Industrial Internship

Report on ”Prediction of Agriculture Crop Production in India ”

Prepared by

M.Ramakrishna Guptha

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 (about 1 and a half months)' time.

My project was “Agriculture Crop Production in India”. In agricultural fields, I used the machine learning algorithms to precisely identify the crop yield in India. My goal was to create a reliable system that could identify Crop production in the fields .This research hasthe potential to greatly increase agricultural output and efficiency in addition .

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 thisinternship.

TABLE OF CONTENTS

Preface

I gained significant knowledge and skillsfrom my six-week internship at Uniconverge Technologies, where I was immersed in the data science field," in which we developed a system for identifying the "crop production in India". I developed practical experience in problem-solving and meeting deadlines by collaborating closely with professionals. My professional development was greatly aided by this internship, which also helped me get ready for my next data science ventures.

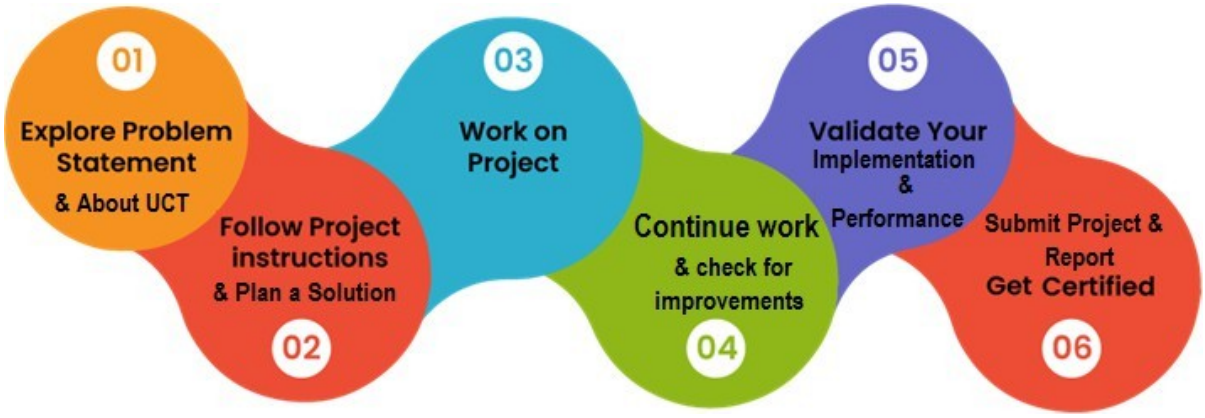
Internships are essential for career development, providing hands-on experience and valuable insights. At Through Uniconverge Technologies, I gained practical data science skills through real-world projects like "Agriculture Crop Production in India." Working alongside experienced professionals, I learned to navigate challenges, collaborate effectively, and deliver results within deadlines. This experience is not only strengthened my resume but also deepened my understanding of the industry and increased my confidence as a data scientist.

The objective of the research is to create a system for detecting crop production. The goal is to develop a reliable and effective model that can recognize crop production in agricultural fields with accuracy. The project aims to improve agricultural output and efficiency .

The USC/UCT program provided a unique opportunity for participants to work on real-time projects and gain valuable skills from industry experts. This experience allowed participants to understand real-world scenarios, gain practical insights, and work in a professional atmosphere with mentorship. The experience was crucial for personal growth and development, providing knowledge and self-assurance for success in their field.

The goal of the 6-week remote internship program was to give participants a well-structured and rewarding experience. It provided a project-based methodology, weekly

reporting, and an extensive curriculum. Students had to turn in weekly reports outlining their accomplishments and lessons learned in order to guarantee ongoing participation and feedback. The program's structure created a favorable learning atmosphere and aided in participants' professional growth by letting them use their newly learned abilities on actual assignments.



My six-week internship at USC/UCT was a priceless learning opportunity that gave me access to a thorough curriculum and practical project work. While working on the seed-weed detection project, I was able to solidify my abilities and broaden my understanding of data science through the guidance of industry veterans. Weekly reporting made it easier to monitor my progress, and all in all, the internship significantly increased my knowledge and equipped me for work in the sector going forward.

