Traffic Prediction Using Gated Recurrent Unit Neural Networks

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***Abstract*— In an intelligent transportation system, traffic prediction is vital. Accurate traffic forecasting can help with route selection, vehicle dispatching, and traffic congestion reduction. Due to the complex and dynamic spatio-temporal relationships between different parts in the road network, this problem is difficult to solve. Recently, a large amount of research work has been committed to this area, particularly the machine learning method, which has substantially improved traffic forecast abilities. Despite the fact that the infrastructure is outdated and can only support a small population, there is an influx of residents looking for work and opportunity. Fuel combustion is enhanced as a result of traffic congestion. In this project, i will be able to be exploring the dataset of 4 junctions and built a model to predict traffic on an equivalent . This could potentially help in solving the traffic jam problem by providing a far better understanding of traffic patterns which will further help in building an infrastructure to eliminate the matter .**

***Keywords*— traffic flow prediction; LSTM; GRU;RNN;**

I. INTRODUCTION

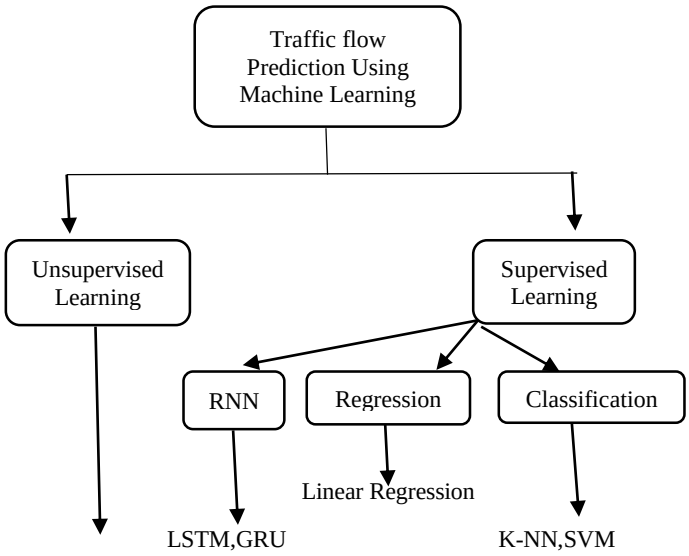
ITS has become an increasingly essential component of smart city deployment in recent years. Traffic flow information, in particular, plays an important role in ITS.The necessity for short-term traffic flow data is critical.Individual travellers and businesses are both welcome. However,The ability to estimate traffic flow accurately and in real time is still a challenge.Due to its stochastic and nonlinear nature, it has posed a significant challenge for many decades. The majority of existing approaches rely on linear models And machine learning models that aren't too complex to forecast what will happen next It is impossible to characterise the non linearity of traffic flow and the non-linearity of the non-linearity of the non well, uncertainty.

Challenges Traffic prediction is very challenging, mainly affected by the following complex factors:

(1) Because traffic data is spatio-temporal, it is constantly changing with time and space, and has complex and dynamic spatio-temporal dependencies.

(2) External factors. Traffic spatio-temporal sequence data is also influenced by some external factors, such as weather conditions, events or road attributes

There are many methods for Traffic Flow Prediction,they are;



Clustering Algorithm

dia.1

II. METHODOLOGY

Traffic prediction using GRU consist of many procedures like Importing the Libraries, Loading Data, Data Exploration ,Data Transformation and Preprocessing , Model Building ,Fitting the Model , Inversing The Transformation Of data.

a) Importing the Libraries

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```
# Importing Libraries
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import datetime
import tensorflow
from statsmodels.tsa.stattools import adfuller
from sklearn.preprocessing import MinMaxScaler
from tensorflow import keras
from keras import callbacks
from tensorflow.keras import Sequential
from tensorflow.keras.layers import Conv2D, Flatten, Dense, LSTM, Dropout, GRU, Bidirectiona
l
from tensorflow.keras.optimizers import SGD
import math
from sklearn.metrics import mean_squared_error

