TRAFFIC ACCIDENT PREDICTION BASED ON CNN MODEL

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Abstract—**The traffic accident prediction represents a vital role in the combined planning and management of traffic, the design which involve some nonlinear components, such as people, road, vehicle, weather and so on. The convention way of extended studies cannot expose the real situation since the noise corruption and amount of data are too small, so that the result of prediction cannot be satisfied. This paper proposes deep learning-based new road traffic accident prediction applying a "Convolutional Neural Network model" (CNN). It uses traffic accident influencing circumstances like light, weather, traffic flow to make a state matrix describing the traffic state and CNN model. This paper utilizes examples to examine the accuracy of the proposed model. The empirical results show that the proposed model is more efficient than the current neural network design to predict traffic accidents compared with the traditional "Backpropagation" (BP) algorithm**

Keywords—Convolutional Neural Networks; Traffic Accident Prediction; Deep Learning; Prediction Loss, Feature Extraction; Backpropagation

I. INTRODUCTION

According to the life-loss facts published by the World Health Organization, the number of accidents that occur each year around the world is alarming. Injuries to website visitors kill 1.2 million people every year, and 50 million people are injured. Nearly 3,300 people were killed and 137,000 wounded every day. A direct economic loss of $ 43 billion, an expected repeat of visitor injuries threatens human existence and property integrity.[13] Anticipating the transformation of the fate of road visitors is an important content of road safety research [8]. The prevalence of traffic injuries is mainly influenced by the street's engineering characteristics, the influx of visitors to the site, the factors of drivers, and the perimeter of the road [1].

This traffic accident prediction based on CNN model; the results are predicted under the concept of Data science. "Data science "is the study of data [7]. And it is an inter-disciplinary field that uses mathematical systems, algorithms, interdisciplinary methods, scientific models, statistical process to extract knowledge and insights from structured and unstructured data, and apply knowledge and actionable insights from data across a broad range of application domains[9]. Data science is related to data mining, machine learning and big data [10]. To accurately predict people's traffic accidents, this paper uses the convolutional neural network to create a traffic accident prediction system. It presents how to construct a traffic accident prediction model for the road that relies entirely on the convolutional neural network.

This paper organized as follows: Section II explains Review of literature, Section III explains Proposed methodology, Section IV explains Results and Discussions and paper ends with Conclusion and References.

II. REVIEW OF LITERATURE

Many researchers have been used so many algorithms and techniques to predict traffic accidents in urban, rural areas. The accidental data was useful for the passengers to avoid the accident in traffic areas. In this section, some of the literary works are described below.

Atif Naseer et al [2020] With the massive increase in highway cars the traffic accidents rapidly. Those accidents lead to accidents and disabilities and may result in loss of life. To analyses traffic accident records, you want to familiarize yourself with and formalize the dataset. These records are mostly kept in relational databases or raw text content layouts. This document proposes a framework for storing accident records of site visitors on a massive Casandra logging platform. That was allowed for a fast and correct analysis method that uses large data structures. The paper proposes to apply deep field strategies to build predictions and segregation patterns from method chance statistics. In particular, the trends will focus on forecasting and identifying critical points on roads to reduce various injuries in the future.

Mayank Chaudhari et al [2020] among all the transportation systems used by humans, public traffic ways are most common and dangerous, leading to many deaths

worldwide. Statistics showed that accident-related death rates from website visitors are higher among young adults. Simultaneously, many road protection technologies and systems are being developed through the use of law enforcement agencies and companies to combat the situation. These methods are primarily aimed at the design, operation, and value of the visitor approach. Most of the most recent fact-based assessment documents review traffic patterns or anticipate casualties from other records. In this document, we consider the Fatal Analysis Reporting System (FARS)

Sanming Wang et al. [2020] Predicting visitor accidents on the road is an essential topic in traffic studies taking the fame of traffic protection in China because the subject of investigation, according to the non-linear features of road visitor injuries in China and the use of evaluation of essential components to reduce the dimensions of the data from the matching records of road site visitors in China and compare the two Neural Network comparison methods for SVR and BP show that the estimation accuracy of SVR is better than that of BP's neural network. Its predictive accuracy meets the requirements of predicting the cycle and destination of road visitors

