Industrial Internship Report on Smart City Traffic Pattern Recognition

By Mukesh S K

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' time. My project was Smart City Traffic Pattern Recognition This internship gave me a very good opportunity to get exposure to Industrial problems and design/implement solutions for them. It was an overall great experience to have this internship.

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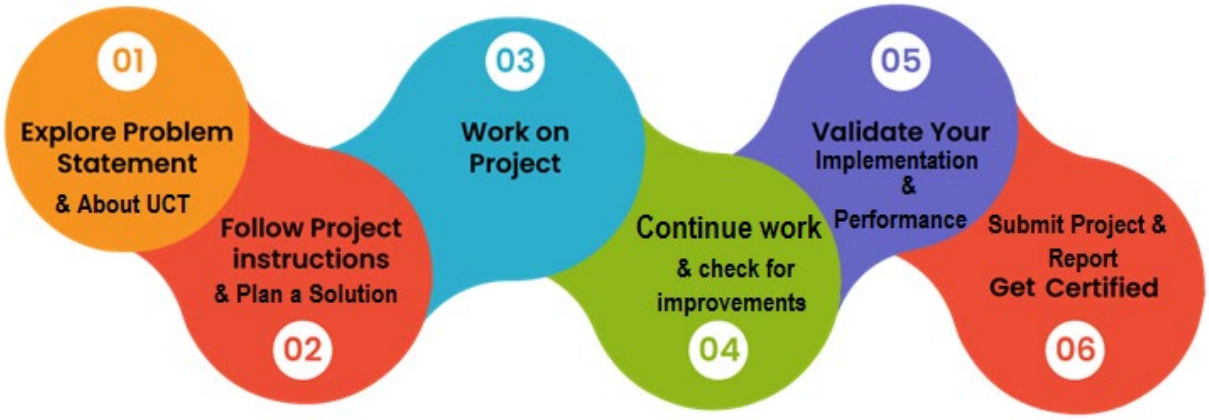
1 Preface

Summary :

I learned lot about Machine Learning and Data Science, Implemented my skills and expertise in real life industial project, In short gained a industrial work experience. Also I wish this Internship would be very useful for my carrer

- My task is to predict a smart city traffic pattern using its time series data .
- USC/UCT gave me opportunity to choose the project which is relalted to my interest.
- Program was well planned and frequent test have been conducted to keep track on our theoritical knowledge.



I learned a lot of things such as data science, machine learning and even useful mathematics topics such as probability and statistics

I wish to thank all of the higher officers and problem setters for giving me this opportunity

Message to your juniors and peers : Follow the weekly tasks carefully and enjoy your tenure.

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.

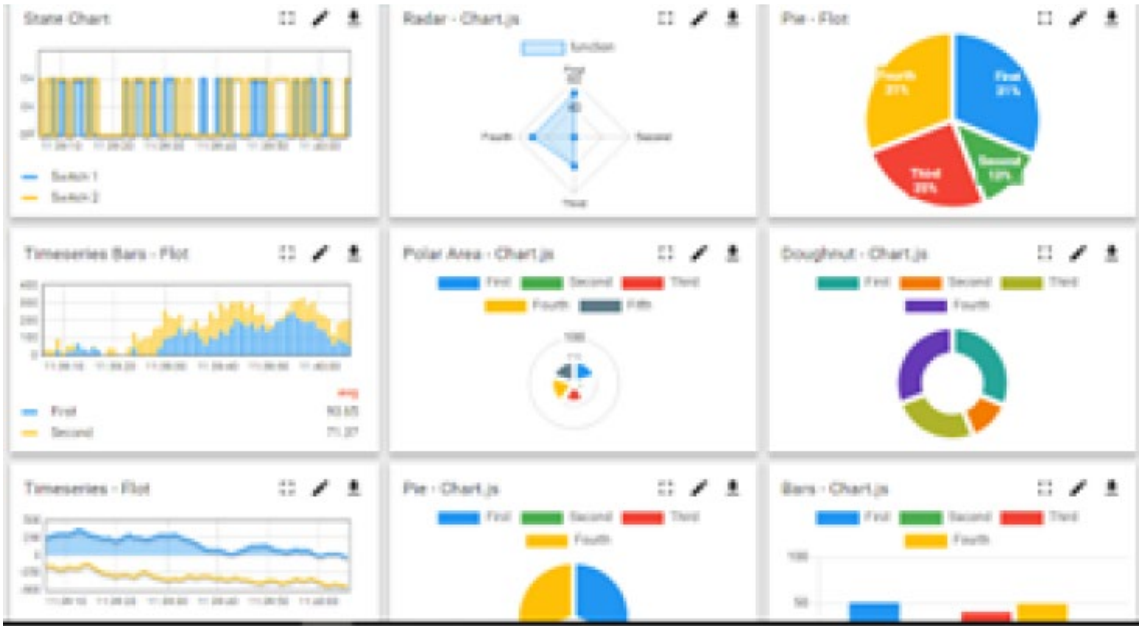
For developing its products and solutions it is leveraging various **Cutting Edge Technologies e.g. Internet of Things (IoT), Cyber Security, Cloud computing (AWS, Azure), Machine Learning, Communication Technologies (4G/5G/LoRaWAN), Java Full Stack, Python, Front end** etc.