import warnings
warnings.filterwarnings("ignore")
```

Fig.1

b) Loading Data

```
data = pd.read_csv("../input/traffic-prediction-dataset/traffic.csv")
data.head()
```

Fig2

Concerning the information

This dataset is a collection of hourly counts of vehicles at four intersections. There are four features in the CSV file:

- Date Time
- Junction
- Ploting Weather

The sensors at each of these intersections collected data at different times, resulting in traffic data from several time periods. Limited or sparse data was provided by several of the junctions.

c) Data Exploration

- Pharsing dates
- Ploting timeseries
- Ploting Weather

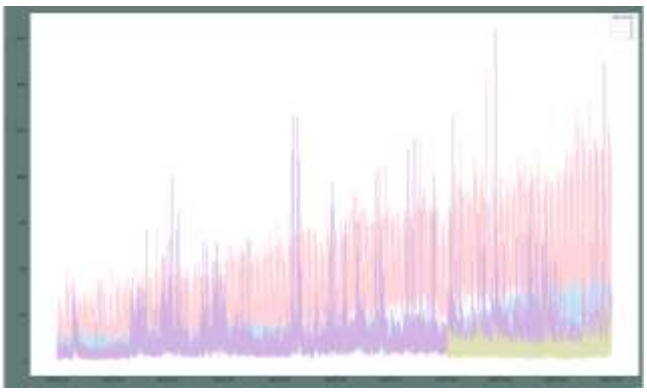

Fig3

