**Industrial Internship Report on**

**”Crop and Weed Detection System using Image Processing”**

**Prepared by**

**Jagjot Singh**

|  |
| --- |
| *Executive Summary* |
| This report provides details of the Industrial Internship provided by upskill Campus and The IoT Academy in collaboration with Industrial Partner UniConverge Technologies Pvt Ltd (UCT).  This internship was focused on a project/problem statement provided by UCT. We had to finish the project including the report in 6 weeks’ time.  My project was about detection of unwanted weed in the crops using machine learning and image processing techniques and algorithms.  This internship gave me a very good opportunity to get exposure to Industrial problems and design/implement solution for that. It was an overall great experience to have this internship. |

**TABLE OF CONTENTS**

[1 Preface 3](#_Toc139702806)

[2 Introduction 4](#_Toc139702807)

[2.1 About UniConverge Technologies Pvt Ltd 4](#_Toc139702808)

[2.2 About upskill Campus 8](#_Toc139702809)

[2.3 Objective 9](#_Toc139702810)

[2.4 Reference 9](#_Toc139702811)

[2.5 Glossary 10](#_Toc139702812)

[3 Problem Statement 11](#_Toc139702813)

[4 Existing and Proposed solution 12](#_Toc139702814)

[5 Proposed Design/ Model 13](#_Toc139702815)

[5.1 High Level Diagram (if applicable) 13](#_Toc139702816)

[5.2 Low Level Diagram (if applicable) 13](#_Toc139702817)

[5.3 Interfaces (if applicable) 13](#_Toc139702818)

[6 Performance Test 14](#_Toc139702819)

[6.1 Test Plan/ Test Cases 14](#_Toc139702820)

[6.2 Test Procedure 14](#_Toc139702821)

[6.3 Performance Outcome 14](#_Toc139702822)

[7 My learnings 15](#_Toc139702823)

[8 Future work scope 16](#_Toc139702824)

# Preface

Summary of the whole 6 weeks’ work.

About need of relevant Internship in career development.

Brief about Your project/problem statement.

Opportunity given by USC/UCT.

How Program was planned



Your Learnings and overall experience.

Thank to all the mentors technical support team and my seniors, who have helped you directly or indirectly.

My message to my juniors is that keep working hard make projects of real word do internships like these to get more exposure to industry.

# Introduction

## About UniConverge Technologies Pvt Ltd

A company established in 2013 and working in Digital Transformation domain and providing Industrial solutions with prime focus on sustainability and RoI.

For developing its products and solutions it is leveraging various**Cutting Edge Technologies e.g. Internet of Things (IoT), Cyber Security, Cloud computing (AWS, Azure), Machine Learning, Communication Technologies (4G/5G/LoRaWAN), Java Full Stack, Python, Front end**etc.



1. UCT IoT Platform **(****)**

**UCT Insight** is an IOT platform designed for quick deployment of IOT applications on the same time providing valuable “insight” for your process/business. It has been built in Java for backend and ReactJS for Front end. It has support for MySQL and various NoSql Databases.

* It enables device connectivity via industry standard IoT protocols - MQTT, CoAP, HTTP, Modbus TCP, OPC UA
* It supports both cloud and on-premises deployments.

It has features to  
• Build Your own dashboard  
• Analytics and Reporting  
• Alert and Notification  
• Integration with third party application(Power BI, SAP, ERP)  
• Rule Engine

 

1. **Smart Factory Platform (****)**

Factory watch is a platform for smart factory needs.

It provides Users/ Factory

* with a scalable solution for their Production and asset monitoring
* OEE and predictive maintenance solution scaling up to digital twin for your assets.
* to unleased the true potential of the data that their machines are generating and helps to identify the KPIs and also improve them.
* A modular architecture that allows users to choose the service that they what to start and then can scale to more complex solutions as per their demands.

Its unique SaaS model helps users to save time, cost and money.

 

1.  based Solution

UCT is one of the early adopters of LoRAWAN teschnology and providing solution in Agritech, Smart cities, Industrial Monitoring, Smart Street Light, Smart Water/ Gas/ Electricity metering solutions etc.

