An Efficient Prediction of Traffic Flow By Using LSTM In Artificial Intelligence

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Abstract- *Nowadays traffic flow is major problem. Approximately 1.3 million people die each year because of accidents according to WHO in 2022. Knowing how traffic will move is important for managing traffic, easing congestion, and making transportation smarter. This research focuses on deep learning techniques within AI(artificial intelligence) domain to predict traffic flow. To resolve this method need to develop an accurate model to predict traffic flow. Here I involve the integration of LSTM(long short-term memory) and RNN(recurrent neural network) to capture traffic data and dependencies. Using past traffic information, weather conditions, and special events helps the model get good at understanding and handling tricky and complicated traffic situations. Our main aim to develop a proposed system to predicting accuracy model.*

Keywords*-* Recurrent Neural Network, Long Short-Term Memory, Traffic, Accident Prediction, Deep Learning

I. INTRODUCTION

Traffic flow prediction (TFP) means predicting the volume and density of traffic flow, usually to control vehicle movement, reduce traffic jams, and create the optimal (least time or energy-consuming) route.[1] Traffic flow prediction is an essential part of the Intelligent Transport System (ITS). This helps traffic stakeholders to make safer and smarter use of transport networks can assist ITS in forecasting traffic flow.[3] With the recent advancement in Artificial intelligence, Machine learning (ML), Deep learning (DL), and big data, research in the field of predicting traffic flow has been expanded extensively.[3] Large cities have exceedingly difficult traffic regulations. many countries have adopted ITS to reduce the costs associated with traffic congestion. This study reviews the application of artificial neural network (ANN), ML, DL and other techniques and models for TFP. To resolve this method, need to develop accurate model to predict traffic flow. Here I involve the integration of LSTM(long short-term memory) and RNN(recurrent neural network) to capture traffic data and dependencies. Finally, we will propose our own predictive model using DL, train and test it, analyse the accuracy and compare the accuracy of our model with other models.

AI(Artificial Intelligence):

Artificial intelligence is the process of creating a computer, computer-controlled robot, or software object that is as intelligent like the human mind.[5]

AI Forms the basis for all computer learning and is the future of all complex decision making.

Application:

- Gaming
- Natural Language Processing.
- Robotics
- Social Media
- Businesses Management

Deep Learning:

Deep learning is kind a sub set of the Machine Learning, which is an algorithm inspired by Structure of human brain called ANN (Artificial Natural Network).[5] Is take a More time to the training a model , and take less time to testing a Model as compare to Machine learning. [6]

ANN (Artificial Natural Network): It is a Simply systems inspire by the Biological Natural Network. ANN is a Model that Consist several processing, that receive input and deliver output based on their predefine activation function.[7]

Input layer: In this layer enter input to hidden layer.[7]

Hidden layer: This layer is responsible for the mathematical computation or feature extraction of our inputs.[7]

Output layer: This layer responsible given us appropriate result for the given input.[7]

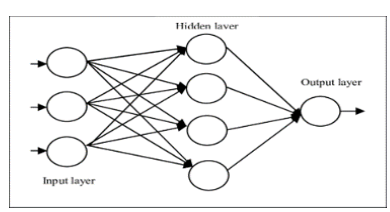


Fig.1.3 Architecture of ANN[10]

LSTM(Long Short Term Memory):

LSTM models are a subtype of RNN. The problem with RNN is that they have a short- term memory to retain former information in the current neuron. still, this capability decreases veritably snappily for longer sequences. As a remedy for this, the LSTM models were introduced to be suitable to retain once information indeed longer. [07]
For this purpose, the LSTM armature consists of an aggregate of three different stages

1) **Forget Gate**: it's decided which current and former information are kept and which are thrown out. This includes the retired status from the former run and the current status. These values are passed into a sigmoid function, which can only affair values between 0 and 1. The value 0 means that all former information is forgotten and 1 consequently that all former information is kept.
2) **Input Gate**: it is decided how precious the current input is to break the task. For this purpose, the current input is multiplied by the retired state and the weight matrix of the last run.
3) **Output Gate**: the output of the LSTM model is calculated. Depending on the operation, it can be, for illustration, a word that complements the meaning of the judgment.

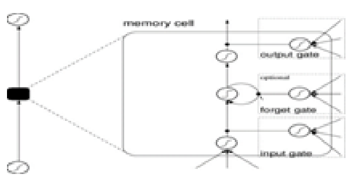


Fig.1.4 Structure of LSTM[20]

RNN(Recurrent Neural Network):

RNNs are called *recurrent* because they perform the same task for every element of a sequence, with the output being depended on the previous computations.[11]

Input: *x(t)* is taken as the input to the network at time step *t.* For example, *x1*,could be a one-hot vector corresponding to a word of a sentence.[11]

Hiddenstate*:* *h(t)* represents a hidden state at time t and acts as “memory” of the network. *h(t)* is calculated based on the current input and the previous time step’s hidden state: $h(t) = f(U\,x(t) + W\,h(t-1))$. The function *f* is taken to be a non-linear transformation such as *tanh*, *ReLU.[11]*

Weights: The RNN has input to hidden connections parameterized by a weight matrix U, hidden-to-hidden recurrent connections parameterized by a weight matrix W, and hidden-to-output connections parameterized by a weight matrix V and all these weights (*U, V, W)* are shared across time. .[11]

Output: *o(t)* illustrates the output of the network. In the figure I just put an arrow after *o(t)* which is also often subjected to non-linearity, especially when the network contains further layers downstream.