In the graphic above, there is some noteworthy information:

The first junction clearly has an upward tendency, as can be seen above.Only after 2017 does data for the fourth junction become available.Seasonality obvious from the above graphProposed System

d)Data Transformation and Preprocessing

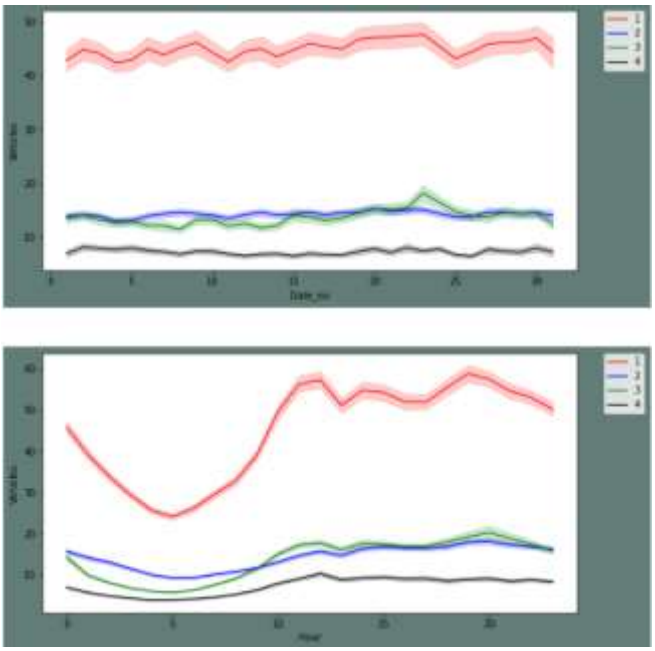

Fig4

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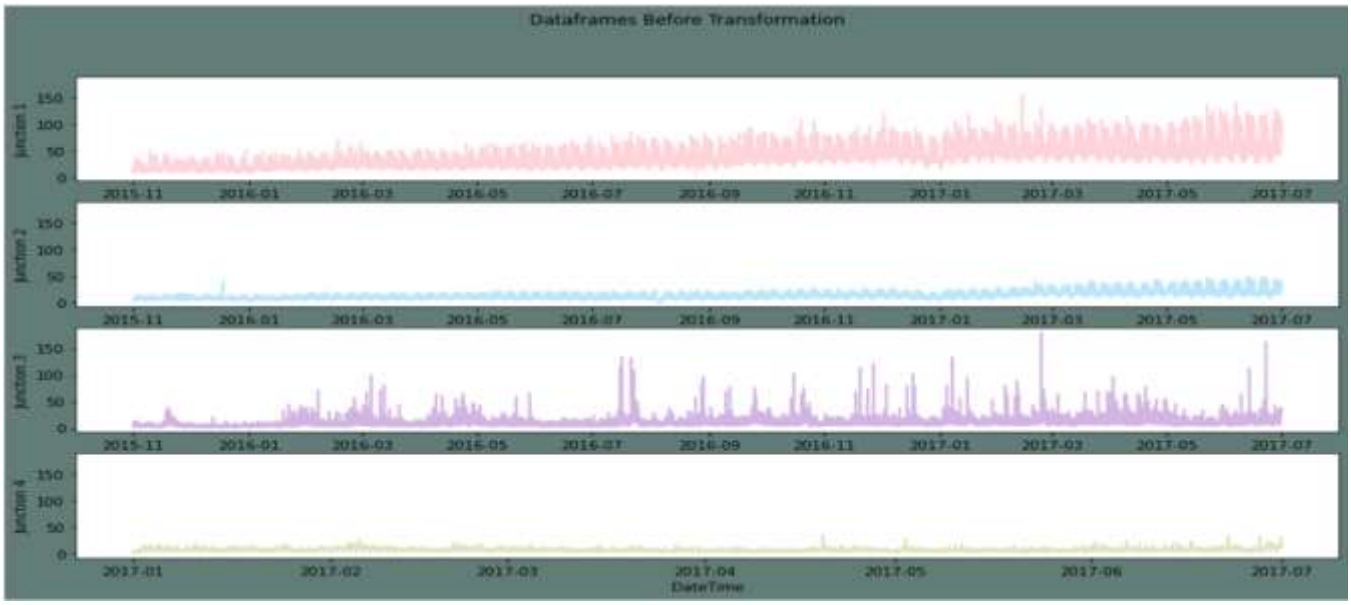

Fig5 - Dataframe before Transformation

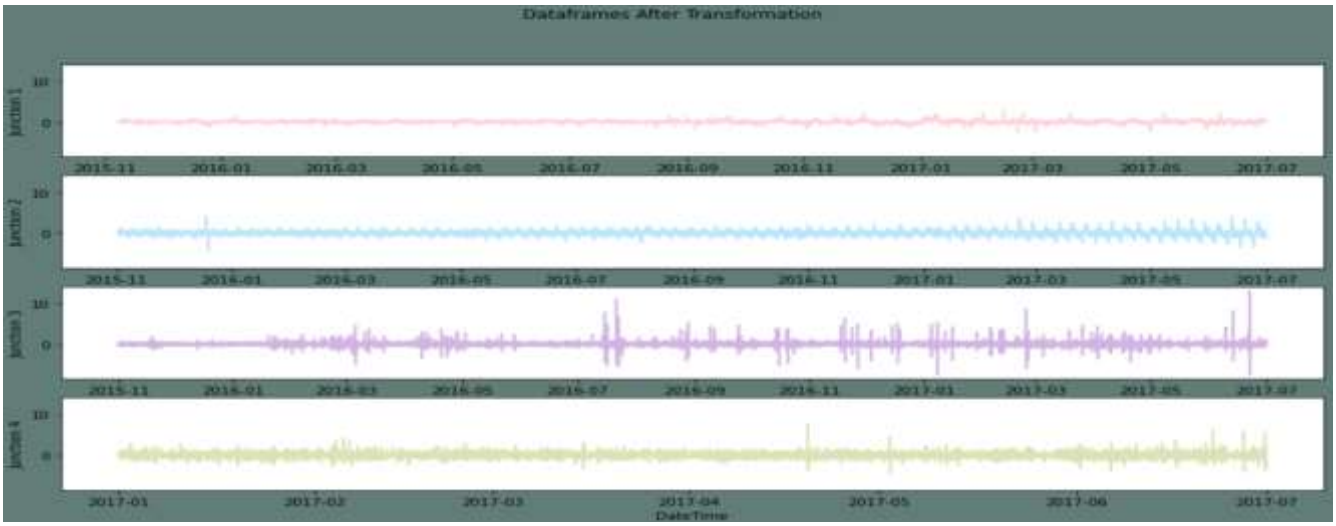

Fig6 - Dataframe After Transformation

In addition to Traffic Prediction in each junction, Number of vehicles in each junction is also analysed and predicted using RNN

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
```