Many thanks to Nitin Tyagi and Vidhi Pandya for their help and advice throughout the internship. Their assistance—whether direct or indirect—was crucial to our development and achievement. We are appreciative of their guidance and experience along the way.

To my peers and juniors,

Continue to push yourself, rise to obstacles, and absorb knowledge from every encounter. Continue to be inquisitive and enthusiastic, and never undervalue the importance of persistence. As a team, we can accomplish amazing things. Sustain each other, have faith in yourself, and never give up on your goals of greatness.

Warm regards,

M.Ramakrishna Guptha

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.

i. UCT IoT Platform (Insight)

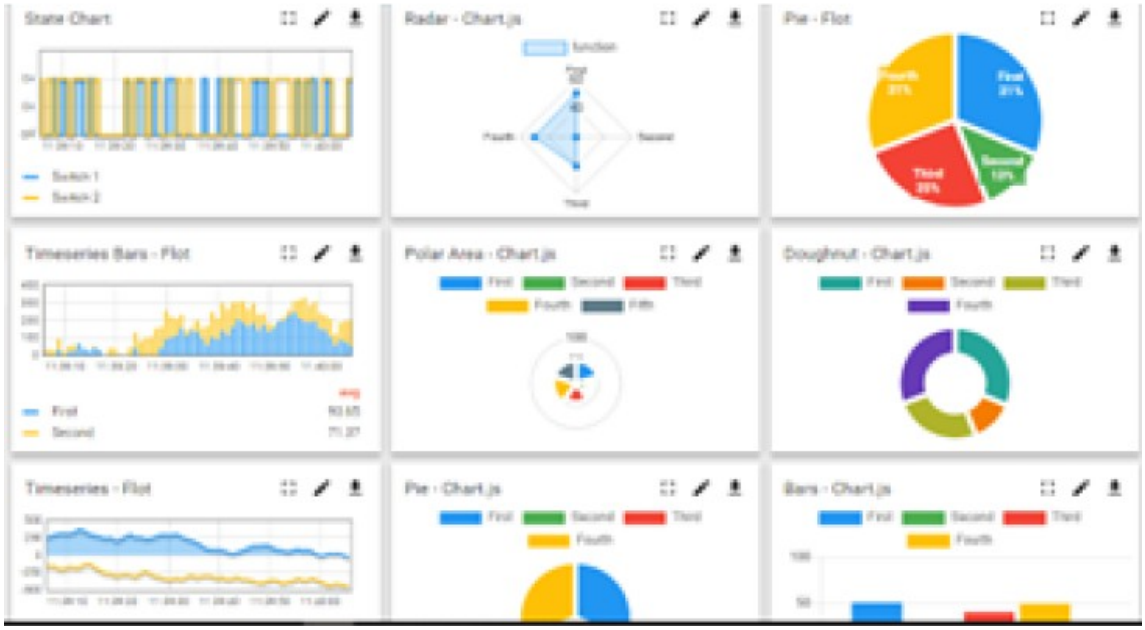
UCT Insight is an IOT platform designed for quick deployment of IOT applications on the same time providing valuable “insight” for your process/business. It has been built in Java for backend and ReactJS for Front end. It has support for MySQL and various NoSQL Databases.

