Industrial Internship Report on

"Quality Prediction of a Mining Process"

Prepared by

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| *Executive Summary* |
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| 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 (Tell about ur Project) |
| 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. |

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1   Preface

I began with the project "Quality Prediction in a Mining Process." First, I looked at the dataset. The data access was a bit challenging because it was provided in YOLO format. Once that was out of the way, my machine learned to distinguish between crops and weeds. The extracted features from the image dataset were carried out by a model known as Convolutional Neural Network (CNN). Ultimately, the trained model classified the test images with accuracy at the end.

This internship shaped my personal development and had me realize both my strengths and weaknesses. For anyone with a keen interest in studies, I would say internships are a key aspect of career growth.

My project involved trying to differentiate crops from weeds, then developing a system that only uses pesticides on the weeds. This would mean not having these pests on the crops unnecessarily and minimizing pesticide wastage through the reduction of contamination of crops.

During that course, I was lucky to get this opportunity from Uni-Convergence-Technology Ltd. (UCT/USC). I get polished in my skills and successfully completed each assigned task.

The program is very well managed and puts much effort to pay heed to even the smallest details. The structured schedule by the organizers helped me stay on track with my reports and further enhance my capabilities.
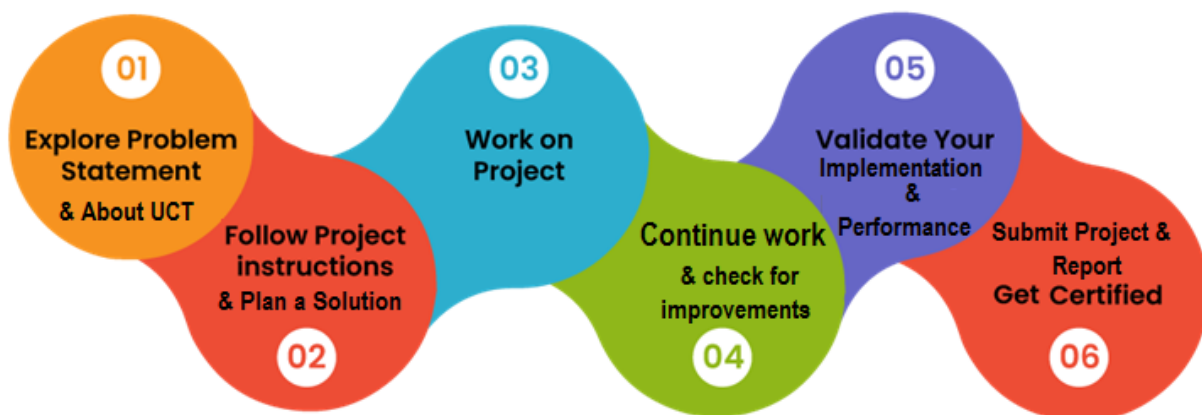
This internship greatly influenced my learning process, it did contribute significantly to both my professional and personal developments. I had the opportunity to build deeper expertise in my field of study: Data Science and Machine Learning.

I would like to thank all my co-mentors and organizers of this internship for providing me with this great opportunity to refine my skills and support my career progressions.

To my juniors and peers despite the exhaustion it might get you to keep managing time just to finish their weekly assignments, never give up and be relentless. And in the end, it will all prove to be worth it.

