AI BASED FRUIT FRESHNESS IDENTIFICATION AND DISEASE PREDICTION USING AUTONOMOUS DRONE

Agenda

- Abstract
- Introduction
- Literature Review
- Analysis of Literature Review
- Objectives
- Problem Statement
- YOLO Algorithm
- Architecture diagram
- Modules
- Conclusion

Abstract

- The nutritional value of perishable food items, such as fruits and depends on their freshness levels.
- The existing approaches solve a binary class problem by classifying a known fruit class into fresh or rotten only.
- We propose an automated fruits categorization approach that first recognizes the class of object in an image and then categorizes that fruit into one of the three categories: fresh, not fresh, and rotten , if rotten the remedy class will be displayed By using autonomous drone in any location.

Introduction

- Hand-sorting rotten fruits from fresh ones in a batch of mixed fruits is a tedious and tiring job. Despite being time-consuming, most food processing factories carry out this method for making jams and other fruit-based products.
- So to provide a much less demanding solution, today's project focuses on creating a smart AI camera using a Raspberry Pi Development Board for Fresh and Rotten Fruit Detection if it's rotten the remedy to the plant will be feed to the land and automatically sort it out.

Literature Review

PAPER NAME: T. Ilyas, A. Khan, M. Umraiz, Y. Jeong, and H.Kim,"**Multiscale context aggregation for strawberry fruit recognition and disease phenotyping**," IEEE Access, vol. 9, pp. 124491–124504, 2021,

PAPER DESCRIPTION :

Smart farming is a recently coined terminology to solve the problems in agriculture, related to production, environmental impact, and sustainability. With an increase in the global population, food demand is growing monotonically.

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PAPER NAME: QILIN AN 1,2, KAI WANG2 , ZHONGYANG LI1 , CHENGYUAN SONG2 , XIUYING TANG1 , AND JIAN SONG 2 "**Real-Time Monitoring Method of Strawberry Fruit Growth State Based on YOLO Improved Model.**" Received 21 October 2022, accepted 3 November 2022, date of publication 7 November 2022, date of current version 1 December 2022.

PAPER DESCRIPTION :

- Strawberries are one of the most popular fruits in the world, with worldwide production reaching more than 9 million tons in 2022 . However, the detection of strawberry fruit at the fruit growth state in the orchard is usually based on farmers' experience and is highly subjective, which may lead to errors and affect the pollination, spraying, harvesting, and marketing of the fruit.

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PAPER NAME: Bolappa Gamage Kaushalya Madhavi 1 , Jayanta Kumar Basak 2 , Bhola Paudel 1 , Na Eun Kim 1 , Gyeong Mun Choi 2 and Hyeon Tae Kim 1,"**Prediction of Strawberry Leaf Color Using RGB Mean Values Based on Soil Physicochemical Parameters Using Machine Learning Models(**2022**)** ."

PAPER DESCRIPTION :

- Intensively grown strawberries in a greenhouse require frequent and precise soil physicochemical constituents for optimal production. Strawberry leaf color analyses are the most effective way to evaluate soil status and protect against excess environmental nutrients and financial setbacks. Meanwhile, precision agriculture (PA) endorsements have been utilized to mimic solutions to these problems.

ANALYSIS OF LITERATURE REVIEW

Paper Name	YEAR	MERITS	DEMERITS
Multiscale context aggregation for strawberry fruit recognition and disease phenotyping	2021	F-Measure for CNN is 0.7and 0.8 for SVM, the accuracy of identification of leaf disease of CNN is 0.6 and SVM is 0.8	Various segmentation algorithms can be implemented to improve accuracy.
Real-Time Monitoring Method of Strawberry Fruit Growth State Based on YOLO Improved Model	2022	The CNN has achieved an accuracy of 95.48. Used model has high rate along with better recognition of diseases.	Images in the dataset are very less.Train a dataset for at long time.
Prediction of Strawberry Leaf Color Using RGB Mean Values Based on Soil Physicochemical Parameters Using Machine Learning Models	2022	Best accuracy of 99.09% other models who have done the crop recommendation have the accuracy in the range between 92 to 96%.	More time to take for train the dataset.We should feed n number of dataset for traing process.

Objectives

- To improve fruit health and yield by detecting and addressing nutrient deficiencies and other factors that contribute to the onset of plant diseases.
- This can be accomplished through the following specific objectives:Disease detection,Nutrient assessment,Fertilizer recommendation.