Zhaosheng Yang et al [2020] Aiming at the phenomenon of road traffic accident frequency, one form of road traffic accident leads to an analysis based entirely on the mining facts presented. First, consider the related features and causes of avenue visitor accidents. Then they put forward two forms of the basic concept of log mining: the notion of difficult groups and the concept of union organizing. Finally, a technique for analyzing the causes of road site visitors' accidents relying mainly on mining statistics is proposed. By using the method of analyzing website visitor facts, you can improve the degree of successfully managing the safety of road visitors.

The deep learning models was also described in traffic flow prediction using RNN, Auto Encoders, Deep Boltzmann Machines and Restricted Boltzmann Machines [11]. Big data is also introduced to predict traffic flow using SAE model.[12]
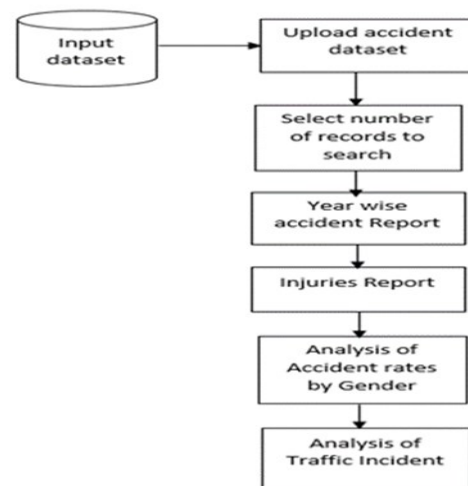
III. PROPOSED METHODOLOGY

Fig 1:Flow of the Proposed method

As shown in the Fig.1, the proposed architecture shows the various stages in predicting the traffic accident data.

Algorithm

Addressing the CNN on Traffic accident data set.

Input: Traffic accident dataset on 36 States.

Step 1: The traffic accidents data set comprehend multiple records which are to be given as an input to the convolution layer.

Step 2: The convolution layer adapts the input of records and apply the filters to eliminate duplicate fields that is not columns in records. (part of the day, weather) as shown in Fig 2.

age	alcohol usage	travel sp	injury report	parts of th	weather	
25	1	60	nonincapacitatin	morning	rain	
54	1	63	no injury	night	snow	
19	0	67	possible injury	afternoon	rain	
21	1	70	nonincapacitatin	night	strong cross w	
20	0	73	incapacitating	afternoon	strong cross w	
18	0	76	fatalinjury	night	sand	
86	1	83	possible injury	morning	rain	
20	1	86	incapacitating	afternoon	sand	

Fig 2: The original data set

Step 3: From the input data set, after removing the unnecessary records the input data set fed to the new layer. And that process is called polling. As shown in Fig 3, the optimized values i.e., 10 such as 2016, 2017, 2018-year wise accidents, killed, injured records, vehicles, gender, alcohol usage, travel speed, injury severity record values are stored and others like part of the day (am, pm), weather are removed.

male	female	age	alcohol usage	travel sp	injury report
238	150	25	1	60	nonincapacitating
482	80	54	1	63	no injury
214	23	19	0	67	possible injury
685	861	21	1	70	nonincapacitating
351	568	20	0	73	incapacitating
523	325	18	0	76	fatalinjury
375	120	86	1	83	possible injury
210	80	20	1	86	incapacitating

Fig 3:After passing through the convolution layer

Step 4: The retrieved 10 features are assigned with the weights based on random number generation. These retrieved features are moved through the fully connected layer.

Step5: Based on the error calculation the network back propagation accomplishes till given threshold value.

Output: Displays the output as pie chart of all the features based on the input that is, state and year.

IV. RESULTS AND DISCUSSION

A. Discussion

This paper uses Java high-level neural network API framework India Accident 2016-2018 data set to simulate the suggested traffic accident prediction algorithm. The proposed Convolutional neural network (CNN) is compared with traditional neural network based back propagation prediction method.