1. Predictive Maintenance

UCT is providing Industrial Machine health monitoring and Predictive maintenance solution leveraging Embedded system, Industrial IoT and Machine Learning Technologies by finding Remaining useful life time of various Machines used in production process.



## About upskill Campus (USC)

upskill Campus along with The IoT Academy and in association with Uniconverge technologies has facilitated the smooth execution of the complete internship process.

USC is a career development platform that delivers **personalized executive coaching** in a more affordable, scalable and measurable way.



Seeing need of upskilling in self paced manner along-with additional support services e.g. Internship, projects, interaction with Industry experts, Career growth Services

<https://www.upskillcampus.com/>

upSkill Campus aiming to upskill 1 million learners in next 5 year

A pink and black logo

Description automatically generated

Seeing need of upskilling in self paced manner along-with additional support services e.g. Internship, projects, interaction with Industry experts, Career growth Services

<https://www.upskillcampus.com/>

upSkill Campus aiming to upskill 1 million learners in next 5 year



## The IoT Academy

The IoT academy is EdTech Division of UCT that is running long executive certification programs in collaboration with EICT Academy, IITK, IITR and IITG in multiple domains.

## Objectives of this Internship program

The objective for this internship program was to

 ☛ get practical experience of working in the industry.

 ☛ to solve real world problems.

 ☛ to have improved job prospects.

 ☛ to have Improved understanding of our field and its applications.

 ☛ to have Personal growth like better communication and problem solving.

## Reference

[1] Upskill campus Course content

[2] You tube

[3] Stackoverflow

# Problem

Weed is unwanted thing in agriculture. Weed use the nutrients, water ,land and many more thihngs that might have gone to crops.Which result less production of required crop.Farmer often use pesticides to remove weed which also affective but some pesticide may stick with crop and may causs problem for humans.

**4 Data**

we using our dataset uploaded on [kaggle](https://www.kaggle.com/ravirajsinh45/crop-and-weed-detection-data-with-bounding-boxes). This dataset contains 1300 images of sesame crops and different types of weeds with each image labels. Each image is a 512 X 512 color image. Labels for images are in YOLO format. Data on <https://www.kaggle.com/ravirajsinh45/crop-and-weed-detection-data-with-bounding-boxes>

**5 Some Images**

### 1.sesame crop

[](https://camo.githubusercontent.com/c4500dcde87433a1432c406517d8f743bb31137e74055b80b68571d190ec0726/68747470733a2f2f7777772e676f6f676c65617069732e636f6d2f646f776e6c6f61642f73746f726167652f76312f622f6b6167676c652d757365722d636f6e74656e742f6f2f696e626f7825324633373435323830253246646438346531306364353663373435313636353665316665653237343237363325324674616c5f35352e6a7065673f67656e65726174696f6e3d3135383934333839363837383833393126616c743d6d65646961) [](https://camo.githubusercontent.com/6d2ad969ec3de177f9eaf5caddd1af77e03d2ece037ee3f5831dad0e08f0fb4e/68747470733a2f2f7777772e676f6f676c65617069732e636f6d2f646f776e6c6f61642f73746f726167652f76312f622f6b6167676c652d757365722d636f6e74656e742f6f2f696e626f7825324633373435323830253246626638363639343732636137373961333666626439393263366565383062396225324674616c5f34342e6a7065673f67656e65726174696f6e3d3135383934333839373531313033313026616c743d6d65646961)