Problem Statement

STATEMENT 1

- To Collect a dataset of images of healthy and diseased fruits .

STATEMENT 2

- To use the collected dataset to train a YOLOv5 model for detecting fruits diseases in images.

STATEMENT 3

- To develop a fertilizer recommendation system.

YOLO (You Only Look Once) Algorithm

- YOLO is a popular object detection algorithm that uses a single neural network to predict multiple bounding boxes and class probabilities in an image.
- It can be trained on a large dataset of annotated images to recognize different objects and their locations within an image.
- To use YOLO for fertilizers recommendation and disease prediction, the drone would need to capture images of the fruits from different angles and heights.

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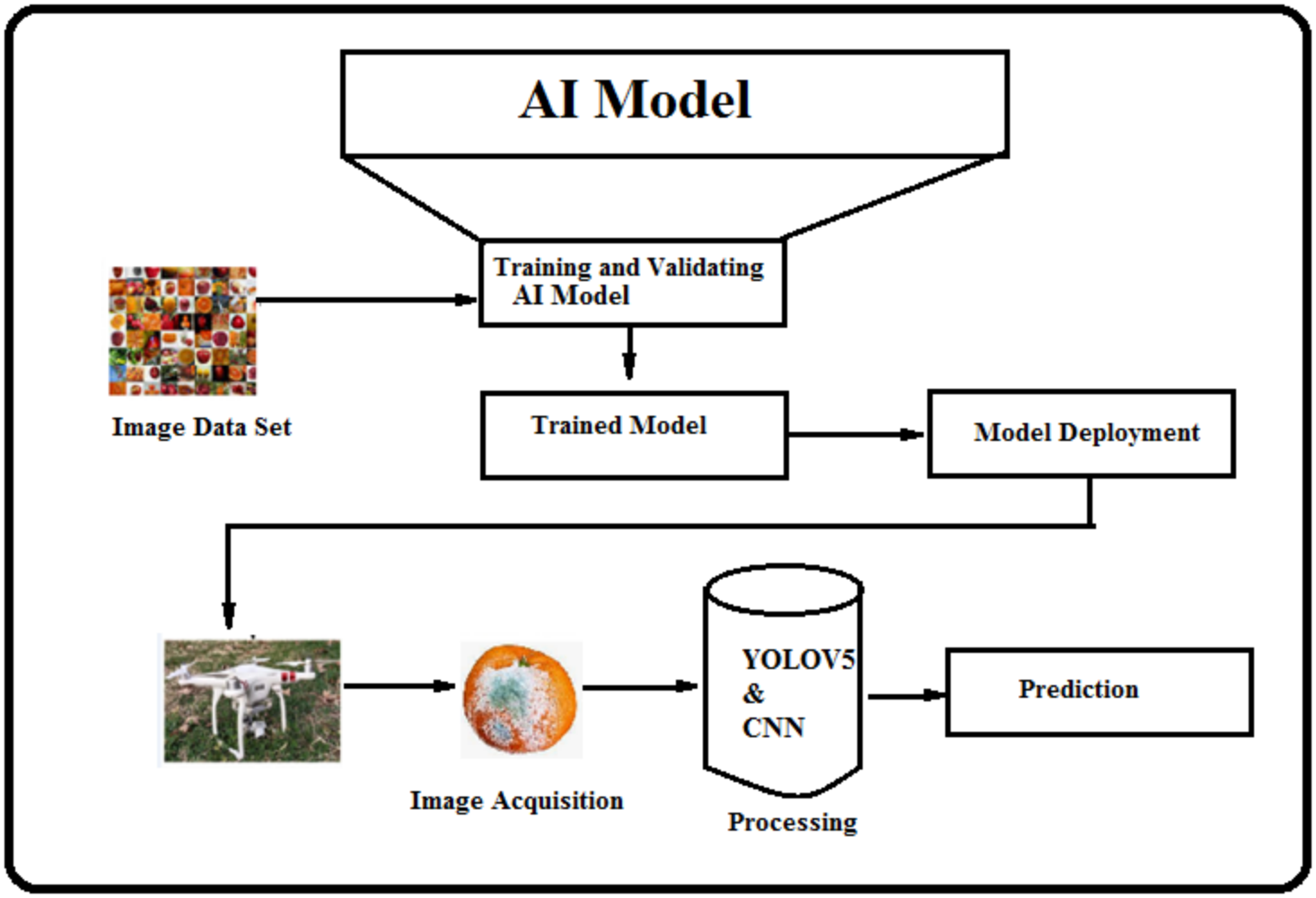
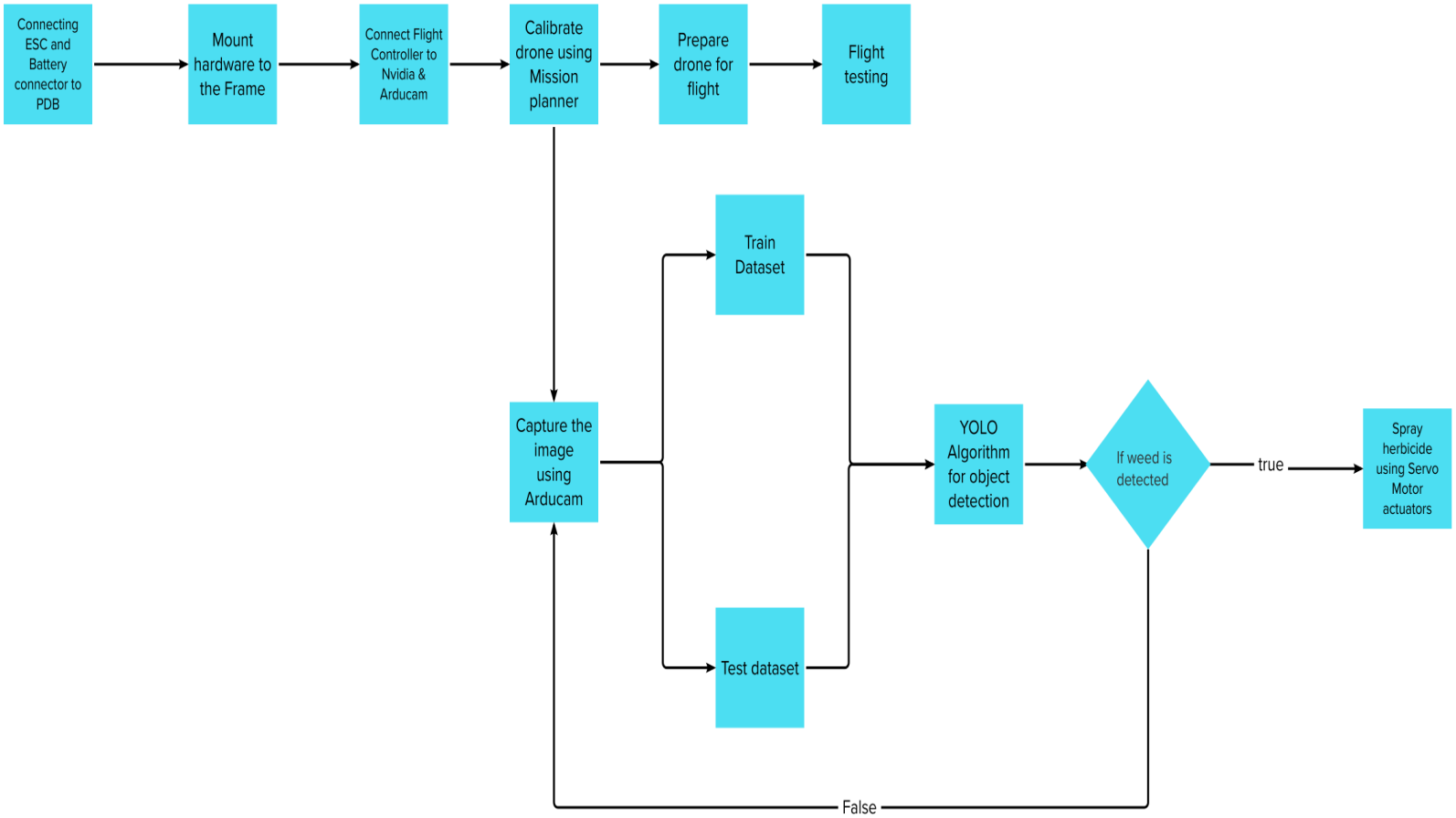
- These images would then be fed into a YOLOv5 model that has been trained on a dataset of annotated fruits images.
- The YOLOv5 model would be able to detect and identify different fruits features, such as fruits color, texture, and shape, and use this information to make recommendations for the appropriate type and amount of fertilizer to apply.