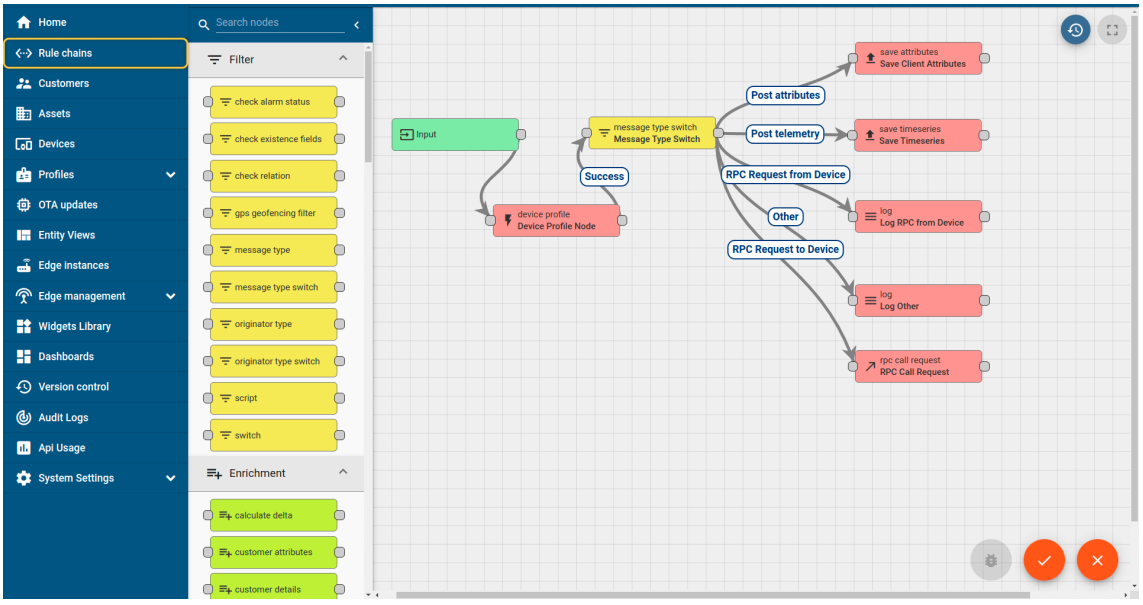
i. UCT IoT Platform (UCT Insight)

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.