### 2.weed

[](https://camo.githubusercontent.com/c1b43f0daa8ad79d038ef85b6e1211e11939e01bf292a93f169b9f735134c8c3/68747470733a2f2f7777772e676f6f676c65617069732e636f6d2f646f776e6c6f61642f73746f726167652f76312f622f6b6167676c652d757365722d636f6e74656e742f6f2f696e626f78253246333734353238302532463232336531616531626332623264393736636366373936383562623565663234253246696d6167655f3335392e6a7065673f67656e65726174696f6e3d3135383934333931353436383136323226616c743d6d65646961) [](https://camo.githubusercontent.com/3728b79cb2fbdd6779c85253c0390c20ca85fa95ddac46694b7080c810b2c0be/68747470733a2f2f7777772e676f6f676c65617069732e636f6d2f646f776e6c6f61642f73746f726167652f76312f622f6b6167676c652d757365722d636f6e74656e742f6f2f696e626f78253246333734353238302532466563313264626166626634623562366531623436636331613437653935313437253246696d6167655f3532382e6a7065673f67656e65726174696f6e3d3135383934333931363630313031383926616c743d6d65646961) [](https://camo.githubusercontent.com/d65083f58974d8c6d087781213c32aeb4e220a4d27813b6f5602a64af425b1e2/68747470733a2f2f7777772e676f6f676c65617069732e636f6d2f646f776e6c6f61642f73746f726167652f76312f622f6b6167676c652d757365722d636f6e74656e742f6f2f696e626f78253246333734353238302532466334653134376430316166323636376132393363336666316361616336613835253246696d6167655f32312e6a7065673f67656e65726174696f6e3d3135383934333931383730383236323526616c743d6d65646961)

# How to use this repo?

This Repository is diveded in two part:-

1. Training

2. Performig detection using pre train model

- Using pytorch

- Using openCV (skip installation using requirements.txt file)

## Training:-

* For traning you have to make **Agriculture** folder on your google drive, open clone repo and copy all files from Crop\_weed\_detection\_training folder and paste it in google drive.
* Now from drive open crop\_weed\_detection.ipynb file and you will get all documentation regarding it within the file.

### setting up environment:-

* First of all you need anaconda, if you don't have click here for [Download](https://www.anaconda.com/products/individual) and install.
  + Now open Anaconda Prompt and clone this repo
* (base) C:\Users\user> git clone https://github.com/ravirajsinh45/Crop\_and\_weed\_detection.git
  + (Optional) If you get any error like **git is not recogize internal command** than run below command
  + (base) C:\Users\user> pip install git
  + change your working directory to clone repo.
  + (base) C:\Users\user>cd Crop\_and\_weed\_detection
  + After that you have to create environment to install require libraries. Follow the steps:-
    1. open Anaconda Prompt and write below command for install requirements.
    2. (base) C:\Users\user\Crop\_and\_weed\_detection> conda create -n pytorchenv python=3.7.7
    3. After creating environment you have to activate it.
    4. (base) C:\Users\user\Crop\_and\_weed\_detection> conda activate pytorchenv
    5. Now run below command for install libraries
    6. (pytorchenv) C:\Users\user\Crop\_and\_weed\_detection> pip install -r requirements.txt
  + Now your environment is ready to roar:)
  + For detection you need weights for network. Due to large file i attaching google drive link. You have to download weight file unless you have your own weights file. [click here](https://drive.google.com/open?id=1-Aam2D-fqnwecbeHwa4rtzxtNjwcDkP6)
  + You have to add weights flie into Crop\_and\_weed\_detection > performing\_detection > data > weights folder.

## Performig detection using pre-trained model

### Using pytorch

* Let Open jupyter lab
* (pytorchenv) C:\Users\user\Crop\_and\_weed\_detection>jupyter-lab
* After that open [performing\_detection\_with\_pytorch.ipynb](https://github.com/ravirajsinh45/Crop_and_weed_detection/blob/master/performing_detection/pytorch/performing_detection_with_pytorch.ipynb) and follow alonge. After this you will able to detect crop and weed from images. Explore images from [images](https://github.com/ravirajsinh45/Crop_and_weed_detection/blob/master/performing_detection/data/images) folder.

### Using OpenCV:-

* This easy compare to pytorch implementation and for this you don't need pytorch.
* if you have opencv library already installed (opencv included in requirements.txt), skip this step else run below code
* pip install opencv-python
* open [detection\_with\_opencv.ipynb](https://github.com/ravirajsinh45/Crop_and_weed_detection/blob/master/performing_detection/opencv/detection_with_opencv.ipynb) and just run cell.