As shown in Fig: 4 and Fig:5, proposed algorithm compared to the Back Propagation (BP) algorithm, the proposed algorithm has a much lower loss and higher prediction accuracy than the traditional BP algorithm. The simulation results confirm that the prediction method suggested by CNN has lower losses and high prediction accuracy compared to the conventional device, which obtains knowledge of the prediction algorithm.
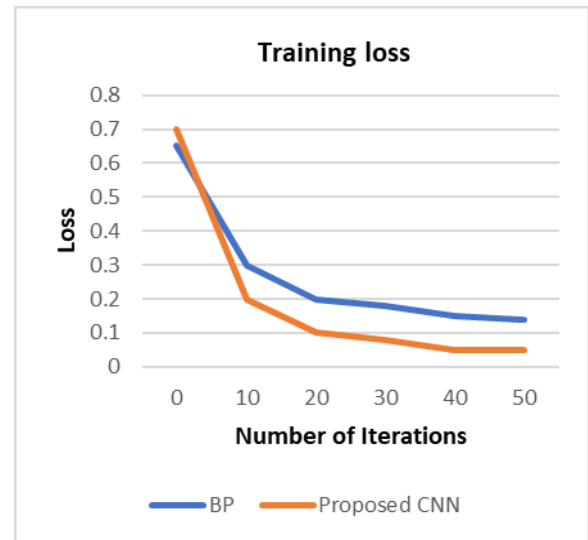

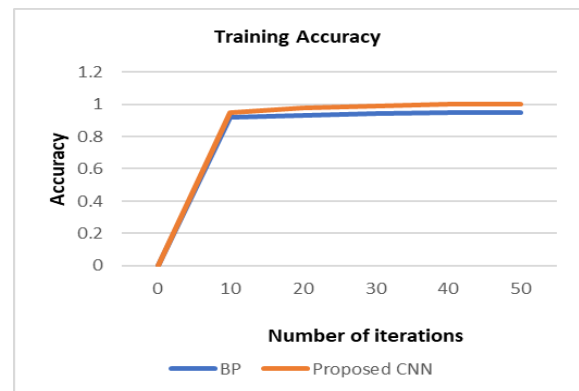Fig 4: Comparison of Loss predicted by proposed CNN and Back propagation (BP)