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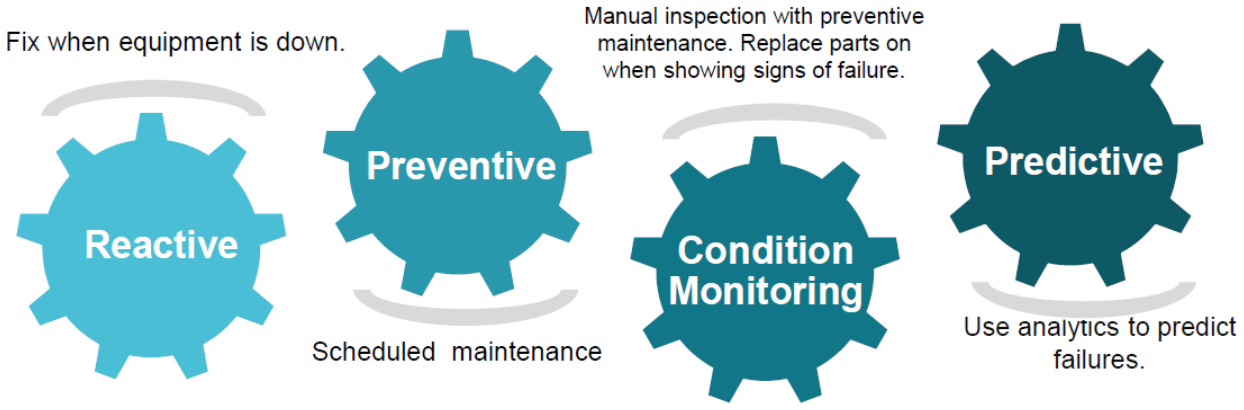
Machine	Operator	Work Order ID	Job ID	Job Performance	Job Progress		Output		Rejection	Time (mins)				Job Status	End Customer
					Start Time	End Time	Planned	Actual		Setup	Pred	Downtime	Idle		
CNC_S7_81	Operator 1	WO0405200001	4168	58%	10:30 AM		55	41	0	80	215	0	45	In Progress	i
CNC_S7_81	Operator 1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

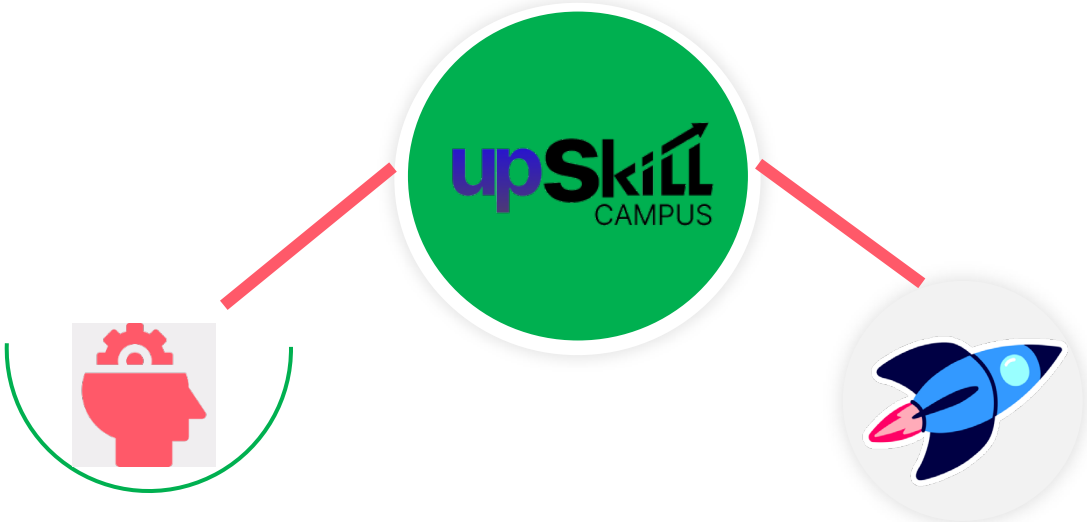
UCT is providing Industrial Machine health monitoring and Predictive maintenance solution leveraging Embedded system, Industrial IoT and Machine Learning Technologies by finding Remaining useful life time of various Machines used in production process.



