Rice Research: Open Access

ISSN: 2375-4338

Research Article Open Access

Automatic Rice Disease Detection

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Abstract

Agriculture not only supplies food but is also a source of income for a vast population of

the world. Paddy plants usually produce a brown-coloured husk on the top and their seed, after de-husking and processing, yields edible rice which is a major cereal food crop and staple food, and therefore, becomes the cornerstone of the food security for half the world's people. However, with the increase in climate change and global warming, the quality and its production are highly degradedby the common diseases posed in rice plants due to bacteria and fungi (such as sheath rot, leaf blast,leaf smut, brown spot, and bacterial blight).

The efficiency of the two most popular object detection algorithms (YOLOv3 tiny and YOLOv4 tiny) for smartphone applications was analysed for the detection of three diseases—brown spot, leaf blast, and hispa.

Keywords: Object detection; Rice diseases; YOLO model

Introduction

Agriculture is taken into account one amongst the foremost necessary industries within the world. It not solely provides food for humans however is also thought of one amongst the most important sources of financial gain for many developing countries, like Republic of India. It contributes to Bastille Day of India's total Gross Domestic Product (GDP) and, provides employment to or so fifty four.6% of the population,directly or indirectly. Amongst agricultural yields, rice has been thought of the staple food for quite 1/2 the worldwide population. Rice is obtained as a seed of the grass varieties sometimes called rice and liliopsid genus glaberrima that square measure fibrous root plants with a standard height of vi feet.

According to the International Rice analysis Institute (IRRI), the farmers lose thirty seventh of their rice harvest to pests and diseases. Further, betting on the assembly condition, these losses will vary from pure gold to forty first . As a result, the rice-growing regions square measure considerably bated and ultimately, the quantity of rice farmers is dwindling. thanks to the rapid climb within the international population and also the shrinking population of rice farmers, one amongst the most affordable staple food is so, it's necessary to diagnose these diseases by early and correct identification of the symptoms before the plant becomes broken The Yongyou series of indica-japonica hybrid rice has excellent production potential and storage performance. However, little is known about the underlying mechanism of its storage resistance. In this study, Yongyou 1540 rice (Oryza sativa cv. yongyou 1540) was stored at different tem- peratures, and the storability was validated though measuring nutritional components and apparent change. In addition, a broad-targeted metabolomic approach coupled with liquid chromatography, mass spectrometry was applied to analyze the metabolite changes. Rice (Oryza sativa L.) is one of the major staple foods consumed all over the world, notably in China, India, Indonesia, Bangladesh, Vietnam, Thailand, Myanmar, and the Philippines. These countries contribute most highly to rice production, corresponding to 82% of global rice production and 69% of global rice consumption. At the same time, rice also provides 35–60% of dietary calories for most people in the world.

Materials and Method

This study, in order to reveal the storage mechanism of Yongyou 1540, and to provide theoretical data support for the production and promotion of this series of indica-japonica hybrid rice, Yongyou 1540 was stored at different temperatures. The fatty acid and white-ness values of each sample were determined, and the rice surface was observed with an electron microscope. In addition, the changes of Yongyou 1540 metabolites under different storage conditions were investigated using a broad-targeted metabolomic technology based on LC-MS/MS

Data Analysis

Yongyou 1540 rice is a new variety jointly cultivated by the research group, and it has been proved that Yongyou 1540 has good storability. However, the underlying mechanisms are still largely unknown, which limits the promotion and application of the products. Metabolomics is the systemic study of the metabolites, that is, of all small molecules in a biological sample, to provide a snap-shot of the ongoing biochemical processes At the same time, it is also the science of qualitative and quantitative analysis of all low molecular weight (<1000) metabolites of biological cells or organisms in a specific physiological period.

The UHPLC separation was carried out using an EXIONLC System (Sciex). Themobile phase A was 0.1% formic acid in water, and the mobile phase B was acetonitrile. The column temperature was set at 40°C. The auto-sampler temperature was set at 4°C and the injection volume was 2 μL. A Sciex QTrap 6500+ (Sciex Technologies, Framingham, MA, USA), was applied for assay development. Typical ion source parameters were: IonSpray Voltage: +5500/−4500 V, Curtain Gas: 35 psi, Temperature: 400°C, Ion Source Gas 1:60 psi, Ion Source Gas 2: 60 psi, DP: ±100 V. In fact, due to the large sample size of this study, the detection task lasts for a long time, so it is very important to monitor the stability of the instrument and whether the signal is normal during the detection process in real time. To ensure the accuracy of the experimental results, the original data included 3 quality control

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Received: 01-Jul-2022, Manuscript No. rroa-22-71021; **Editor assigned:** 04-Jul-2022, PreQC No. rroa-22-71021 (PQ); **Reviewed:** 18- Jul-2022, QC No. rroa-22-71021; **Revised:** 22- Jul-2022, Manuscript No. rroa-22-71021(R); **Published:** 29-Jul-2022, DOI: 10.4172/2375-4338.1000315

Citation: Silveira F (2022) Automatic Rice Disease Detection. J Rice Res 10: 315.