Fig5: Comparison of Accuracy prediction of proposed CNN and BP

B. Results

Fig6-shows analysis of accident rates by gender, Fig7-shows analysis of traffic incidents, Fig8-shows accident rates by over speed and alcohol usage, Fig-9 maximum age of people involved in alcohol cases, Fig-10 shows the number vehicles infected with traffic accidents
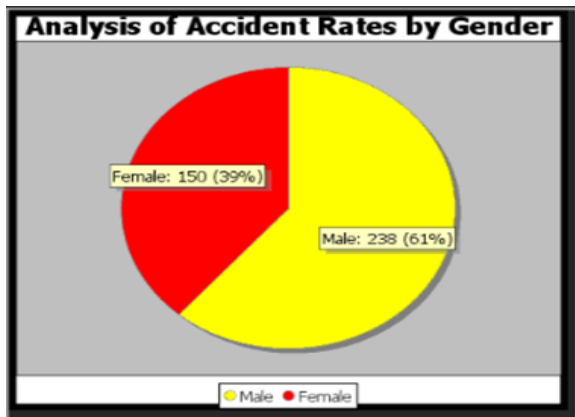
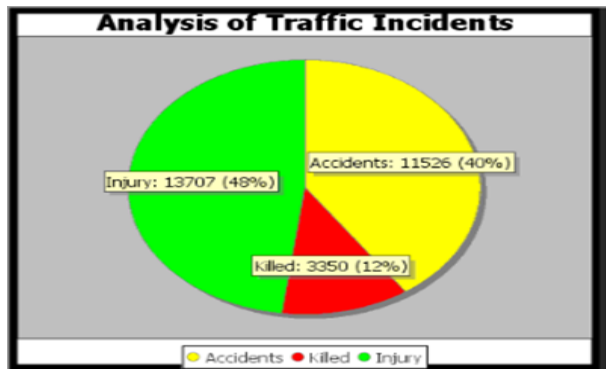Fig: 6 Analysis of accident rates by gender
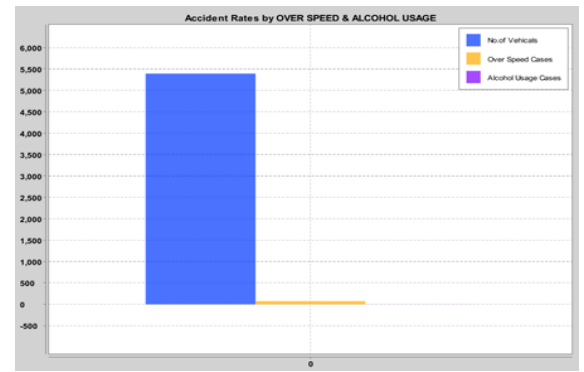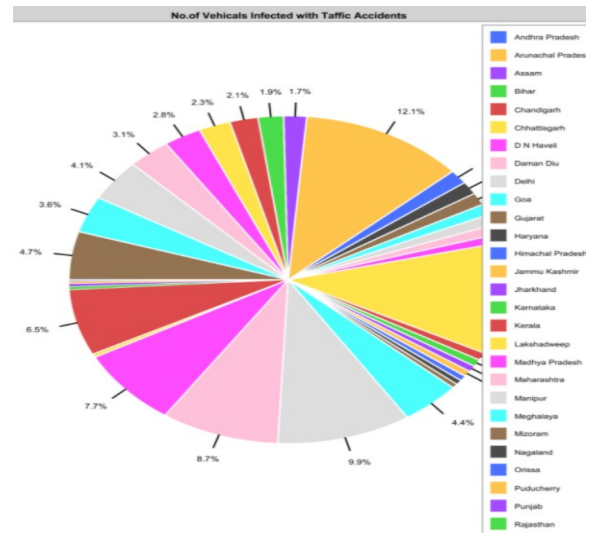

Fig:7 Analysis of traffic incidents

Fig:8 Maximum age of peoples involved in accident cases

Fig 9: Accident rates by over speed and alcohol usage

Fig10: Number of vehicles infected with traffic accidents from 2016-2018
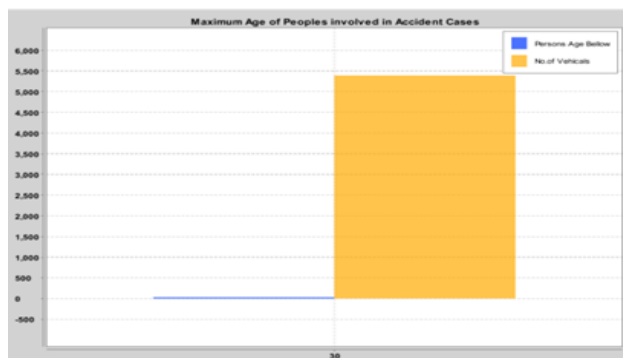
V. CONCLUSION

In this paper, a version of the accident prediction model is designed that relies entirely on the convolutional neural networks to predict traffic accidents on highways. It analyzed the effect of mastery costs and identified frequencies on the prediction accuracy of the proposed CNN. Compared with the traditional neuronal network model of the Back Propagation network (BP), the proposed CNN model shows its advantages in terms of prediction accuracy and prediction loss. The prediction loss shows lower than the traditional model BP and also higher prediction accuracy than traditional BP. Although the incident prediction model proposed in this paper has a modest effect on predicting rate, there are many shortcomings, and there are many aspects that wish to proceed. The experimental results determined that the proposed CNNs prediction method has less loss and high prediction accuracy than the conventional machine learning prediction algorithm. The future scope for the proposed work is to pick other features to input into CNN. More efficient models can be applied instead of CNN.

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