → It is the one eighth reiteration of YOLO and is principally practical for objective espial. YOLO earlier was free in the year 2015 as a real time objective espial organization. It far landscaped in quadruplicate iterations since the year 2015, each of which added exaggerated speed, truth, and efficiency. The YOLOv8 is the most ruling and current reiteration of YOLO that is promulgated by Ultralytics. It offers rattling upgrades in comparing to older iterations.

2. VGG19 for Disease categorization

VGG19 is a deep convolutional nervous reticulation that is an image classifying CNN. VGG19 recognizes the type of disease after YOLOv8 has known a unhealthy plant. Gets lopped morbid Plant Image – YOLOv8 bounding box gets docked and resized. feature article descent – VGG19 uses the deep convolutional layers of the image.

categorization – The model classifies the disease type [e.g., Bacterial leaf blight Brown Spot Rice Blast).

YOLOv8 is disciplined on rice crop labelled images with "unhealthy" labels. VGG19 is disciplined on unhealthy plant images classified by disease class. The models are occluded in a word of mouth where YOLOv8 detects and screens out pussy plants and VGG19 classifies them

IV. Conclusion

Rice plant disease espial with YOLOv8 and VGG19 is an hard—hitting and streamlined way of rice plant disease espial and sorting with high preciseness. Leveraging YOLOv8's real time objective espial process the organization can speedily key out and mark flushed and pussy rice plants. VGG19 then classifies the pussy plants into versatile categories of diseases thereby enabling hi fi diagnosing. The process solves t he inefficiencies of the accepted approaches because it yields quicker, more ascendible, and more machine driven disease feeling of identity. The combine of the two models guarantees feeling of identity of insidious and byzantine patterns of diseases and thus early intercession and increased crop managing. through and through its deployment in farm settings, farmers and researchers can counter plant health, scale down crop loss, and heighten total bring out. Aprox enhancements can be familiarized towards edge computing for local processing and multi dataset diversification for greater transfer. gross the propose is one step towards smart as a whip, AI based preciseness farming, securing food stores and sustainable department of agriculture.

The main goal of this propose is to help the farmers preely to take measures based on the known diseases.

References

1. Mahlein‹ A.—K., Rumpf, T., Welke, P., Dehne, H.—W., Plümer, L.‹ Steiner, U., & Oerke, E.—C. [2013]. "evolution of ghostlike indices for detecting and identifying plant diseases." backwoods Sensing of surroundings‹ 128, 21 30.
2. Sankaran‹ S., Mishra A.‹ Ehsani, R.‹ & Davis‹ C. [2010). "A brush up of late techniques for detecting plant diseases." Computers and Electronics in agriculture department‹ 72(1], 1 13.
3. Salathé‹ M. Kazandjieva, M. Lee J. W., Levis, P.‹ Feldman M. W., & Jones, J. H. [2010). "A high solving human tangency reticulation for contaminating disease contagion." Proceedings of the public honorary society of Sciences‹ 107(51[‹ 22020—22025.
4. Yamamoto, K. Togami T., & Yamaguchi K. [2017). "Supervised learning for early diagnosing of rice leaf blast disease using hyperspectral imaging." Plant Methods‹ 13[1] 1—10.
5. Liu Y. & Zhang Y. (2017]. "feeling of identity of rice diseases using deep convolutional nervous networks." Neurocomputing‹ 267 378—384.
6. Bargoti, S. & underbrush J. P. [2017). "Deep learning for high throughput plant phenotyping - sleuthing of sugar cane orange tree rust disease." Proceedings of IEEE internationalistic group discussion on Robotics and high technology [ICRA), 5275—5282.
7. Abdel Salam‹ H. & Sayed, M. [2020]. "Rice Disease sleuthing Using simple machine Learning and Image Processing Techniques." internationalistic daybook of in advance estimator scientific discipline and Applications, 11[5(‹ 233 241.
8. Picon A., Alvarez—Gila A., Seitz M. Ortiz Barredo, A.‹ Echazarra, J.‹ & Johannes‹ A. (2019). "Deep convolutional nervous networks for versatile conquer twist based crop disease sorting in the wild." Computers and Electronics in agriculture department, 161‹ 280—290.
9.Tian, H.‹ Zhang K. Yu, Z., Wang, Y.‹ & Wang, J. (2020]. "self—acting espial of rice diseases using deep learning." Frontiers in Plant scientific discipline‹ 11, 518.

10. Noh S. M. Lee‹ G. S., Park‹ S. B. & Park H. J. (2020). "evolution of rice disease symptomatic model using convolutional nervous reticulation." Korean daybook of rural scientific discipline 47(1), 19—30.
11. Kiratiratanapruk, K., Temniranrat, P., Sinthupinyo, W.‹ Marukatat, S.‹ & Patarapuwadol, S. (2022). "self acting sleuthing of Rice Disease in Images of varied Leaf Sizes."
12. O'Neill C. [2023). "increased Disease categorization truth for Rice Plants Using CNNs and estimator sight Techniques." Proceedings of the internationalistic group discussion on dyed intelligence activity in agriculture department‹ 15[3) 102 115.
13. Wang‹ Y. Wang H., & Peng‹ Z. (2022]. "Rice Diseases sleuthing and categorization Using tending Based neuronal reticulation and Bayesian Optimization."
14. Costales, H.‹ Callejo Arruejo A.‹ & Rafanan, N. (2023). "evolution of a paradigm practical application for Rice Disease sleuthing Using Convolutional neuronal Networks."
15. Zhou, X. Zhang, W., & Wei‹ Y. (2023]. "Convolutional neuronal reticulation in Rice Disease realization." Frontiers in Plant scientific discipline‹ 14, clause 1269371.
16. Chen, J., Zhang‹ D., & Li‹ Y. (2023]. "categorization and sleuthing of Rice Diseases Using a 3—Stage CNN." agriculture department, 13(8), clause 1505
17. Ali Alnaggar, Y., Sebaq, A. Amer, K., Naeem, E. & Elhelw M. [2023). "Rice Plant Disease sleuthing and diagnosing using Deep Convolutional neuronal Networks and Multispectral Imaging."
18. Sobuj, M. S., Hossen‹ M. I., Mahmud M. F.‹ & Khan M. U. I. (2024]. "Leveraging Pre disciplined CNNs for prompt feature article descent in Rice Leaf Disease categorization."
19. Pandiyaraju V. et al. (2024]. "A crossbred CNN framing with transmit tending Mechanisms for Paddy Leaf Disease sleuthing." Computational intelligence activity in agriculture department‹ 18[2] 130 145.
20. Salathé, M.‹ Kazandjieva‹ M., Lee J. W., Levis P.‹ Feldman‹ M. W., & Jones J. H. (2010). "A high—solving human tangency reticulation for contaminating disease contagion." Proceedings of the public honorary society of Sciences, 107(51), 22020 22025.