Fig7

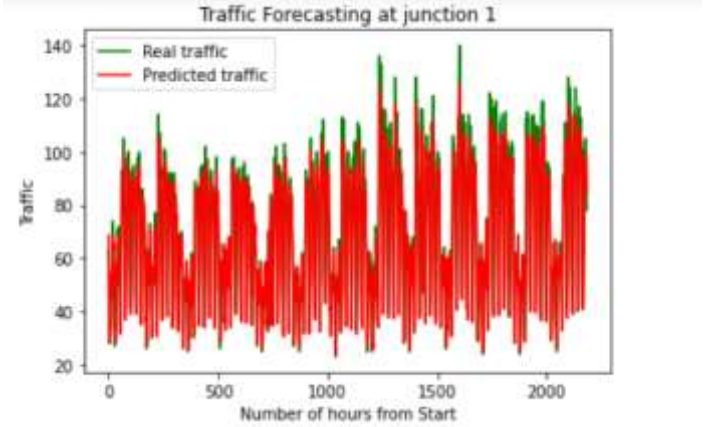

Fig 8

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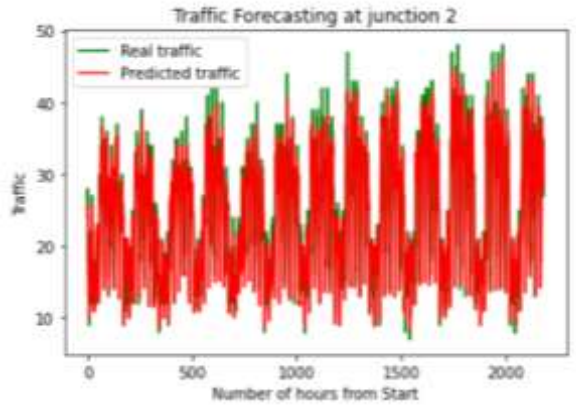
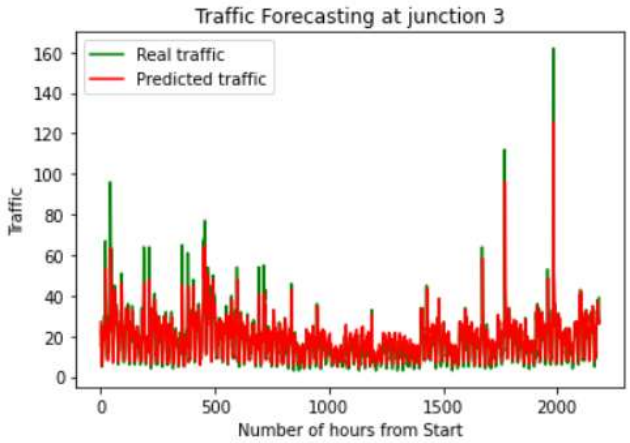


fig9



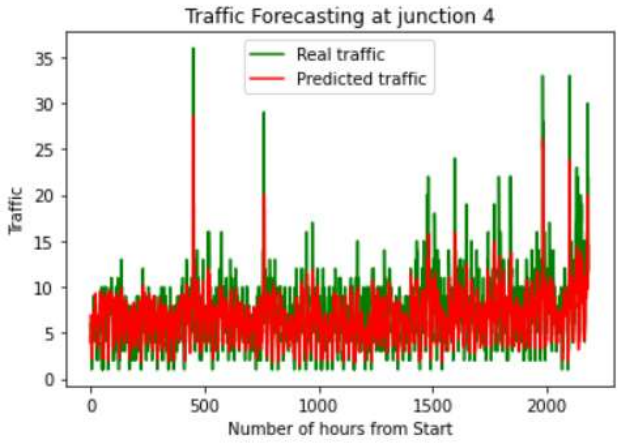


fig10

Future Prediction of the number of vehicles in each junction

```
[['2015-11-01 00:00:00' 1 15 20151101001]
 ['2015-11-01 01:00:00' 1 13 20151101011]
 ['2015-11-01 02:00:00' 1 10 20151101021]
 ...
 ['2017-06-30 21:00:00' 4 16 20170630214]
 ['2017-06-30 22:00:00' 4 22 20170630224]
 ['2017-06-30 23:00:00' 4 12 20170630234]]
```

III. Conclusion

In this project, I trained a GRU Neural network to predicted the traffic on four junctions. To achieve a stationary timeseries I used a normalisation and differencing transform. As the Junctions vary in trends and seasonality, I took different approach for each junction to make it stationary. I applied the root mean squred error as the evaluation metric for the model.

In addition there to I plotted the Predictions along side the first test values. Take aways from the data analysis: The Number of vehicles in Junction one is rising sooner compared to junction two and three. The sparsity of knowledge in junction four bars me from making any

conclusion on an equivalent The Junction one's traffic features a stronger weekly seasonality also as hourly seasonality. Where as other junctions are significantly linear.

References

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