UAS-DTU

Unmanned Aerial Systems - Delhi Technological University

ROUND 2: Technical Round
## Software Department

Background

In greenhouse environments, accurate fruit counting is critical for effective crop management, yield estimation, and optimizing harvesting schedules. Traditional manual counting methods are time-consuming, prone to human error, and labor-intensive, especially in large-scale operations. Leveraging computer vision techniques to automate fruit counting can significantly enhance precision and efficiency. This task focuses on developing a system that accurately counts fruits by color from paired images of each shelf, captured from the front and back. The key challenge is to ensure no fruit is double-counted due to visibility in both images. Accurate fruit counts will help greenhouse operators monitor crop health, predict yields, and streamline operations, ultimately contributing to better resource utilization and improved productivity.

Task

The task involves determining the count of fruits categorized by color from a set of paired photos for each shelf, where each pair includes a photo taken from the front and another from the back of the shelf. The objective is to ensure that fruits visible in both photos are not counted twice. This requires accurately identifying and matching the fruits in the front and back views using

their visual features (such as shape, size, and color) to avoid duplication, while also accounting for occlusions and overlaps in the images. The final output should provide a distinct count of fruits for each color on the shelf.

The sample image is given below:

Front   Back
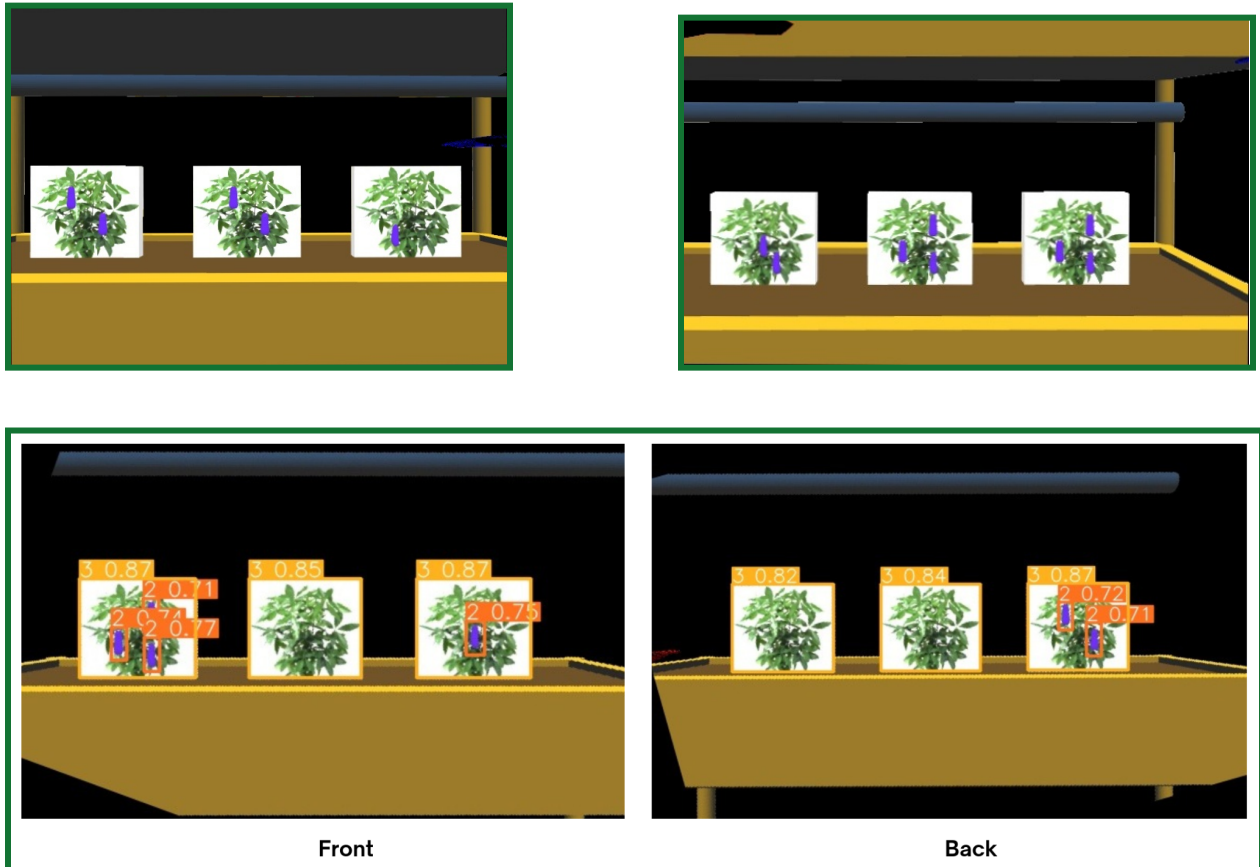
Your task involves :
1.Object Detection
2.Object location
3.Object Classification
4.Fruit Counting

YOLO(You Only Look Once):

YOLO, short for "You Only Look Once," is a popular computer vision technique used to detect,localise and classify objects in images or videos. YOLO is known for being very fast and efficient, making it ideal for real-time tasks like self-driving cars, security systems, or even

counting fruits in greenhouses. Instead of analyzing parts of an image piece by piece, YOLO processes the entire image at once, making it both accurate and speedy in recognizing objects.