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
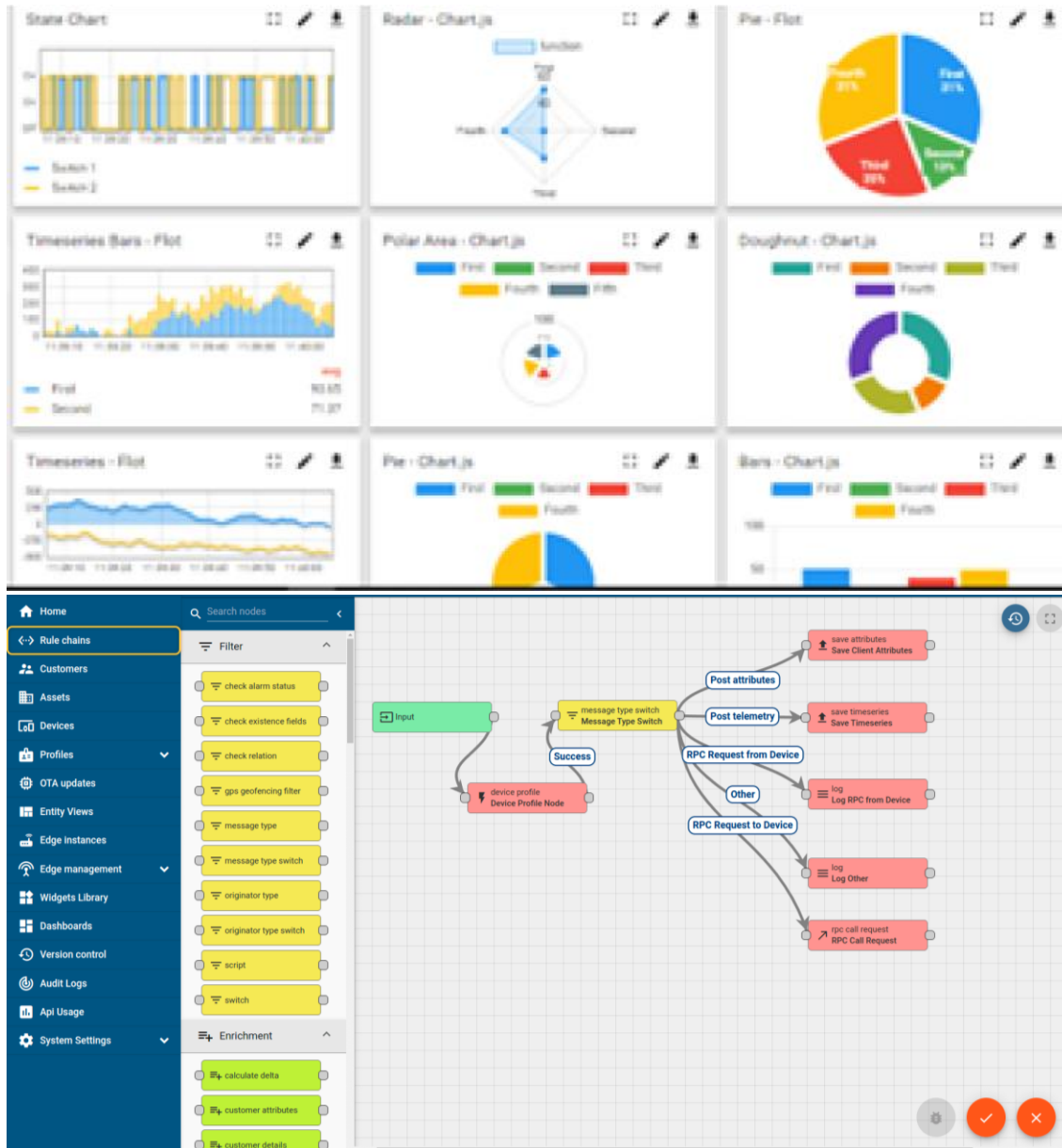
ii. **Smart Factory Platform (** FACT⦾RY WATCH **)**

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
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 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.
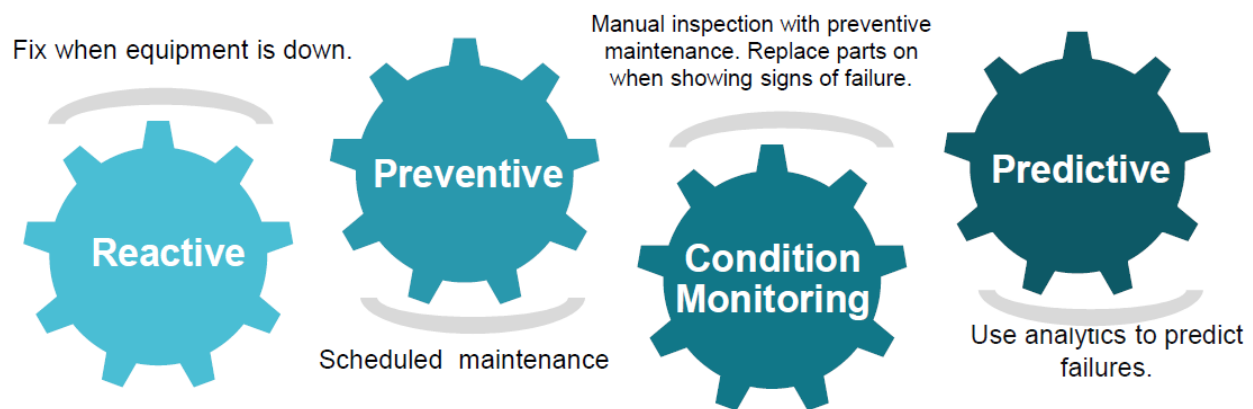
2.2   About upskill Campus (USC)

