Industrial Internship Report on

"Crop and Weed Detection Using Machine Learning"

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Executive Summary

This report details my experience during the **UPSKILLS Campus Internship** in collaboration with **UniConverge Technologies Pvt Ltd (UCT)**. The project focused on automating weed detection in agricultural fields using machine learning techniques, specifically **image classification**. The objective of the project was to classify images of crops and weeds, offering a solution to the time-consuming and error-prone manual weed detection process.

During this internship, I gained valuable experience in handling image data, preprocessing, and applying machine learning algorithms to real-world problems. I also developed an understanding of how agricultural automation can be enhanced through machine learning, contributing to sustainable farming practices.

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1. Preface

This internship gave me the chance to work on a real-world problem in the agricultural industry, utilizing machine learning to automate the detection of weeds in agricultural fields. The internship was well-organized, providing me with the necessary resources and guidance to understand the industry's challenges and apply machine learning models to solve them.

My work primarily focused on preparing image data, training machine learning models, and evaluating their performance. The hands-on experience has significantly enhanced my skills in data science and machine learning.

I would like to extend my thanks to all those who supported me during the internship, especially my mentors at **UCT** and **UPSKILLS Campus**.

2. Introduction

2.1 About UniConverge Technologies Pvt Ltd

UniConverge Technologies Pvt Ltd (UCT) is a leading company specializing in **digital transformation** for industrial solutions. Established in 2013, UCT focuses on sustainability and return on investment (RoI) through cutting-edge technologies such as **IoT**, **cybersecurity**, **machine learning**, and **cloud computing**.

UCT offers various platforms:

- **UCT IoT Platform**: Enables device connectivity and analytics for industrial applications using IoT protocols such as MQTT, HTTP, and Modbus.
- **Smart Factory Platform**: Provides scalable solutions for production monitoring, predictive maintenance, and asset management, aiming for **digital twins** and enhanced operational efficiency.
- **Predictive Maintenance Solutions**: Utilizing IoT and machine learning to predict the remaining useful life of industrial machines.

2.2 About Upskill Campus

Upskill Campus (USC), in collaboration with **The IoT Academy**, facilitated the internship process, providing personalized coaching and career development. USC offers specialized training programs that focus on enhancing the career growth of individuals in the fields of machine learning, data science, and IoT.

2.3 Objectives of this Internship Program

The internship aimed to:

- Provide practical exposure to working in the industry.
- Solve real-world problems using machine learning and data analytics.
- Enhance job prospects and industry-specific skills.
- Foster personal growth in communication, problem-solving, and technical expertise.

2.4 Reference

UniConverge Technologies Pvt Ltd Website – www.uniconverge.com

Upskill Campus Website – www.upskillcampus.com

The IoT Academy Website – www.iotacademy.com

2.5 Glossary

- **IoT**: Internet of Things
- **AI**: Artificial Intelligence
- **ML**: Machine Learning
- **CNN**: Convolutional Neural Network
- **RMS**: Root Mean Square