2.2 About upskill Campus (USC)

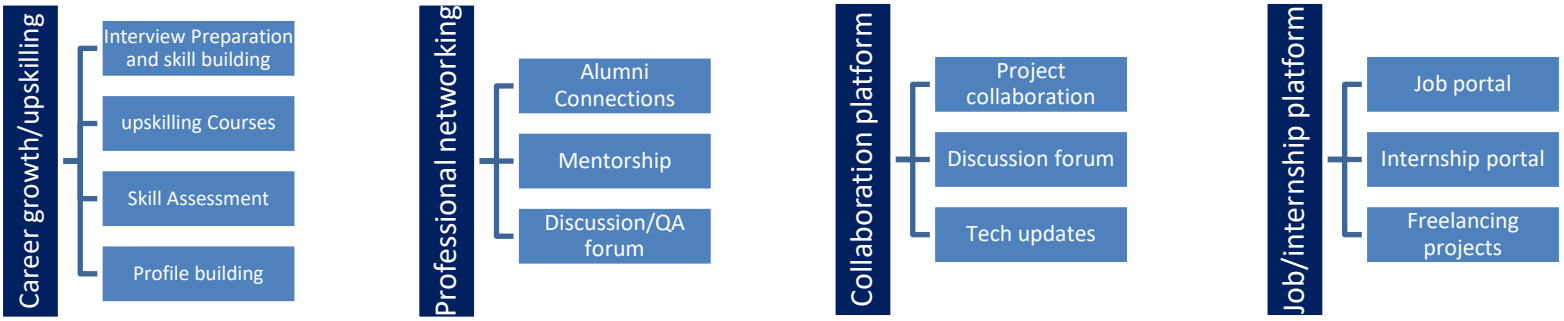
upskill Campus along with The IoT Academy and in association with Uniconverge technologies has facilitated the smooth execution of the complete internship process.

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 upskill 1 million learners in next 5 year



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] Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems

[2] https://towardsdatascience.com/10-best-free-websites-to-learn-more-about-data-science-and-machine-learning-f2c6d7387b8d

[3] ChatGPT

3 Problem Statement

In the assigned problem statement

You are working with the government to transform your city into a smart city. The vision is to convert it into a digital and intelligent city to improve the efficiency of services for the citizens. One of the problems faced by the government is traffic. You are a data scientist working to manage the traffic of the city better and to provide input on infrastructure planning for the future.

The government wants to implement a robust traffic system for the city by being prepared for traffic peaks. They want to understand the traffic patterns of the four junctions of the city. Traffic patterns on holidays, as well as on various other occasions during the year, differ from normal working days. This is important to take into account for your forecasting.

4 Existing and Proposed solution

My Approach and Proposed Solution:

- Performed EDA & created lag features for time series data by shifting & concatenating input and forecast sequence
- Implemented and trained an RNN model with LSTM layers for regression tasks using the Adam Optimizer
- Implemented Machine Learning models on the preprocessed TimeSeries data.

4.1 Code submission (Github link)

https://github.com/MUKESH-SK/Machine-Learning-Deep-Learning-Projects/blob/main/Smart_City_Traffic_Patterns.ipynb