Architecture diagram



Design Methodology



Modules

- Module -1 :
  - Data Collection
  - Data Preprocessing
- Module - 2 :
  - Training
  - Evaluation
  - Testing
- Module - 3 :
  - Fertilizer Recommendation

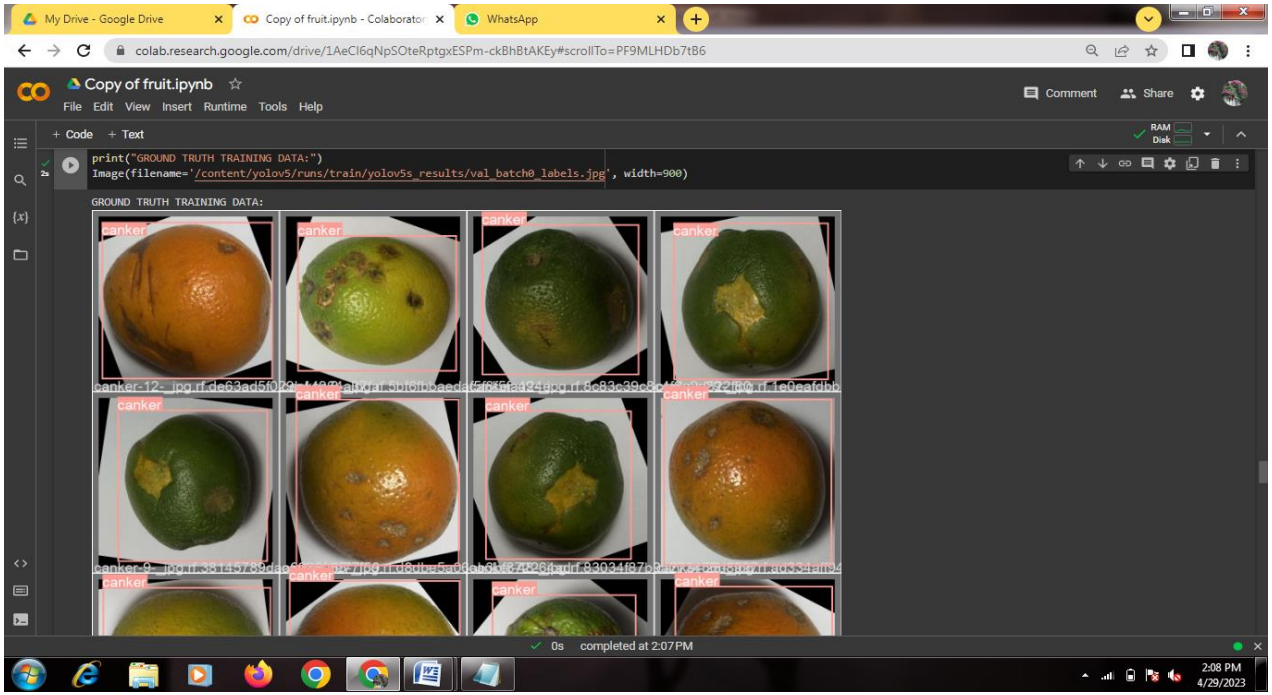
Module - 1

- **Data Collection:** The first step is to collect a large dataset of images of healthy and diseased fruits.

- **Data Preprocessing:** The collected images need to be preprocessed to enhance the quality and improve the model's accuracy.

Module - 2

- **Training:** The next step is to train the YOLOv5 model using the annotated dataset. During training, the model learns to detect and classify the different types of fruits diseases.