Getting Started:

```python
from ultralytics import YOLO
model=YOLO('best.pt')
results=model.predict('forward',save=True)
```

The results object will contain all the predictions of fruits that are detected by YOLO. Refer to the documentation of ultralytics to understand the details of the results object. The predictions will also be saved in a directory called 'runs'.Make sure to download the weights called "best.pt" and make sure add correct path of the pt file as the argument of YOLO class.

Step By Step:

1. [Optional] Install Ubuntu in your disk partition, refer to this link (https://www.youtube.com/watch?v=-iSAyiicyQY) for details on how to do this. Note that this task often takes time but we highly encourage you to use Ubuntu once recruited so doing this might give a head start. But note that this is purely optional and you will not be evaluated on the basis of this.
2. Learning and picking up new things is the key to work we do. Download and learn Python3, get comfortable with basic data structures used in Python3 (lists, dict, strings, etc). If you know CPP this might not be a steep learning curve. Refer to the beautifully written documentation python has to offerhttps://www.python.org/downloads/release/python-378/. Also, refer to youtube and blogs for learning quickly.
3. Learn the basics of NumPy. It is the fundamental package for scientific computing with Python. NumPy brings the computational power of languages like C and Fortran to Python, a language much easier to learn and use. With this power comes simplicity and speed. You can refer to these tutorials: https://www.codecademy.com/learn/intro-statistics-numpy/modules/dspath-intro_-numpy. If you want to go deeper you can read the official documentation of NumPy on https://numpy.org/ or YouTube videos.
4. Learn the basics of OpenCV (Open Source Computer Vision Library), It is an open-source computer vision and machine learning software library which is available in

multiple programming languages. You can refer to this video lecture series to learn the basics quickly: https://pythonprogramming.net/loading-images-python-opencv-tutorial/. You can also refer to the official documentation of OpenCV on https://opencv.org/ or YouTube videos.

5. Maintain a logbook or write a short report of details showing on a google doc. Share this with your mentor on his/her email address.
   a. What did you do each day?
   b. What changes did you make to your code to improve its performance?
      i. Error Analysis
      ii. Identify areas of improvement
      iii. Make changes
      iv. Write it down
6. You can refer to the documentation of ultralytics (https://docs.ultralytics.com/) to understand the specific formats in which the model returns the output.

The task should be compulsorily done on GitHub and should have a comprehensive readme.

Evaluation Criteria:
1. Your overall approach to understanding the basics of python
2. Understanding of basic NumPy and OpenCV
3. Code writing skills (is the code clean)
4. Skills in understanding and usage of new tools which are integral to the work that we are doing here.
5. Documentation.
6. Ability to think analytically and critically.
7. Ability to do the error analysis appropriately.
8. Most importantly grit and commitment!

Task Deadline : 3 Feb '25 22:00 IST

Relevant Links:
● Dual boot Ubuntu 22:https://www.youtube.com/watch?v=QKn5U2esuRk
● Python 3.7: https://www.python.org/downloads/release/python-378/
● Learn Python 3: https://automatetheboringstuff.com/ (First 6 chapters are sufficient)
● Learn OpenCV: https://docs.opencv.org/4.x/d6/d00/tutorial_py_root.html [Video Lecture]
● Learn GitHub : https://docs.github.com/en/get-started/quickstart/hello-world
● Ultralytics documentation:https://docs.ultralytics.com/

End Note:

For those of you with a background in programming and knowledge of python we assume this task won't be very difficult for you. Similarly if someone's just starting off with python this may seem overwhelming and impossible. We need you to know **that's okay and your previous knowledge will not play a role in our selection.** We will make sure it's a level playing field for everyone, so in case you're just starting out we don't expect you to complete this task 100% but we expect 100% follow through and dedication from all. If you are able to complete this task earlier than stipulated time we will assign more things to you, the purpose of this task is to see your adaptability to new environments so we encourage you to ask doubts search the internet and find solutions and most importantly enjoy (you will most likely have a good looking project by the end of this recruitment)

We wish you all the best, and hope to work with you soon!