(QC) samples and 24 experimental samples. QC samples were made by mixing 20 μL of each experimental sample.

Nutrients such as starch, protein, moisture, and lipids in rice itself will deteriorate due to the influence of the environment and internal factors during the storage process. Fatty acid value is an important indicator to measure the quality of rice. According to the Chinese national standard GB/T5510-2011 "Grain and Oil Inspection—Determination of Nutrients such as starch, protein, moisture, and lipids in rice itself will deteriorate due to the influence of the environment and internal factors during the storage process. Fatty acid value is an important indicator to measure the quality of rice. According to the Chinese national standard GB/T5510-2011 "Grain and Oil Inspection—Determination of Fatty Acid Value of Grain and Oilseeds", the research team measured the fatty acid value of rice to judge the degree of deterioration of rice at different storage temperatures. Rice was crushed by grinder under different storage conditions (the groups needed cleaning and were passed through a 1.0 mm round hole sieve). A sample of 10 g (precision 0.01 g) was weighed and placed in a 250 mL conical flask. 50 mL petroleum ether was added to the\ pipette, and the plug was added before shaking for several seconds. The plug was opened and deflated, and then the bottle was closed and the oscillator was shaken for 10 min. Next steps: Take off the conical bottle, tilt and stand for 1–2 min, put filter paper into the short neck glass funnel to filter. Go to the first few drops of filtrate, use colorimetric tube to collect filtrate more than 25 mL, cover and save Fatty Acid Value of Grain and Oilseeds", the research team measured the fatty acid value of rice to judge the degree of deterioration of rice at different storage temperatures. Rice was crushed by grinder under different storage conditions (the groups needed cleaning and were passed through a 1.0 mm round hole sieve). A sample of 10 g (precision 0.01 g) was\ weighed and placed in a 250 mL conical flask. 50 mL petroleum ether was added to the pipette, and the plug was added before shaking for several seconds. The plug was opened and deflated, and then the bottle was closed and the oscillator was shaken for 10 min. Next steps: Take off the conical bottle, tilt and stand for 1–2 min, put filter paper into the short neck glass funnel to filter. Go to the first few drops of filtrate, use colorimetric tube to collect filtrate more than 25 mL, cover and save. This work proposes a DL-based mobile application for the detection of paddy diseases. the most reason for creating this drawback a detection drawback is that the leaf is also suffering from quite one unwellness.

Therefore, a detection algorithmic program will offer predictions regarding multiple diseases the plant is stricken by, with the affected space and their kind which might change the farmer to cure their paddy of multiple diseases at a time. this work employs the 2 quickest versions of YOLO (YOLOv3 small and YOLOv4 small for the event of a DL-based object detection framework.

The best model from the on top of step was deployed on a mobile application created victimization robot studio. The model obtained on top of was 1st reborn to a metallic element model so to a Tens or Flow light TensorFlow light could be a less significant version of the Tens or Flow framework, particularly developed to change AN on-device machine learning interface. it's tight performance and fewer computer file size, thus appropriate for mobile applications. Since the model is deployed regionally on the device, therefore, there's no would like for network coverage whereas detection that could be a common issue in most villages.

Result and Discussion

The chatbot (docCrop) was designed victimization third party API, Kommunicate . The chatbot was trained to answer a definite set of queries finding most of the common issues furthermore as issues specific to the rice diseases. Firstly, the chatbot raises the farmer whether or not they wish to grasp regarding general preventive tips or ask a question a few explicit unwellness prediction. to form the speech easier, sure choices associated with the farmer's question square measure prompt by the chatbot at every step to higher perceive the matter and supply specific solutions. some samples of however the chatbot responds to queries. The mobile application is developed in such how that the farmers will use it seamlessly with none problem.