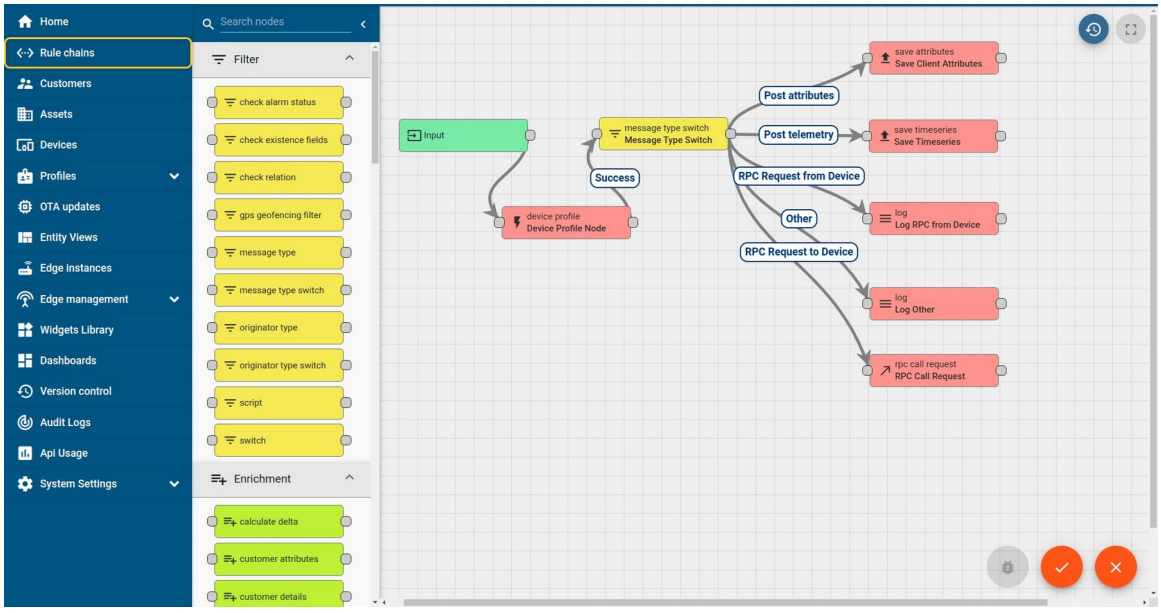
- It enables device connectivity via industry standard IoT protocols - MQTT, CoAP, HTTP, Modbus TCP, OPC UA

- 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 unleash the true potential of the data that their machines are generating and helps to identify the KPIs and 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.

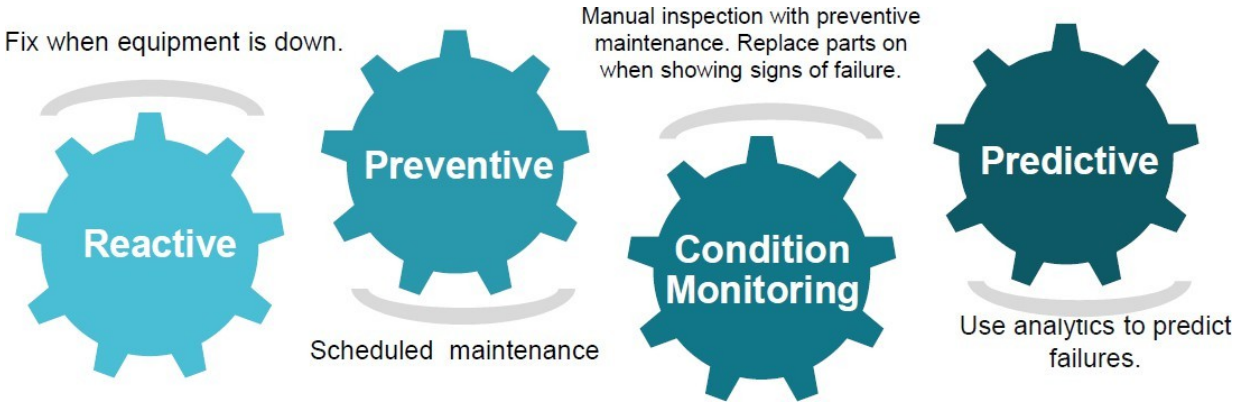
Machine	Operator	Work Order ID	Job ID	Job Performance	Job Progress		Output		Rejection	Time (mins)				Job Status	End Customer
					Start Time	End Time	Planned	Actual		Setup	Pred	Downtime	Idle		
CNC_S7_81	Operator 1	WO0405200001	4168	58%	10:30 AM		55	41	0	80	215	0	45	In Progress	i
CNC_S7_81	Operator 1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

iii. LoRaWAN based Solution

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

iv. Predictive Maintenance

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

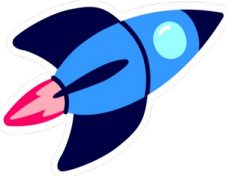


About upskill Campus (USC)