upskill Campus along with The IoT Academy and in association with Uniconverge technologies has facilitated the smooth execution of the complete internship process.
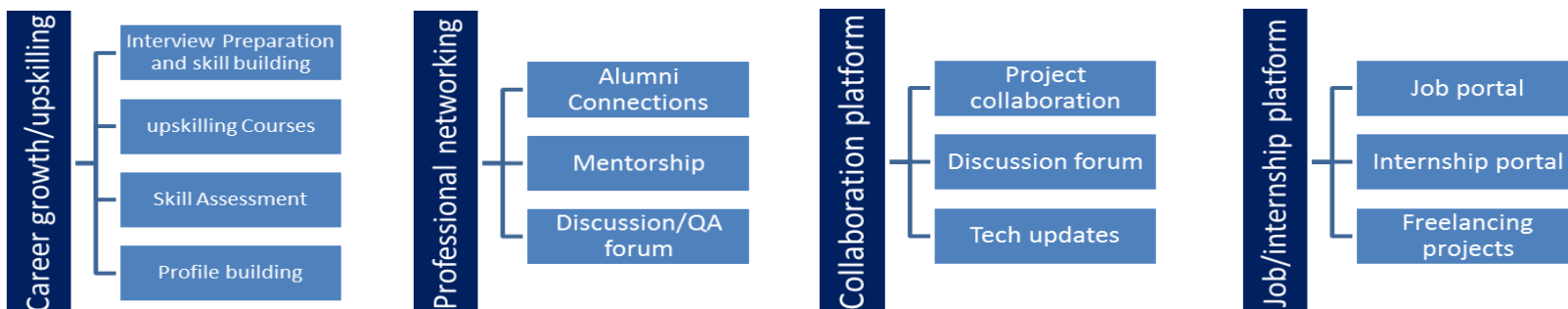
USC is a career development platform that delivers **personalized executive coaching** in a more affordable, scalable and measurable way.
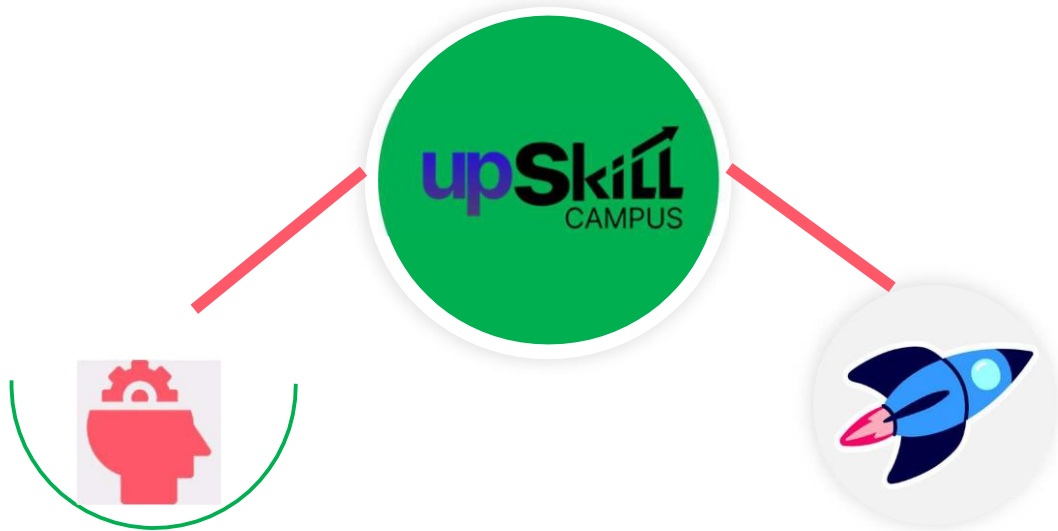
Seeing need of upskilling in self-paced manner along-with additional support services e.g. Internship, projects, interaction with Industry experts, Career growth Services

Upskill Campus aiming to a upskill 1 million learners in next 5 years.

https://www.upskillcampus.com/

Career growth/upskilling
- Interview Preparation and skill 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

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.