Annotation process

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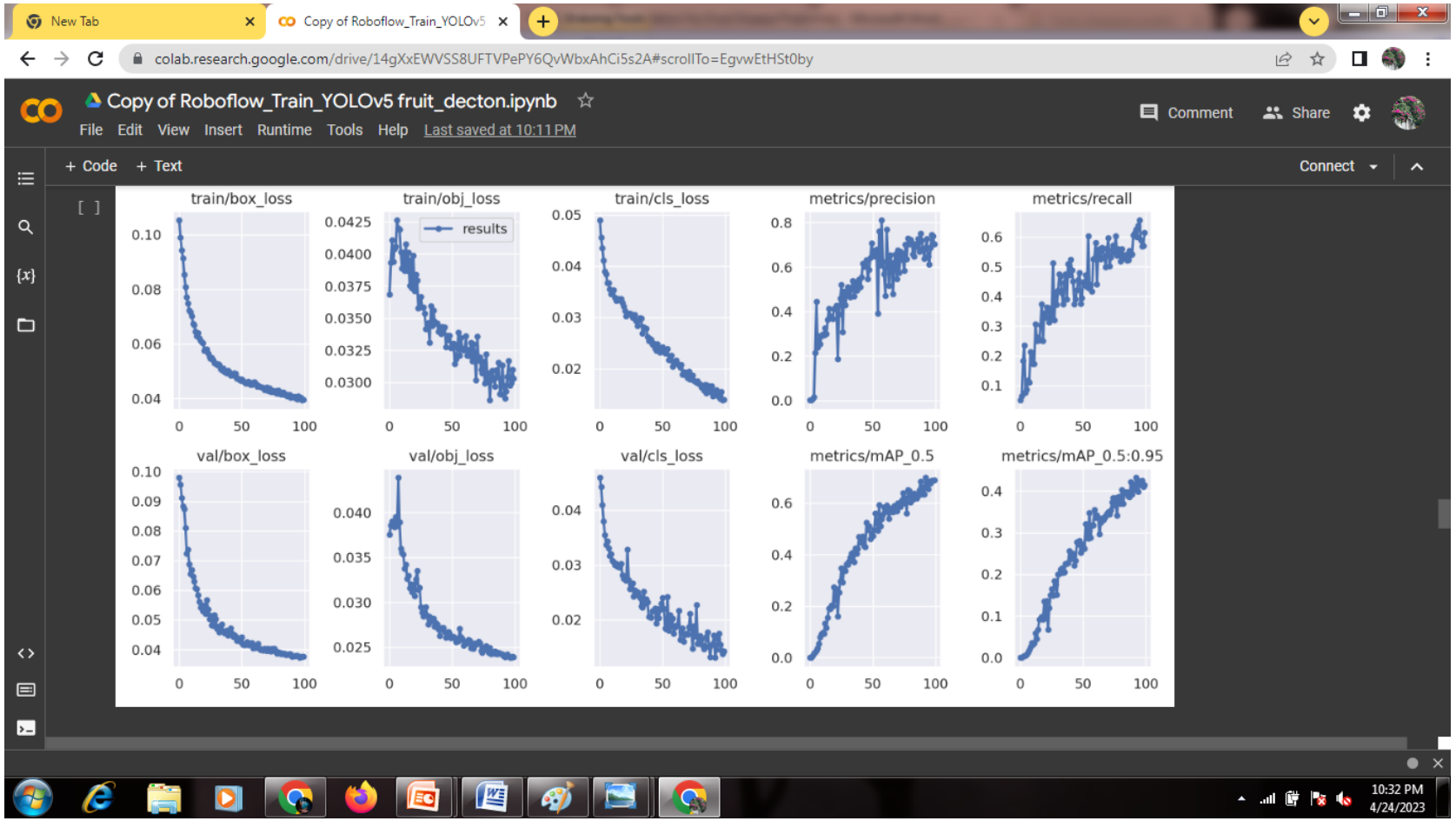
- **Evaluation:** After training, the model needs to be evaluated using a separate validation dataset to check its accuracy and performance.