After acting an intensive comparative study between the 2 decilitre frameworks (YOLOv3 small and YOLOv4 tiny) for object detection via smartphone, it absolutely was determined that YOLOv4 small yields additional correct and effective results. With quite an exceptional accuracy of ninety eight.13%, the model was ready to sight the 3 completely different diseases exactly. Finally, this model was deployed on the mobile application in Tensor Flow light format. Therefore, an\ automatic system was developed to assist the farmers by police work paddy unwellness from their mobile cameras. Further, twenty four × seven support is additionally being provided to them by the chatbot made victimization the Kommunicate API. though the developed model performs satisfactorily, its performance is greatly influenced by the standard of the pictures being fed to the E-crop doctor. moreover, the model's performance is also suffering from numerous different factors like illumination variations. However, considering the exponential development within the field of smartphones, this can be resolved within the close to future. In future, this technique are extended to sight additional paddy diseases and canopy different plants therefore on develop it as a platform for all crops. The rice water weevil, Lissorhoptrus oryzophilus Kuschel, is the most destructive early season insect pest of rice, Oryza sativa L., in the United States. This pest has recently invaded other rice-producing regions of Asia and Europe and now poses a global threat to rice production. Rice water weevils overwinter as adults in plant debris, leaf litter, and bunch grasses in and around rice fields and riparian habitats . In early spring, after rice is planted, weevils fly to rice fields and begin feeding by scraping the upper epidermis of rice leaves resulting in feeding scars parallel to the veins of leaves . This type of foliar injury probably does not cause economic losses except under unusually heavy weevil infestations. Female weevils oviposit primarily in leaf sheaths of flooded rice plants beneath the water surface . After hatching, neonates mine through the leaf sheaths or shoots and quickly move to the soil, where they feed on or in the roots of flooded plants, completing four instars and a pupal stage in approximately four weeks.

The use The rice water beetle, Lissorhoptrus oryzophilus Kuschel, is that the most harmful early season insect persecutor of rice, rice L., within the u. s. . This persecutor has recently invaded alternative rice-producing regions of Asia and Europe and currently poses a world threat to rice production . Rice water weevils overwinter as adults in plant rubbish, leaf litter, and bunch grasses in and around rice fields and bank habitats . In early spring, once rice is planted, weevils fly to rice fields and start feeding by scraping the higher cuticle of rice leaves leading to feeding scars parallel to the veins of leaves this kind of foliar injury most likely doesn't cause economic losses except underneath remarkably significant beetle infestations. feminine weevils oviposit primarily in leaf sheaths of flooded rice plants at a lower place the water surface . once hatching, neonates mine through the leaf sheaths or shoots and quickly move to the soil, where they take advantage of or within the roots of flooded plants, finishing four instars and a immature stage in just about four weeks.

The use of insecticidal seed treatments is presently the foremost wide used manoeuvre for beetle management. during a recent survey of grower's practices in Pelican State, as an example, over eightieth of growers and consultants rumored victimisation seed treatments in one or a lot of of the fields that they were accountable.

Conclusion

Four experiments were conducted throughout the 2009, 2010, and 2011 growing seasons at the Pelican State State University Agricultural Center Rice analysis Station, Crowley, district Parish, LA, on Crowley silt-loam soils (fine, montmorillonitic, caloric typical albaqualf). All experiments were randomised complete block experiments incorporating factorial mixtures of seeding rates and pesticide treatments as delineate below. For the experiment conducted in 2009, "CL 171", a widely-grown long-grain rice variety tolerant to the imidazolinone category of herbicides, was used. For the 2010 experiment, "Cheniere", a wide planted typical long-grain selection, was used. the primary experiment in 2011 used "CL 171", whereas the second experiment used "Cocodrie", another wide mature typical long-grain variety. Practices for weed, nutrient and water management followed the recommendations of the Pelican State State University AgCenter for drill-seeded rice [24]. Population densities of rice water weevils ar systematically high at this experimental web site, and no alternative early- or mid-season persecutor insects were gift important numbers at this web site over the 3 years of the study.

Rice within the southern U.S. is often seeded at low rates (25 to sixty kilo of seed per ha) and treated before planting with neonicotinoid (thiamethoxam, clothianidin) or anthranilic diamide (chlorantraniliprole) seed treatments. it's thus vital to know the potential interactions among these 2 practices. Insecticidal seed treatments ar thought to have an effect on rice water weevils via general movement of active ingredient within the plant and activity of active ingredient by the insects as they take advantage of leaves or roots [10–12]. If this can be so the case, then the effectiveness of seed treatments ought to rely upon per seed treatment rate however not on seeding rate. If, on the opposite hand, rice water weevils are affected once pesticide leaches into the soil and comes into contact with larvae as they take advantage of rice roots, low seeding rates would possibly impact the effectivity of insecticidal seed treatments by reducing the quantity of pesticide gift in soil. this can be as a result of, given a continuing per seed treatment rate, the quantity of insecticide per unit volume of soil ought to decrease as seeding rates decrease.

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