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.

☛ 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.

2.5 Reference

[1]   https://www.kaggle.com/code/dgcoder/timeseries-big-data-project

[2]   https://www.kaggle.com/code/jmas19/mining-process-project

[3]

2.6 Glossary

Terms	Acronym
Convolutional Neural Network	CNN
You Only Look Once	YOLO
Machine Learning	ML

3   Problem Statement

The mining industry can certainly not maintain the quality control. The material extracted often proves to have poor consistency, which may lead to the inefficient processing and high operational expenditure. Inconsistent ore quality can also cause pressure on equipment to be too high at times, causing unexpected maintenance and costly downtime. Besides, poor quality control may lead to severe safety risks to the workers and environmental degradation. The earlier traditional methods of quality prediction are not up to mark, as they fail to handle massive amounts of data and ignore the minute relationships that exist between the variables in the mining process.

4 Existing and Proposed solution

Other proposals trying to address the same problem had poor precision-they could not always successfully classify and identify a crop due to false identification of weeds. It was found that at times, the model applied sometimes made inconsistent performance, misclassifying a number of weeds.

I proposed an improved methodology wherein the training was extensively carried out so that CNN should classify images correctly when used with new images. The enhancement in training is for improving the reliability and correctness of the model in segregating crops and weeds.

4.1 Code submission (Github link)

https://github.com/Vivian1812/Upskill/blob/main/Quality_Prediction_in_mining_process-checkpoint.ipynb

4.2 Report submission (Github link)

https://github.com/Vivian1812/Upskill/blob/main/Quality_Prediction_in_a_Mining_Process_Vishwa_Nayak.pdf

5   Proposed Design/ Model

The starting stage of the model is preprocessing the images for training. Then the model is prepared for training to detect the weeds. The model is then trained using CNN. Then the predictions are made using the deep learning model.