Graph view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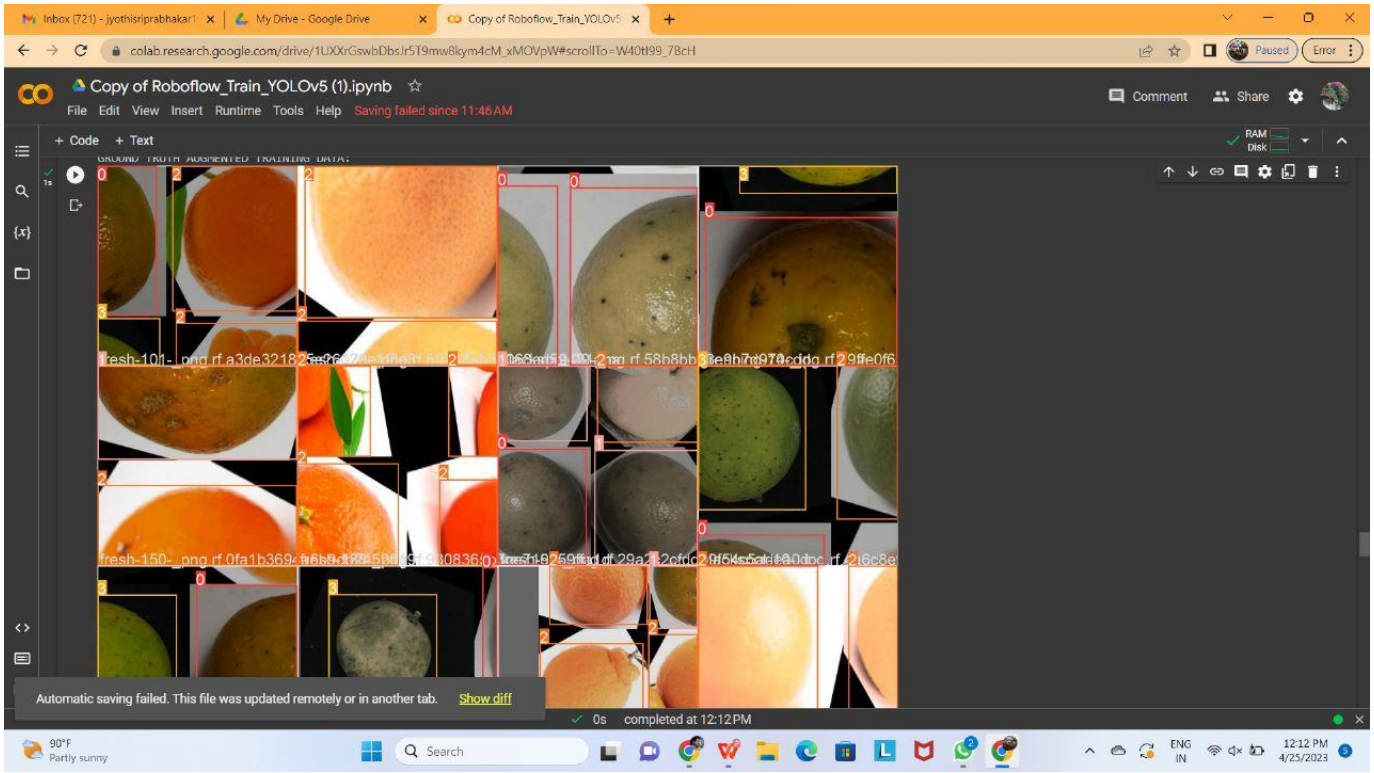
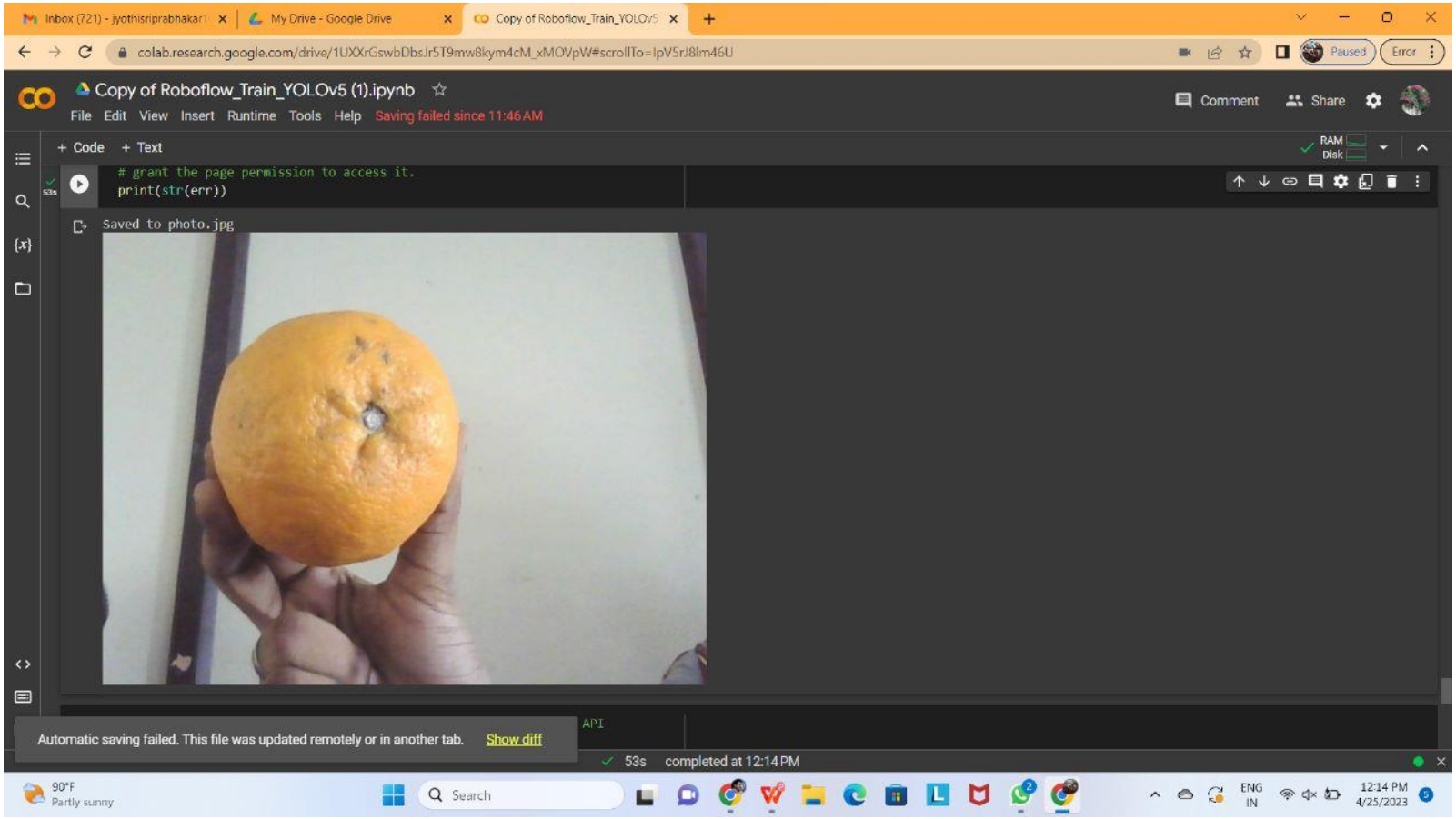
- **Testing:** Once the model is trained and evaluated, it can be used to test new images of fruits to identify and classify any diseases present.