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3. Problem Statement

The project aimed to develop an automated system for detecting weeds in agricultural fields using machine learning. The existing method of manual weed identification is time-consuming and prone to errors. The proposed solution uses **image classification** techniques to automate the process, making it faster and more accurate.
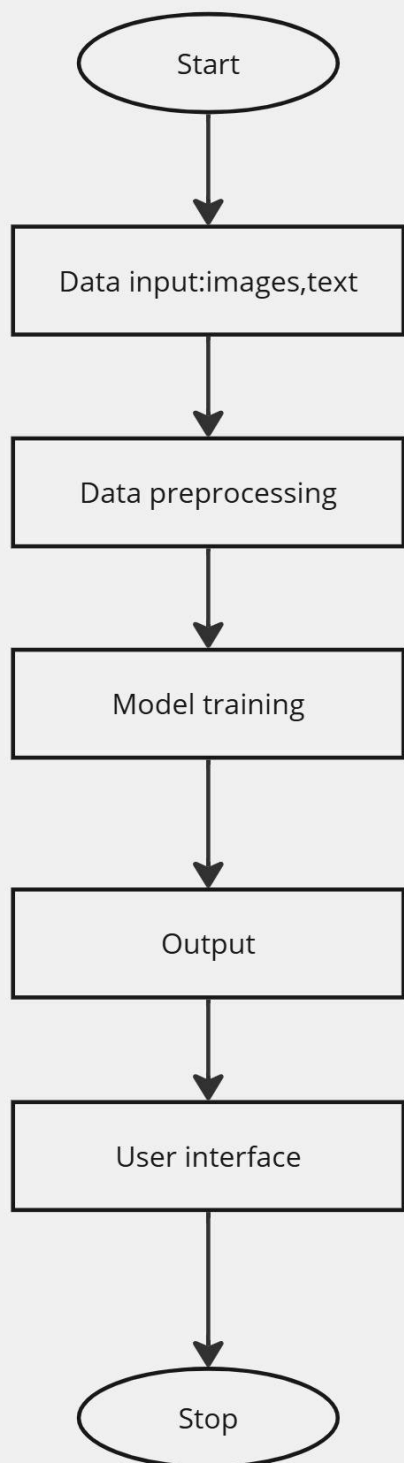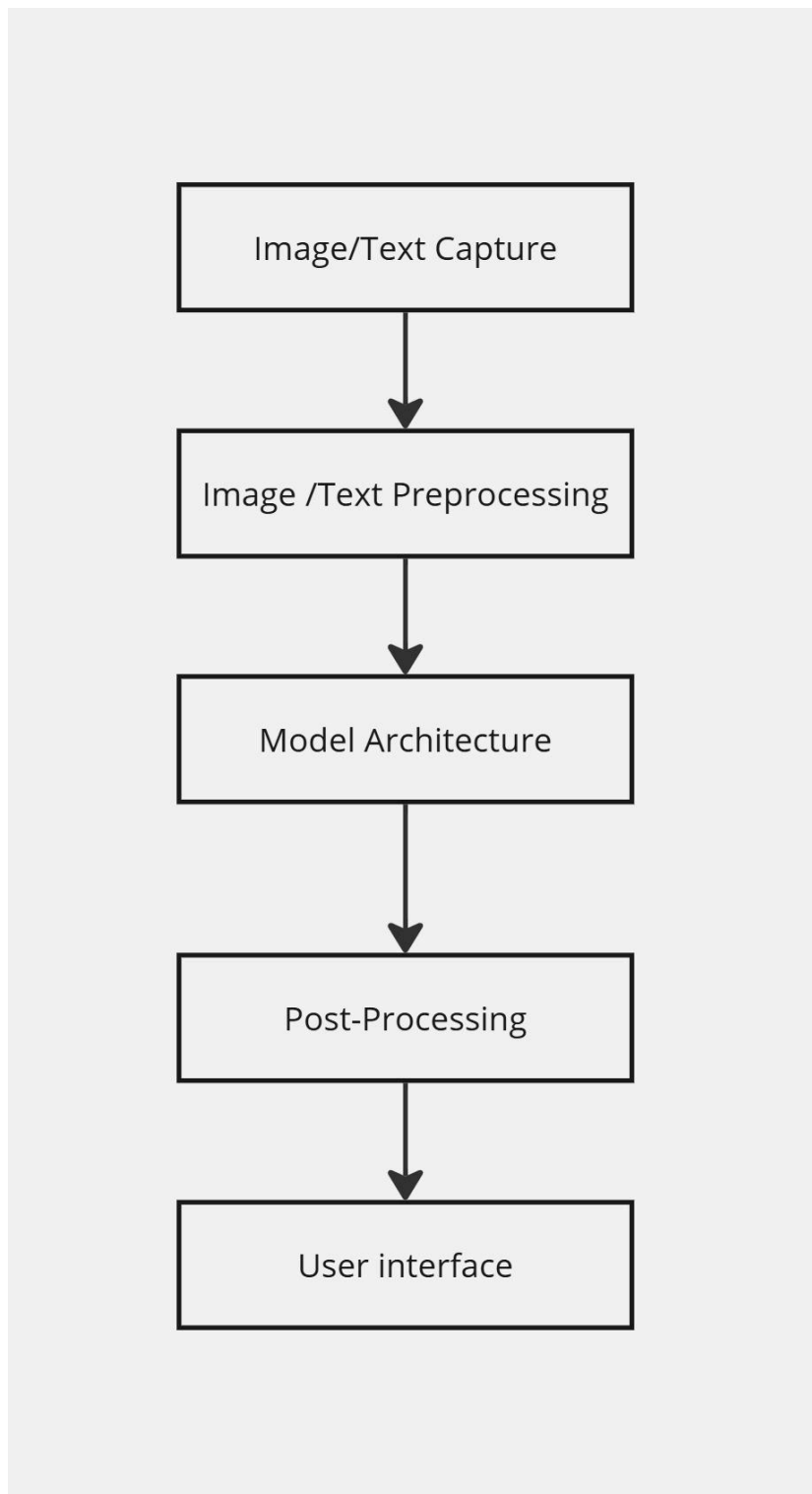
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4. Existing and Proposed Solutions

