Industrial Internship Report on

” Crop and Weed Detection”

Prepared by

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Executive Summary
This report provides details of the Industrial Internship facilitated by Upskill Campus and The IoT Academy in collaboration with Industrial Partner UniConverge Technologies Pvt Ltd (UCT). The internship focused on solving a problem statement provided by UCT within a 6-week timeframe. My project, **Crop and Weed Detection in Machine Learning and Data Science**, involved building a machine learning model capable of distinguishing between crops and weeds using image data. This project gave me hands-on experience with data preprocessing, image augmentation, model training, and evaluation. It was a great opportunity to apply theoretical knowledge in a real-world context and learn how to tackle industrial challenges.

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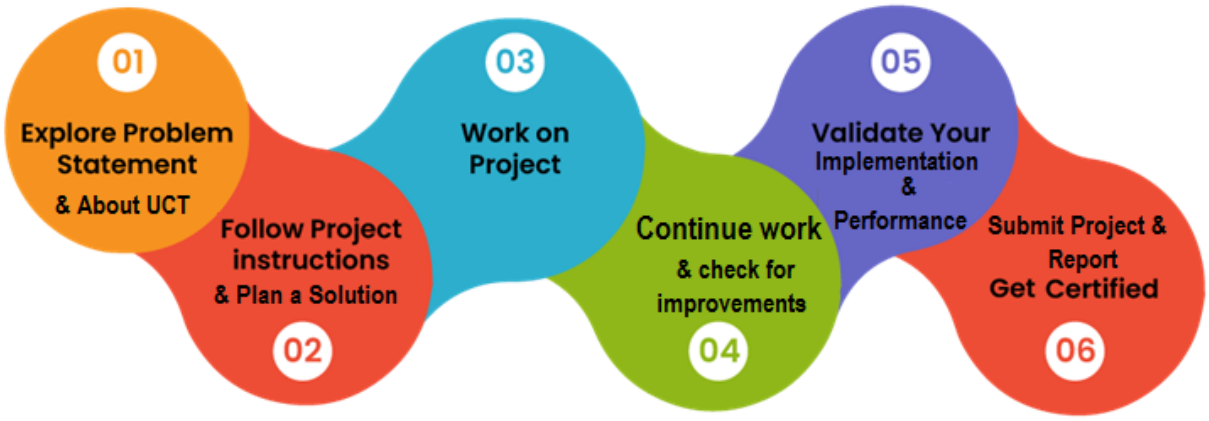
1 Preface

This report summarizes the work completed during my 4-week internship, focusing on the application of machine learning and data science techniques to crop and weed detection. The primary goal was to build a model that could accurately classify crops and weeds based on image data.

- **Project Overview**: My project aimed to solve the problem of identifying crops and weeds in agricultural fields using machine learning. This involved collecting and preprocessing image data, augmenting it for better variability, and training a machine learning model for accurate detection.
- **Program Plan**: The program was divided into distinct phases such as data collection, model design, implementation, testing, and evaluation.
- **Learnings**: I developed skills in Python programming, data preprocessing, and machine learning model evaluation using libraries like TensorFlow and Scikit-learn.
- **Acknowledgments**: I would like to thank my mentors at UniConverge Technologies Pvt Ltd, the teams at Upskill Campus and IoT Academy, and my peers for their constant support and guidance throughout the internship.
- **Message to Juniors and Peers**: I encourage juniors to pursue internships like this one, as it helps bridge the gap between academic knowledge and real-world industrial applications.



My Learnings and overall experience.

Thank to all UniConverge Technologies Pvt Ltd , who have helped you directly or indirectly.

Your message to your juniors and peers.

2 Introduction

2.1 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.