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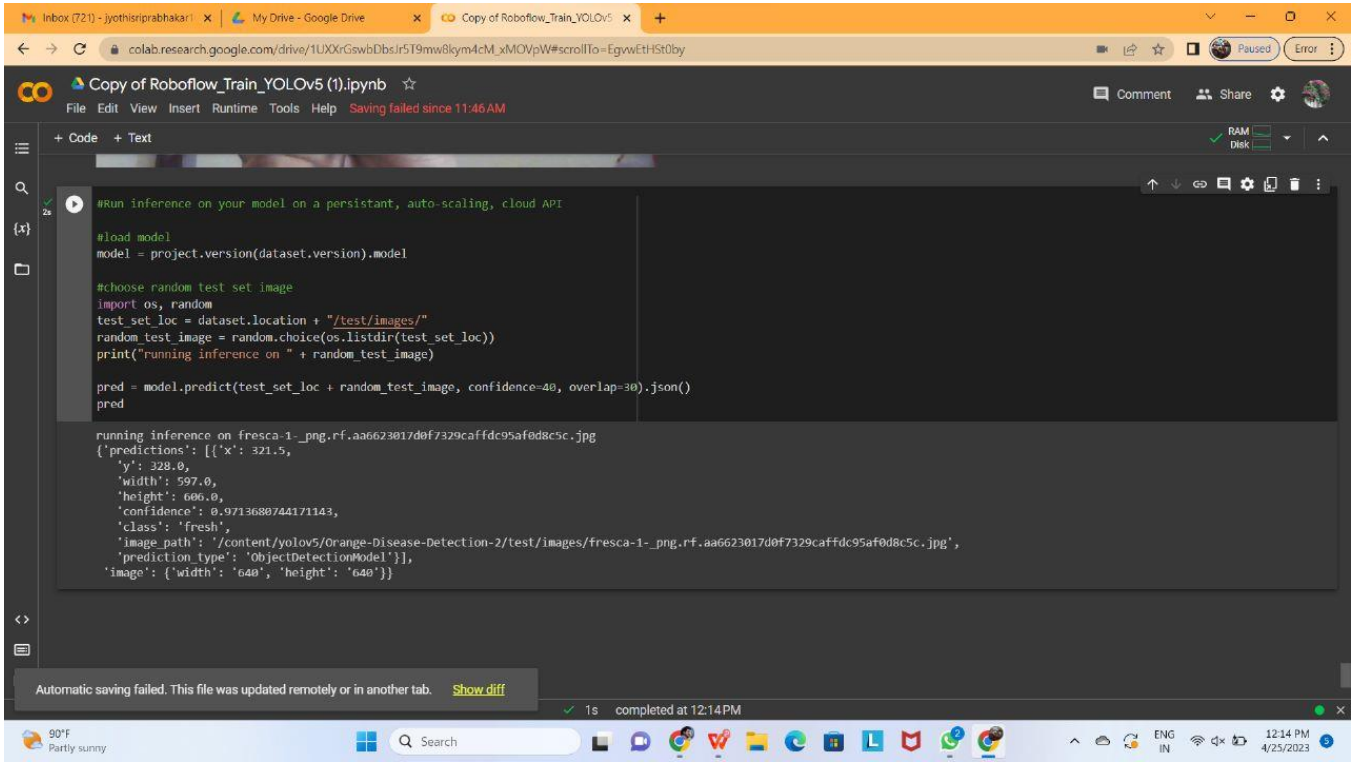
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#Run inference on your model on a persistant, auto-scaling, cloud API
#load model
model = project.version(dataset.version).model
#choose random test set image
import os, random
test_set_loc = dataset.location + "/test/images/"
random_test_image = random.choice(os.listdir(test_set_loc))
print("running inference on " + random_test_image)
pred = model.predict(test_set_loc + random_test_image, confidence=40, overlap=30).json()
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Fertilizer Recommendation