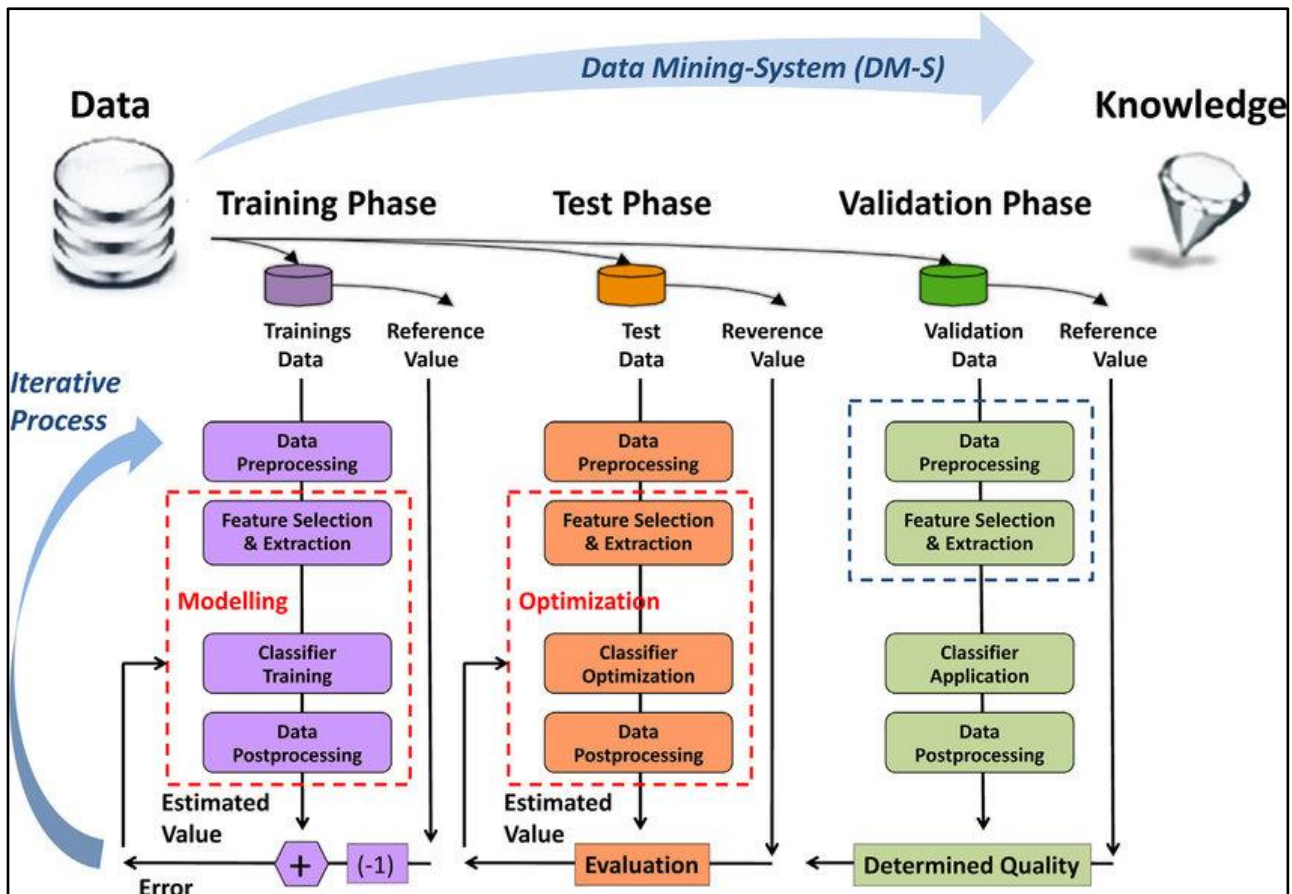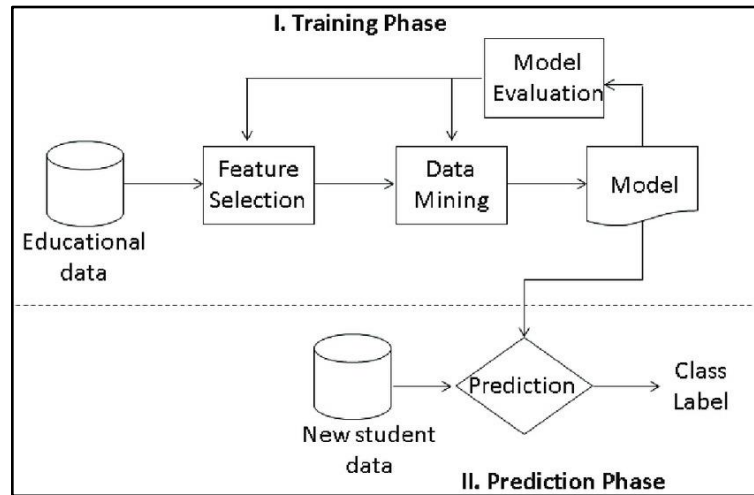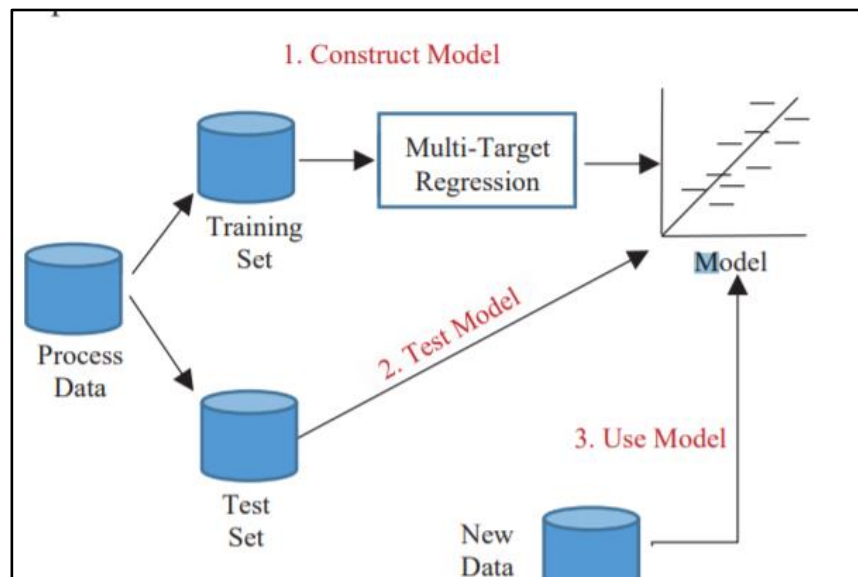## 5.1   High Level Diagram (if applicable)