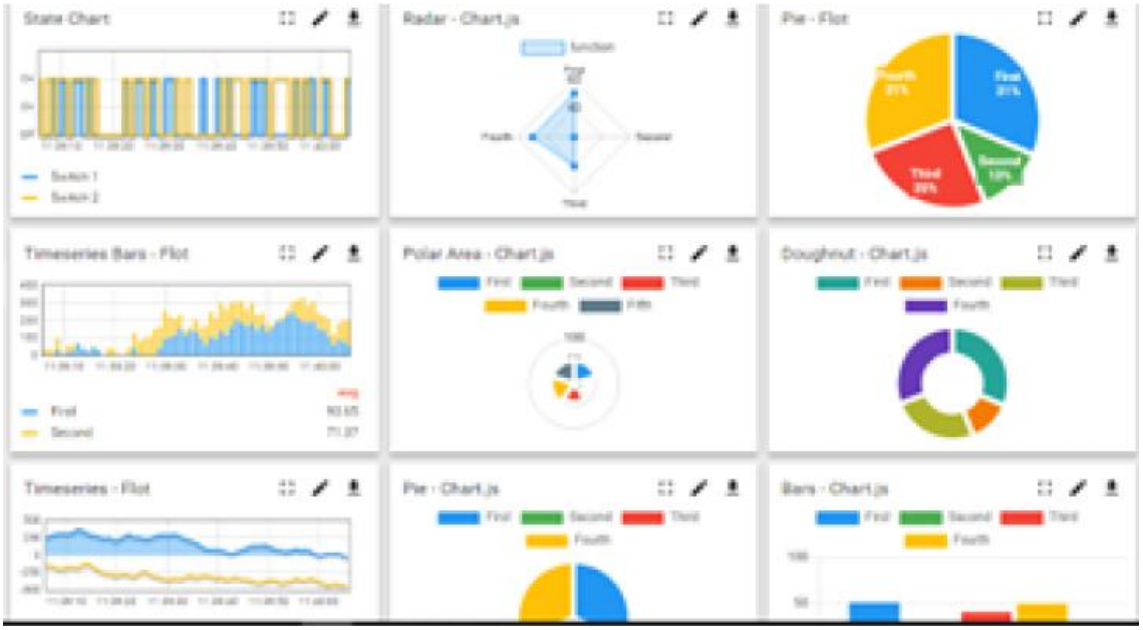
i. UCT IoT Platform (UCT Insight)

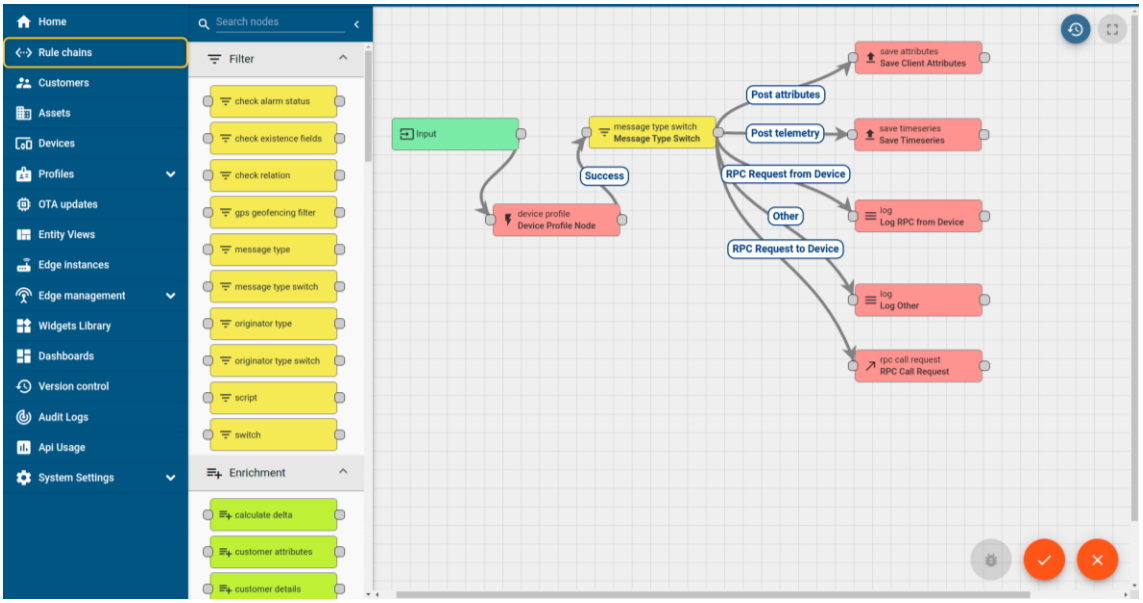
UCT Insight is an IOT platform designed for quick deployment of IOT applications on the same time providing valuable "insight" for your process/business. It has been built in Java for backend and ReactJS for Front end. It has support for MySQL and various NoSql Databases.

- 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





ii. Smart Factory Platform (FACTORY WATCH)

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.