Diseases of Rice	Symptoms	Images	Recommended Fertilizers
Apple scab	Apple scab is a significant fungal disease of crabapple trees. A similar disease affects pears. Apple scab appears on expanding leaves in the spring as olive-green spots without distinct borders. These lesions grow and darken to a greenish-black color and develop black borders.		Plant resistant crabapple varieties, such as Ames White, Autumn Glory, Baskatong, Beauty, Coral Cascade, Gibb's Golden Gage, Gwendolyn, Harvest Gold, Henning, Molten Lava, Narragansett, Prof. Sprenger, Red Snow, or Sparkler. Check nursery catalogs and local garden centers, as there are many other resistant varieties. Rake up and discard all infected and fallen leaves. Prune trees to promote good air circulation.

Diseases of Rice	Symptoms	Images	Recommended Fertilizers
Black rot on grapes	**Black rot** is a fungal disease that causes brown, circular leaf spots and reduces many berries to black, shriveled, raisin-like mummies. The fungus pathogen overwinters in mummified berries from the previousseason's crop. Spores are released during wet periods before bloom when new shoots first emerge. Young leaves are infected first.		**Preventative fungicide sprays are a necessity** to ensure a crop of edible fruit. If using organic sprays, be aware that sulfur may burn the foliage of certain varieties (e.g. Concord) and is not as effective as Bordeaux.

Conclusion

This study tested the improvement of different modules on the performance of the YOLOX algorithm and verified the effectiveness of the improved model. For example, the CSP block is replaced by a self-designed C3HB block in the backbone part; the normalized attention module (NAM) is introduced in the neck and the latest SIOU loss function is embedded. The mAP, precision, and recall are improved by 4.08%, 3.64%, and 2.04%, respectively. And compared with five popular detection algorithms, SDNet has the best detection results. SD Net also meets the requirement of real-time monitoring.

Reference works

- T. Ilyas, A. Khan, M. Umraiz, Y. Jeong, and H.Kim,“Multiscale context aggregation for strawberry fruit recognition and disease phenotyping,” IEEE Access, vol. 9, pp. 124491–124504, 2021,
- A. Subeesh, S. Bhole, K. Singh, N. S. Chandel, Y. A. Rajwade, K. V. R. Rao, S. P. Kumar, and D. Jat, “Deep convolutional neural network models for weed detection in polyhouse grown bell peppers,” Artif. Intell.Agricult., vol. 6, pp. 47–54, Jan. 2022.

THANK YOU