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Industrial Internship Report on

# "Crop Yield Prediction and Weed Detection using Machine Learning and Deep Learning"

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Domain: Machine Learning / Data Science  
Duration: 4 Weeks

# Executive Summary

This report outlines the internship experience provided by Upskill Campus and The IoT Academy in collaboration with UniConverge Technologies Pvt Ltd (UCT). The internship centered around two primary projects: developing a machine learning-based crop yield prediction system and a deep learning-based weed detection model. The work involved data preprocessing, model building, dashboard deployment, and comprehensive testing. This internship provided valuable industrial exposure, technical learning, and a platform for practical application.

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# Preface

Over four weeks, I worked intensively on agricultural data analytics problems, focusing on yield prediction and weed detection. This internship gave me the opportunity to translate classroom learning into solving real-world challenges, enhancing both technical and soft skills. I would like to thank Upskill Campus, The IoT Academy, UCT, and all mentors involved for their continuous guidance.

# Introduction

UCT specializes in providing industrial solutions leveraging emerging technologies like IoT, Machine Learning, Cybersecurity, and Cloud Computing. Their platforms such as UCT Insight and Smart Factory Watch enable efficient digital transformation in industries.  
  
Upskill Campus aims to bridge the skill gap through personalized coaching, practical exposure, and industry collaborations.  
  
Objective:  
- Develop predictive models for crop yield and weed detection.  
- Deploy and validate machine learning and deep learning models.  
- Gain practical exposure to real-world industrial problems.

# Problem Statement

Farmers face challenges in predicting crop yields accurately due to numerous variable factors like climate, soil, and cultivation costs. Also, efficient weed detection is essential to optimize herbicide use and improve productivity. The goal was to build reliable predictive models addressing these challenges.

# Existing and Proposed Solution

Existing solutions often lacked scalability and robustness across different agro-climatic conditions. Our proposed solution integrated diverse datasets, applied advanced machine learning models like Random Forest and XGBoost, and leveraged deep learning (CNN, LSTM) for enhanced prediction accuracy. An interactive Streamlit dashboard was developed for end-user accessibility.

# Proposed Design/Model

Flow:  
- Data Collection ➔ Data Preprocessing ➔ Model Training ➔ Model Evaluation ➔ Dashboard Deployment  
  
Models Used:  
- Random Forest Regressor  
- XGBoost Regressor  
- LSTM for time-series data  
- CNN for image classification (weed detection)

# Performance Test

Test Plan:  
- Data split into training and testing sets  
- Hyperparameter tuning using GridSearch and Optuna  
  
Performance Metrics:  
- RMSE, MAE, R² Score for crop yield prediction  
- Accuracy, F1-Score, Precision, Recall for weed detection  
  
Performance Outcome:  
- Achieved >85% prediction accuracy.  
- Robustness validated across diverse datasets.

# My Learnings

The internship enhanced my understanding of:  
- Data preprocessing and feature engineering  
- Machine Learning and Deep Learning model development  
- Model deployment with web applications  
- Addressing real-world industrial challenges

# Future Work Scope

Future enhancements could include:  
- Real-time satellite and IoT sensor data integration  
- Expansion to more crops and regional datasets  
- Further optimization for mobile devices  
- Field deployment and farmer collaboration for feedback collection.