Machine	Operator	Work Order ID	Job ID	Job Performance	Job Progress		Output		Rejection	Time (mins)				Job Status	End Customer
					Start Time	End Time	Planned	Actual		Setup	Pred	Downtime	Idle		
CNC_S7_81	Operator 1	WO0405200001	4168	58%	10:30 AM		55	41	0	80	215	0	45	In Progress	i
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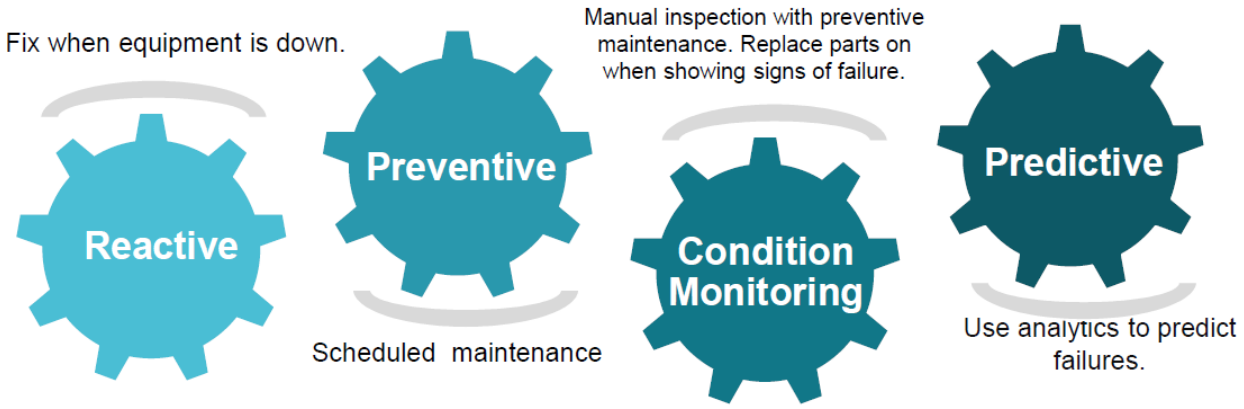
iii. LoRaWAN based Solution

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.

iv. 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.



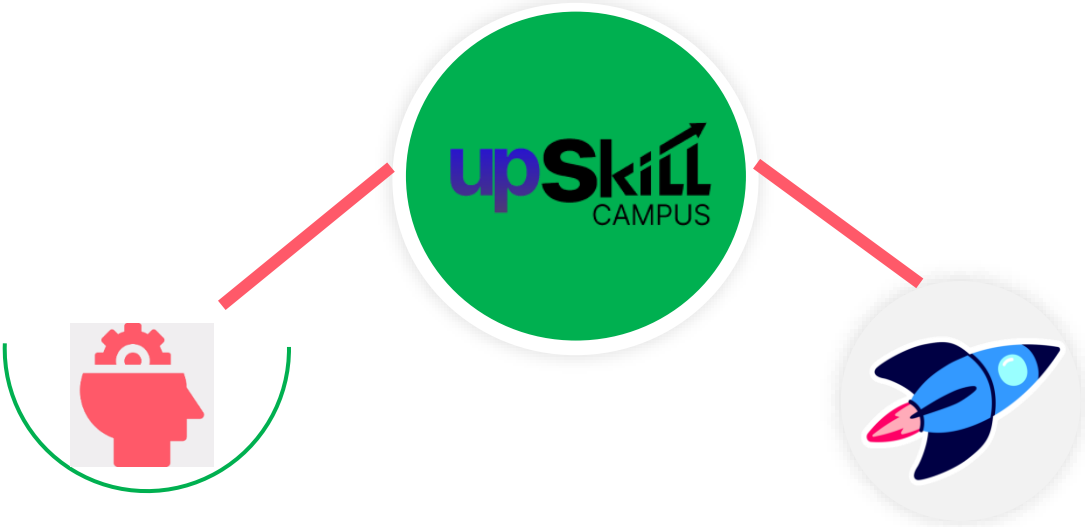
2.2 About upskill Campus (USC)

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.

Upskill Campus is a career development platform that supports professionals in gaining practical, real-world knowledge in industrial domains like IoT and machine learning.