Figure 1: HIGH LEVEL DIAGRAM OF THE SYSTEM

5.2 Low Level Diagram (if applicable)

5.3 Interfaces (if applicable)

Block Diagrams

6 Performance Test

- Performance testing will be important in demonstrating the operational applicability of this project to the mining industry so that it is not an academic exercise.
- The two main challenges were obtaining sufficient accuracy in predicting and optimizing speed of output generation.
- During my approach, I employed machine learning algorithms such as decision trees and random forests wherein the model was trained several times to ascertain which algorithm was going to produce the highest accuracy.
- The results revealed significant improvements over past work in the area. This will mean that, in light of the mentioned constraints, it would be very important to build a model that in itself holds relevance for the real world.

6.1 Test Plan/ Test Cases

My primary strategy of testing was the pre-training model on a wide variety of images. Time taught the model to better classify between crops and weeds.

6.2 Test Procedure

First, I had to train the model with multiple epochs of Convolutional Neural Network in order for it to perform at its best. After training, I tested the model accuracy with a different set of images that were not part of the training data in order to gauge how effective the model was at performing its classification task.

6.3   Performance Outcome
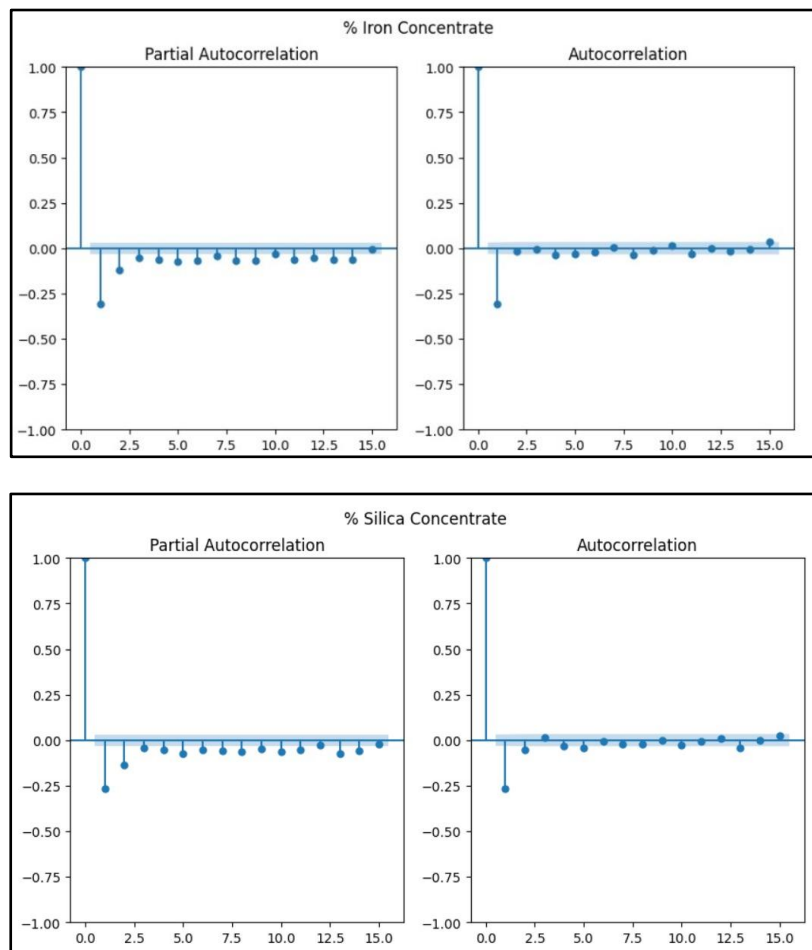
7   My learnings

Gained extensive insight regarding relevance to machine learning libraries and how they could be used to solve real-world problems. Problem statement: Quality prediction for the mining process. The case is related to mines in general and will be applicable for mining companies worldwide. Knowledge and skills acquired during this internship would indeed help my growth professionally and personally.

8 Future work scope

I wanted to put my quality prediction code in a mining process into a Flask module so that the project may be used by mining companies worldwide to understand the ore quality. While integrating with a web interface, of course, the project is more accessible and user-friendly to the miners as well as non-mining professionals, and it is a very useful tool with ease in its quality assessment. This confers great added value as the project becomes far more applicable and usable.