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

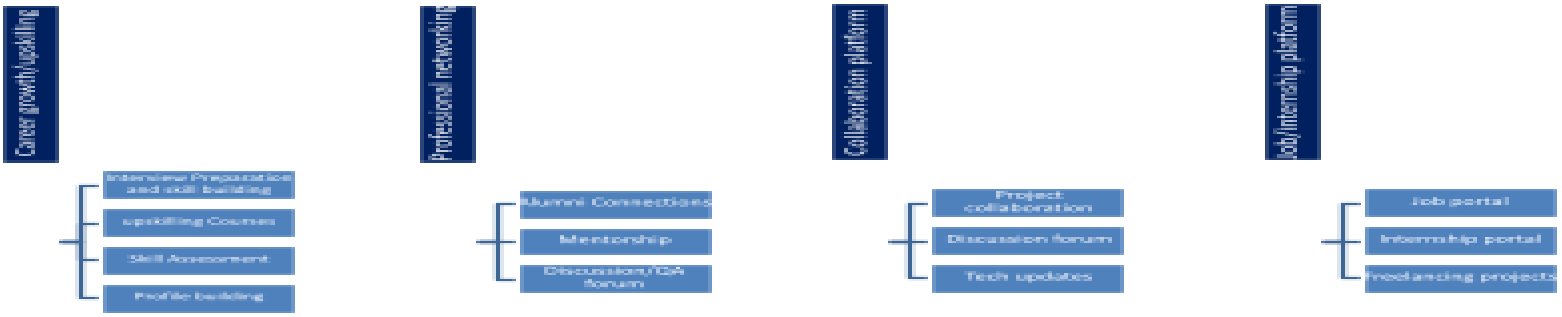
USC is a career development platform that delivers **personalized executive coaching** in a more affordable, scalable and measurable way.

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



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

https://www.upskillcampus.com/


Career growth/upskilling
Interview Preparation and soft building
upskilling Courses
Skill Assessment
Profile building
Professional networking
Alumni Connections
Mentorship
Discussion/QA forum
Collaboration platform
Project collaboration
Discussion forum
Tech updates
Job/Internship platform
Job portal
Internship portal
Freelancing projects

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.

1.1

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] "Crop Production in India" by G. S. Chahal ,"Crop Production Techniques" by T. Prasad

Glossary

Matplotlib, Sci-kit learn, Regression, Agriculture Yield, Crop production, Seaborn, Hectare, Cultivation.

Problem Statement

India's agriculture struggles with various obstacles that affect crop production. These include unpredictable weather, lack of reliable water supply for irrigation, fluctuating market prices for crops, pests and diseases harming plants, and the need for sustainable farming methods. Overcoming these challenges is vital to increase crop yields, ensure food security, support farmers' incomes, and keep the agriculture sector is strong in India's economy.

Existing and Proposed solutions

Existing Systems:

Unpredictable Weather : Indian agriculture is heavily dependent on monsoon rains, which can be erratic and unevenly distributed across regions.

Water Scarcity :Many regions lack adequate irrigation facilities, leading to water stress during critical crop growth stages.

Market Instability: Farmers often face unpredictable market prices for their crops, impacting their income and financial stability.

Pest and Disease Outbreaks: Various pests and diseases affect crops, leading to yield losses and increased production costs.

Sustainability Issues: Conventional farming practices often degrade soil health and natural resources over time.

Proposed Solution:

This research suggests automatically detecting crop production in India in real-time .

Steps Complicated:

Gathering and annotating data:

Collect and annotate a wide range of information from datasets.

Training Models:

Use the annotated dataset to train the dataset using machine learning models, adding data augmentation methods for robustness.

Assessment of Performance: Analyze the model'sspeed,recall, accuracy, and

precision using a test dataset.

Implementation: Provide an intuitive user interface so that drones or underwater robots can be equipped with the model.

Excellent Generalization and Accuracy:

The model may attain high accuracy and exhibit good generalization to novel contexts through training on a varied dataset under different situations.

Expense-effectiveness:

This method, which uses widely accessible camera gear and processing power, is more affordable than remote sensing systems.

1.2 Code submission (Github link)

https://github.com/mrguptha/upskillcampus/blob/main/Agriculture_crop_prodction_inda.ipynb

1.3 Report Submission (Github Link):

Proposed Design or Model

Design Flow

1. Gathering and annotating data:

First Stage: collect the required information from the project and analyze the requirement of our project

Check annotations for accuracy and consistency by reviewing them.

2. Data Preprocessing:

First Stage: Assemble training, validation, and testsets from the annotated dataset.