# Existing and Proposed solution

Several existing solutions for crop and weed detection using image processing have been developed. These solutions typically involve the use of computer vision techniques to analyze images captured in agricultural fields. They can be categorized as follows:

1. **Traditional Image Processing Algorithms:** These solutions often use techniques such as thresholding, edge detection, and morphological operations to distinguish between crops and weeds based on color, texture, and shape. However, these methods can struggle with variations in lighting conditions and might require significant parameter tuning for different scenarios.
2. **Machine Learning-Based Approaches:** Some solutions leverage machine learning models like Support Vector Machines (SVMs), Random Forests, or neural networks to classify crops and weeds. These models can provide better accuracy and adaptability compared to traditional methods. However, they require substantial labeled training data and might still struggle with complex variations and limited generalization.

**Limitations of Existing Solutions:**

1. **Limited Robustness:** Traditional algorithms can struggle in varying lighting conditions and when dealing with different crop and weed species that share similar visual characteristics.
2. **High Data Requirements:** Machine learning models require large amounts of labeled data for training, which can be time-consuming and expensive to gather and annotate.
3. **Generalization Challenges:** Both traditional and machine learning-based methods might struggle to generalize well across different environments, crops, and weed species due to the inherent variability in agricultural settings.

**Proposed Solution:** My proposed solution for the Crop and Weed Detection System utilizes a hybrid approach combining traditional image processing techniques and deep learning:

1. **Preprocessing:** Use image enhancement techniques to normalize lighting conditions and improve image quality.
2. **Segmentation:** Apply color-based segmentation to separate crops and weeds from the background.
3. **Feature Extraction:** Extract relevant features like shape, texture, and color for each segmented region.
4. **Deep Learning:** Utilize a Convolutional Neural Network (CNN) for classifying the extracted features into crop or weed categories.

**Value Addition:**

1. **Robustness:** By combining traditional techniques and deep learning, the system aims to be robust to varying lighting and environmental conditions.
2. **Reduced Data Dependency:** The hybrid approach might require less labeled training data compared to pure machine learning models, potentially easing the data collection burden.
3. **Improved Generalization:** The combination of techniques could enhance the system's ability to generalize across different crops and weed species.
4. **Real-time Processing:** Optimize the processing pipeline for real-time or near-real-time operation, enabling timely decision-making for farmers.
5. **Interactive Interface:** Develop a user-friendly interface for farmers to visualize detection results and intervene if needed, enhancing usability.
6. **Adaptability:** Design the system to be easily adaptable to new crops and weed species with minimal parameter adjustments.

In summary, the proposed Crop and Weed Detection System aims to overcome limitations of existing solutions by combining traditional image processing techniques with deep learning, providing enhanced robustness, reduced data dependencies, improved generalization, real-time processing, user-friendliness, and adaptability.

## Code submission (Github link)

https://github.com/Jagub/UPSKILL-CAMPUS-Crop-and-Weed-Detection-System-Using-Image-processing

## Report submission (Github link) : first make placeholder, copy the link.

https://github.com/Jagub/UPSKILL-CAMPUS-Crop-and-Weed-Detection-System-Using-Image-processing/blob/main/report%20for%20final%20submission

# Proposed Design/ Model

Given more details about design flow of your solution. This is applicable for all domains. DS/ML Students can cover it after they have their algorithm implementation. There is always a start, intermediate stages and then final outcome.

## High Level Diagram (if applicable)

Figure 1: HIGH LEVEL DIAGRAM OF THE SYSTEM

## Low Level Diagram (if applicable)

## Interfaces (if applicable)

Update with Block Diagrams, Data flow, protocols, FLOW Charts, State Machines, Memory Buffer Management.

# Performance Test

This is very important part and defines why this work is meant of Real industries, instead of being just academic project.

Here we need to first find the constraints.

How those constraints were taken care in your design?

What were test results around those constraints?

Constraints can be e.g. memory, MIPS (speed, operations per second), accuracy, durability, power consumption etc.

In case you could not test them, but still you should mention how identified constraints can impact your design, and what are recommendations to handle them.

## Test Plan/ Test Cases

## Test Procedure

## Performance Outcome

# My learnings

You should provide summary of your overall learning and how it would help you in your career growth.

# Future work scope

You can put some ideas that you could not work due to time limitation but can be taken in future.