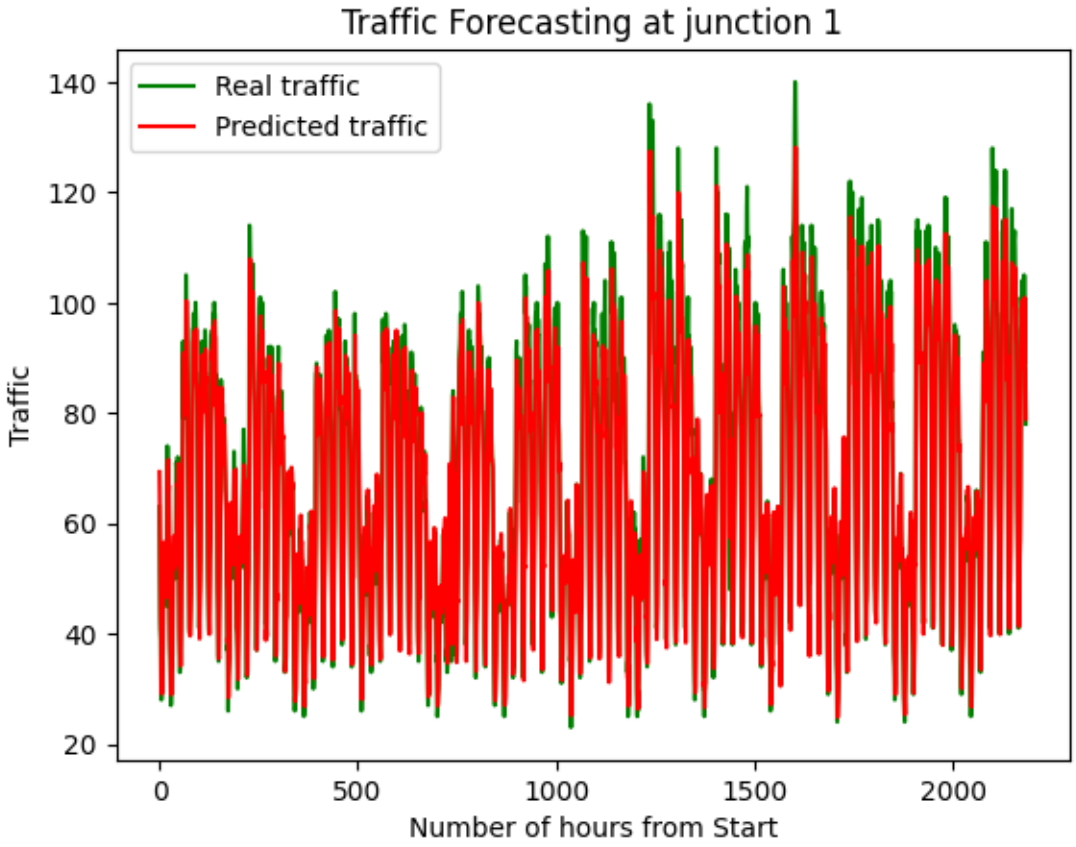
4.2 Report submission (Github link)

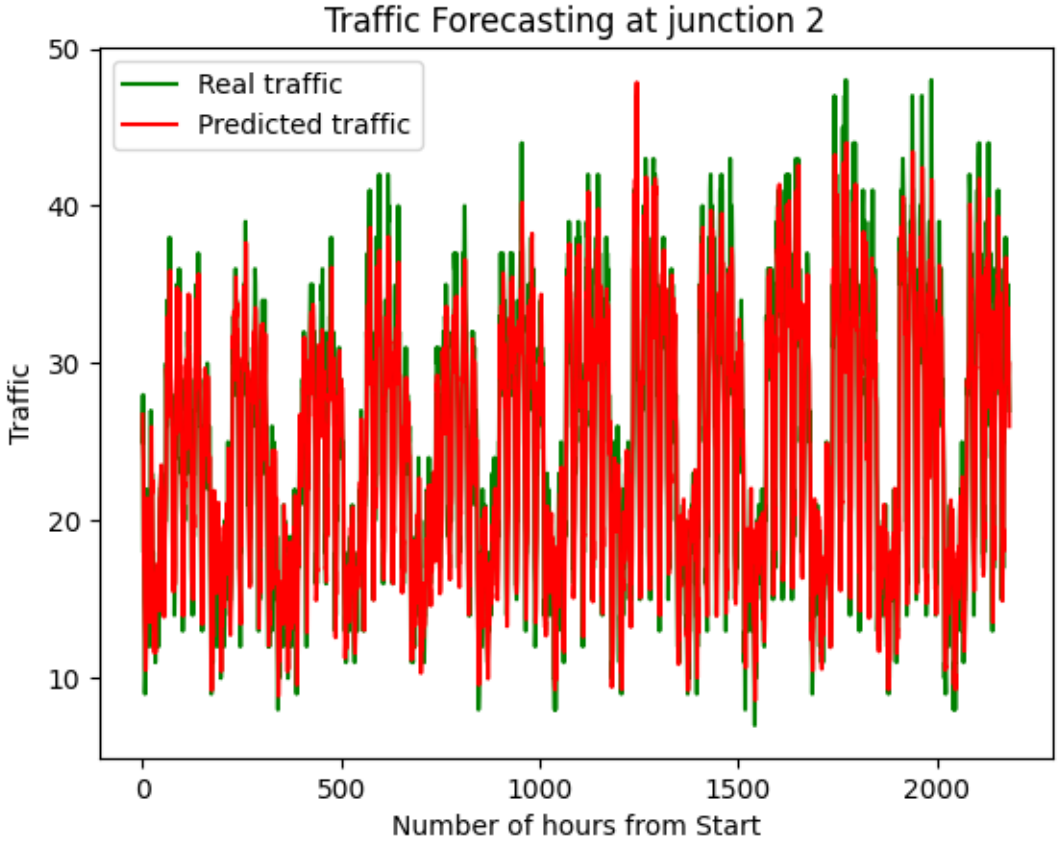
https://github.com/MUKESH-SK/Data-Science-and-Machine-Learning-Internship