- **Crop and Weed Detection**: Existing methods involve manual identification, but they are time-consuming and prone to human error. The proposed solution uses **machine learning** to automate weed detection by classifying images of crops and weeds, making it faster and more accurate.

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5. Proposed Design/Model

5.1 High-Level Diagram

```
        ┌─────────────┐
        │    Start    │
        └─────────────┘
               │
               ▼
   ┌───────────────────────┐
   │ Data input:images,text │
   └───────────────────────┘
               │
               ▼
   ┌───────────────────────┐
   │   Data preprocessing   │
   └───────────────────────┘
               │
               ▼
   ┌───────────────────────┐
   │     Model training     │
   └───────────────────────┘
               │
               ▼
   ┌───────────────────────┐
   │        Output          │
   └───────────────────────┘
               │
               ▼
   ┌───────────────────────┐
   │     User interface     │
   └───────────────────────┘
               │
               ▼
        ┌─────────────┐
        │    Stop     │
        └─────────────┘
```

5.2 Low-Level Diagram

```
┌─────────────────────────┐
│   Image/Text Capture     │
└─────────────────────────┘
             │
             ▼
┌─────────────────────────┐
│  Image /Text Preprocessing │
└─────────────────────────┘
             │
             ▼
┌─────────────────────────┐
│    Model Architecture    │
└─────────────────────────┘
             │
             ▼
┌─────────────────────────┐
│     Post-Processing      │
└─────────────────────────┘
             │
             ▼
┌─────────────────────────┐
│     User interface       │
└─────────────────────────┘
```

5.3 Interfaces

The system interfaces include:

- **Data collection**: Sensors capture data.
- **Model**: Machine learning models analyze the data.
- **User interface**: A dashboard provides insights to users for decision-making.

6.1 Test Plan/Test Cases

The primary test cases involved evaluating the **accuracy**, **precision**, **recall**, and **F1-score** of the model on unseen images. The model's ability to correctly classify crops and weeds was assessed using these metrics.

6.2 Test Procedure

The test procedure involved:

- Collecting new images of crops and weeds.
- Running the images through the trained model.
- Evaluating the results using classification metrics.

6.3 Performance Outcome

The model achieved an accuracy of over **95%**, with high precision and recall, indicating that it was highly effective in classifying crops and weeds correctly.

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7. My Learnings

This internship has significantly enhanced my skills in **machine learning**, particularly in the areas of **image processing**, **data preprocessing**, and **model training**. I also gained valuable experience in **model evaluation** and learned how to apply machine learning algorithms to solve practical problems in agriculture.

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8. Future Work Scope

Future work on this project could include:

- **Real-time weed detection** using live camera feeds.
- **Integration with farming equipment** for automatic weed removal.
- Enhancing the model's accuracy by training it on a larger and more diverse dataset..