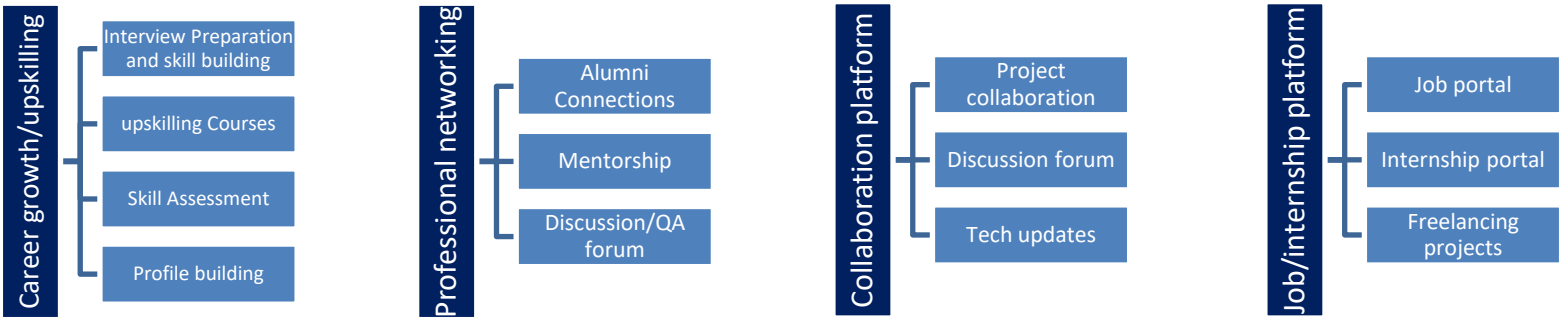
USC partnered with UniConverge to provide this internship, facilitating a structured learning and working experience.



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

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

https://www.upskillcampus.com/



2.3 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.

The IoT Academy is UCT's educational wing, focusing on offering advanced certification programs in collaboration with renowned institutions. Its programs cover various technology domains including IoT, data science, and cloud computing.

2.4 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.
- ☛ Gain practical industry experience by solving real-world problems.
- ☛ Apply machine learning and data science techniques to an industrial use case.
- ☛Improve job prospects through hands-on experience.
- ☛Develop soft skills such as teamwork, communication, and problem-solving. solving.

2.5 Reference

[1] Research papers on machine learning for crop and weed detection

[2] Documentation for libraries like TensorFlow, Scikit-learn

[3]

2.6 Glossary

Terms	Acronym
IoT	Internet of Things
CNN	Convolutional Neural Network
PCA	Principal Component Analysis
AUC-ROC	Area Under the Receiver Operating Characteristic Curve

3 Problem Statement

In the assigned problem statement

The agricultural sector faces significant challenges in distinguishing crops from weeds, which is crucial for optimizing crop yield and minimizing resource wastage. My project aimed to build a machine learning model capable of detecting weeds and crops from images, helping farmers improve efficiency and precision in field management.

4 Existing and Proposed solution

4.1 Existing Solutions

Many traditional methods for crop and weed detection rely on manual labor or outdated technologies. These approaches are time-consuming, prone to human error, and lack scalability.

4.2 Proposed Solution

My solution utilized machine learning techniques, specifically a Convolutional Neural Network (CNN), to classify images of crops and weeds. The key steps included data preprocessing, image augmentation, and training the CNN to maximize accuracy and generalizability.

4.1 Code submission (Github link):

https://github.com/PradnyaWanjari/Upskillcampus

4.2 Report submission (Github link) :

https://github.com/PradnyaWanjari/Upskillcampus

5 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.

5.1 High Level Diagram (if applicable)

Figure 1: HIGH LEVEL DIAGRAM OF THE SYSTEM

5.2 Low Level Diagram (if applicable)

5.3 Interfaces (if applicable)

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

6 Performance Test

6.1 Test Plan/ Test Cases

- Test how accurately the model detects crops vs. weeds on different datasets.
- Test the model's generalization by evaluating its performance on unseen data.

6.2 Test Procedure

- Split the dataset into training and test sets.
- Use cross-validation to tune hyperparameters.
- Measure performance using metrics such as accuracy, precision, recall, and F1-score.

6.3 Performance Outcome

The CNN model achieved an accuracy of **88.7%** with an F1-score of **0.89 .**Further improvements could be made by incorporating more data and fine-tuning the model architecture.

7 My learnings

This internship deepened my understanding of machine learning concepts, particularly in image classification and model optimization. I gained practical experience with libraries such as TensorFlow and Scikit-learn and learned how to handle real-world data challenges like noise and variability. This experience will be valuable for my future career in data science and machine learning.

8 Future work scope

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