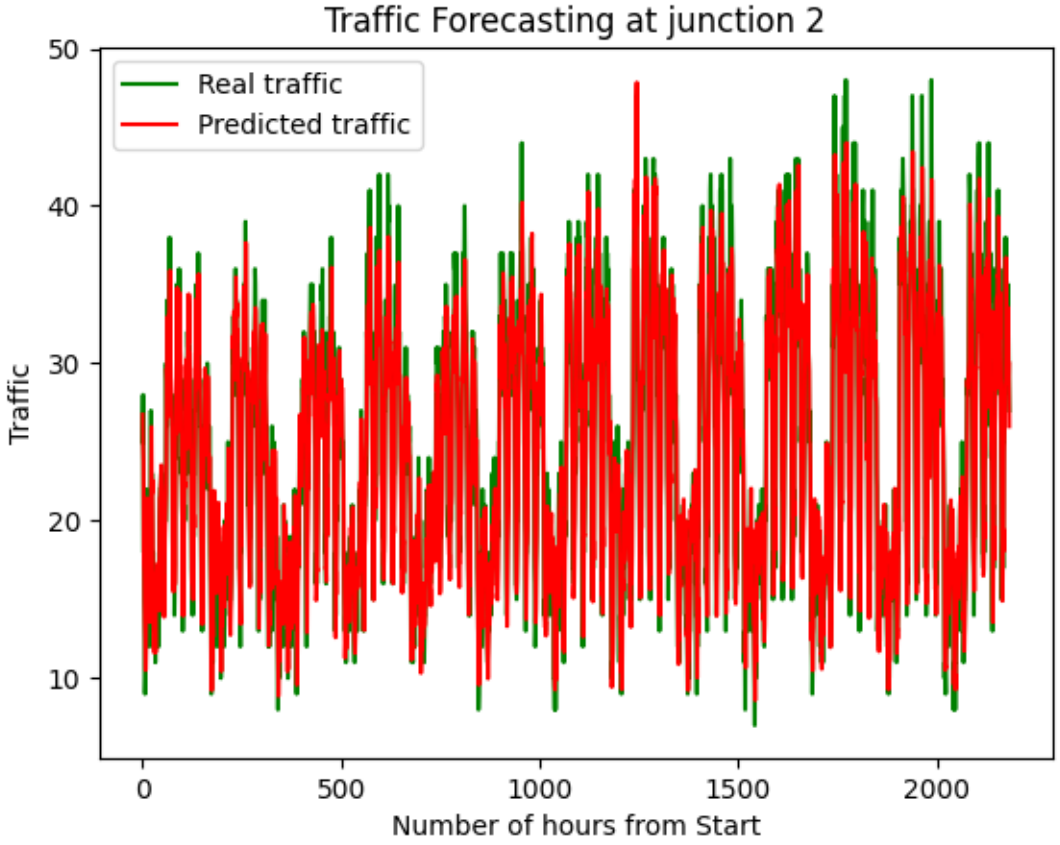
5 Performance Test

5.1 Test Plan/ Test Cases

- Visualizing the input data is the most important step and after visualizing take a necessarty actions such that the improvements can be made to the time series data