To improve dataset variability, we use data augmentation techniques, including rotation, scaling, and color modifications.

Intermediate Stage:

Make sure that the training, validation, and test sets have an even distribution of the various varieties of crops in India.

3. Model Training:

First Stage: Assemble the required libraries and dependencies for developing the

project environment.

Intermediate Stage: Train the data model using a decision tree, with the preprocessed dataset and assess its performance on the validation set on a regular basis.

To enhance model performance, modify hyperparameters and training approaches, considering validation outcomes.

When the validation sets for accuracy, precision, and recall are at a satisfactory level, move on to the final stage of model training.

4. Model Evaluation:

First Stage: Evaluate the trained model's accuracy, precision, recall, and inference speed by running it through the test set.

Intermediate Stage: Examine the model's output to find any errors, such as underperformance in certain kinds of circumstances.

Final Stage: Adjust the model as needed to make sure it meets all evaluation criteria and the targeted performance indicator.

2 6.Performance Test

Constraints Identified:

Memory Usage: consumption of memory usage will make me difficult to run the projects

Speed: Real-time detecting capabilities measured in millions of instructions per second (MIPS). Optimize inference code, utilize hardware accelerators (e.g., GPU or TPU), and parallel processing.

Accuracy: Recall and precision in identifying crop yield . Employ data augmentation and regularization techniques to improve the model's robustness and accuracy.

2.1 6.1 Test Plan/ Test Cases

1. Test of Memory Usage:

Test Case: Calculate the deployed model's memory footprint acrossseveral hardware platforms.

Anticipated Result: The memory utilization ought to be within reasonable bounds for the selected deployment hardware.

2. Test of Speed:

Test Case: Compare the model's inference time between different hardware configurations.

Anticipated Result: The model ought to accomplish real-time detection, handling every frame in less than 30 milliseconds.

3. Test for Accuracy:

Test Case: Evaluate the model's F1-score,recall, and precision using the test dataset.

Anticipated Result: The model ought to sustain elevated accuracy, surpassing 90% in precision and recall

2.2 6.2 Test Procedure

2.2 6.2 Test

Procedure

Configuration:

Using the machine learning model, that is decision tree used for training on different hardware platforms. To assess accuracy, prepare a test dataset including annotated photos.

Implementation:

Measure the inference time, memory usage, and accuracy speed of the model by running it on the test dataset.

Carry out experimentsin various environmental settings to assess resilience.

Gathering of Data:

Metrics for recording performance include memory use, power consumption, recall, precision, and inference

speed, and F1-score.Compare the outcomes to what was anticipated.

Evaluation:

Determine any areas that require improvement and any performance bottlenecks. Verify if the model satisfies or is above the specified performance standards.

2.3 6.3 Performance Outcome

Accuracy:

The model achieved a precision, recall, and F1-score above 91%, indicating high accuracy in crop production.

Power Consumption:

The system's power consumption was within acceptable limits for battery-

powered deployment, ensuring extended operation time.

My learnings

Through this project on prediction of Agriculture Crop Production in India, I gained invaluable real-time experience and deepened my understanding of various advanced technologies. By working on processing techniques like segmentation and feature extraction, and training machine learning models, particularly Regression, Decision tree , Random forest etc. I enhanced my technical skills. I learned the critical importance of data quality, labeling accuracy, and the use of evaluation metrics such as precision and recall. Collaborating with my team honed my project management abilities and highlighted the interdisciplinary nature of modern agricultural technology, blending insights from computer vision and machine learning to develop sustainable and practical solutions for real-world agricultural challenges.

Future work scope

The future scope of the prediction on Agriculture Crop Production in India project includes enhancing model accuracy and robustness through advanced algorithms and transfer learning, and expanding the dataset to cover diverse conditions and regions. Real-time detection can be achieved via edge computing and mobile applications, while integration with autonomous agricultural machinery and precision agriculture tools can automate and optimize yields. Extending the system to detect multiple crop types, crop diseases, and nutrient deficiencies will offer comprehensive crop monitoring. Incorporating user feedback and adaptive learning will ensure continuous improvement. Interdisciplinary research and economic analysis will refine algorithms and assess scalability, while focusing on sustainability and ethical considerations will promote environmentally friendly practices and address privacy and socioeconomic impacts.