In the case of Long Short-Term Memory (LSTM) networks, the update equations become more complex and include components such as input gates, forget gates, and output gates.

The purpose of these gates is to control the flow of information into and out of the cell state, addressing the vanishing and exploding gradient problems associated with basic RNNs.

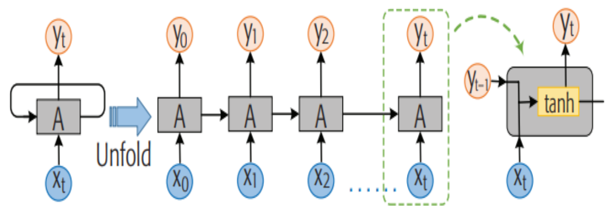


Fig.1.5 Structure of RNN[9]

III. RESEARCH METHODOLOGY

3.1.Propose System:

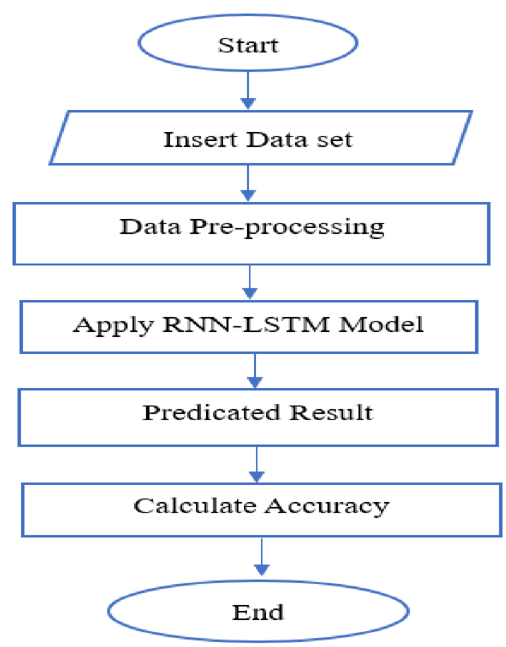


Figure 3.1. Propose System

3.2 Proposed theory

1.Insert Data Set

In this study to predict the traffic risk collected The Metro Interstatedataset from the Kaggle.

2.Data Preprocessing

Before we analyse the pattern of accident and built model, proper data set is necessary.

3.Apply RNN-LSTM Model

Traditional RNN architecture has the so called vanishing gradient problem. To overcome such disadvantage, certain structure of RNNs such as LSTM were proposed, which was designed to give the memory cells ability to determine when to forget certain information, thus determining the optimal time lags for time series problems. These features are particularly desirable for short-term traffic flow prediction in the transportation domain because of its long-standing memory ability.

4.Predicted Result

In this we take predicted result to evaluate accuracy.

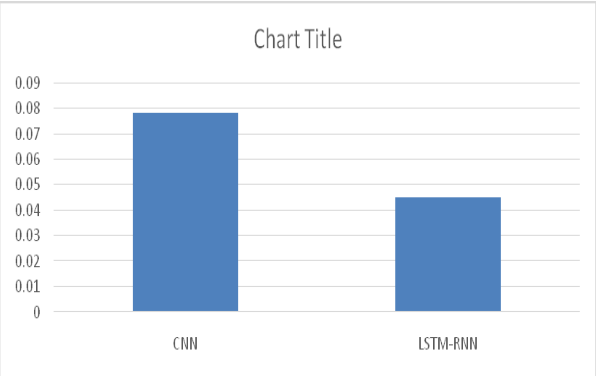
5.Calculate Accuracy

To evaluate the Accuracy, Mean Absolute Error (MAE), Mean Squared Error (MSE) and Root Mean Squared Error (RMSE) they are define as,

MAE = (1/n) Σ(i=1 to n) |y_i – ŷ_i|

Where n is the Size and ri are real and Predicated Risk.

IV. RESULT COMPARISON



As we observe, the proposed system andUpon comparing the results based on Mean Absolute Error (MAE), the LSTM model exhibited superior accuracy with a MAE of 0.0450, outperforming the CNN model, which yielded a MAE of 0.0783. This substantial difference underscores the efficacy of the LSTM architecture in predicting traffic accidents more accurately. The lower MAE achieved by the LSTM model signifies its enhanced predictive capabilities and reinforces its suitability for this task compared to the CNN model. Thus, the LSTM model emerges as the preferable choice for accurately forecasting accident risks in our study.

V. CONCLUSION

In numerous nations, road accidents remain a significant contributor to fatalities. The proactive prediction of traffic accidents holds promise in mitigating future incidents. Our proposed strategy entails the aggregation of pertinent data and the development of an intelligent computational model employing RNN-LSTM architecture to forecast accident probabilities. Evaluation of its efficacy will be conducted through established metrics such as Mean Absolute Error (MAE), Mean Squared Error (MSE), and Root Mean Squared Error (RMSE). By leveraging this system, our overarching objective is to cultivate safer roadways through the proactive prediction and subsequent prevention of potential accidents, thereby fostering enhanced public safety and well-being.

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