Traffic Forecasting at junction 1
Real traffic
Predicted traffic
Traffic
Number of hours from Start
140
120
100
80
60
40
20
0
500
1000
1500
2000


Traffic Forecasting at junction 2
Real traffic
Predicted traffic
Traffic
Number of hours from Start
50
40
30
20
10
0
500
1000
1500
2000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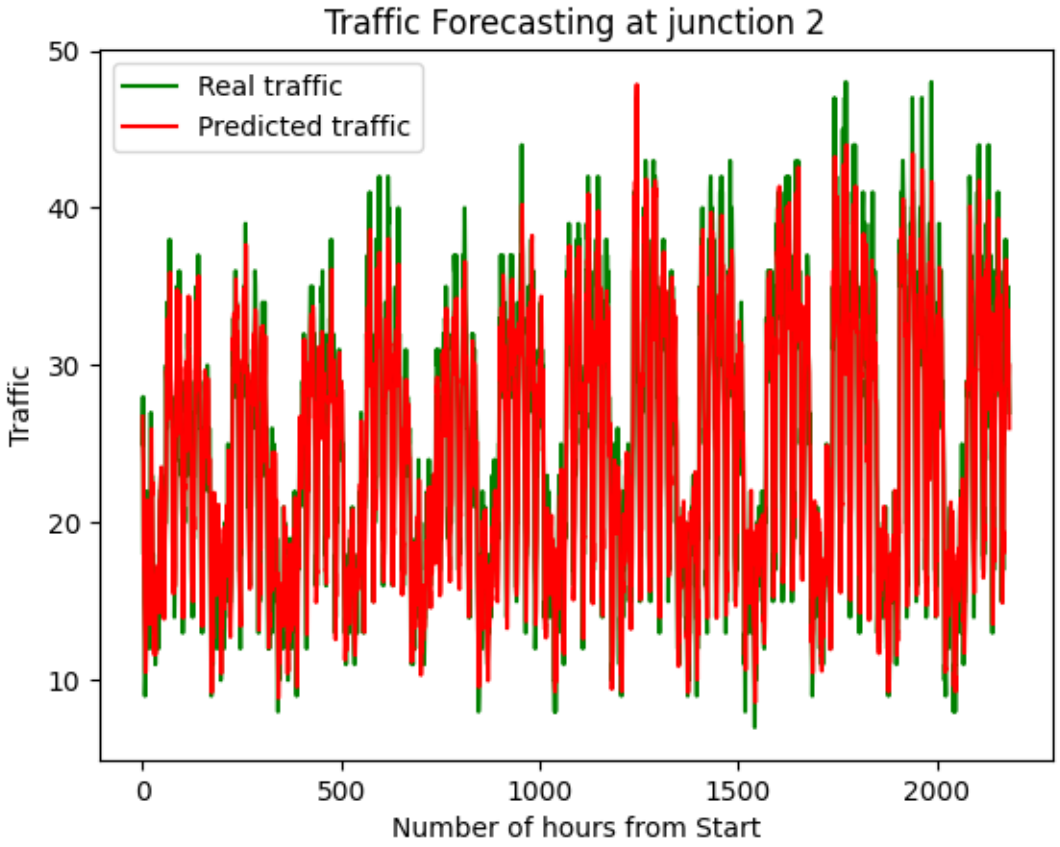
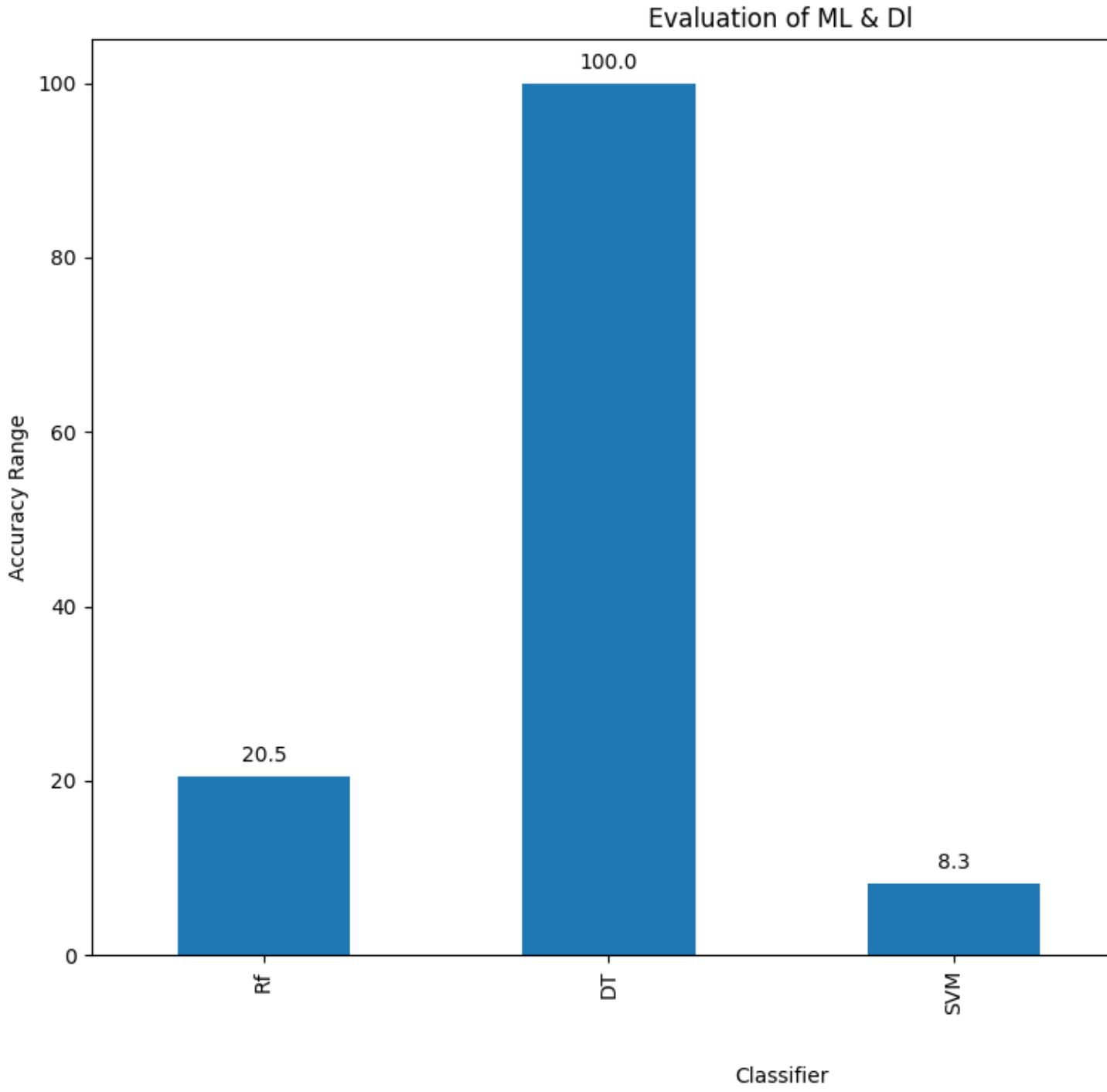


5.2 Test Procedure

- Used Machine Learning Algorithms such as Support Vector Machine, Decission Tree Classifier, Random Forest, XGBoost for testing the preprocessed data

5.3 Performance Outcome



6 My learnings

- Learned Machine Learning, Deep Learning and Data Science.
- Got an knowledge in building real world projects
- Learned mathematics important for probabilty and Data science

7 Future work scope

- I planning to work on sentimental analysis project in future.