International Journal of Distributed Artificial Intelligence
Volume 14 • Issue 1

Significant Enhancement of Classification Efficiency for Automated Traffic Management System

Upendra Kumar, Institute of Engineering and Technology, Lucknow, India*
https://orcid.org/0000-0003-3792-7945

Pawan Kumar Tiwari, Institute of Engineering and Technology, Lucknow, India

Tejasvi Mishra, Institute of Engineering and Technology, Lucknow, India

Lalita Jaiswar, Institute of Engineering and Technology, Lucknow, India

Safiya Ali, Institute of Engineering and Technology, Lucknow, India

ABSTRACT

India as a country has 17.7% of the world's population with the limited availability of land resource which is about only 2.4% of the world's land. Being a developing nation and with such a huge population to accommodate, a number of problems can be seen on a daily basis such as high traffic congestion and unmanaged traffic on the roads. Irritating rush and wastage of time and fuel are severe hindrances to making transportation comfortable. As a country, due to availability of limited lands, the only option is to manage the traffic smartly. Hitherto, a number of attempts have been made in this regard. Still, the statically managed traffic lights can be seen at the junction of roads. So, this work gives an easy but implementable method to manage traffic lights effectively. A hybrid approach-based enhanced convolution neural network model was used for the classification along with a comparison with other model-based techniques (i.e., support vector machine). The proposed enhanced model produced 91.01% accuracy, and it is able to outperform the existing model.

KEYWORDS

Artificial Neural Network, Convolution Neural Network, Support Vector Machine, Traffic Congestion

INTRODUCTION

In metropolitan cities, traffic congestion is increasing rapidly, thereby results in chronic situations in dense downtown areas. Traffic signals play a significant role in the urban transportation system. They control the movement of traffic on urban streets by determining the appropriate signal timing settings. Adaptive traffic signal controllers are principle part of smart transportation system has a primary role to effectively reduce traffic congestion by making a real time adaptation in response to the changing traffic network dynamics. The unmanaged traffic has a number of bad consequences, like delays, fuel consumption and pollution, road rage and problems for emergency vehicles which need early clearance. With the advent of deep learning and neural network applications, it has become easier to solve real life problems more easily. The overall methodology followed by researchers till now is the video camera is implanted on the road to capture traffic conditions and then the algorithm tries to sense the degree of congestion on the road in real time. Based on the traffic condition the

DOI: 10.4018/IJDAI.291086 *Corresponding Author

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algorithm then tries to allocate time for the traffic lights to glow. Hence, the main difference is made by the algorithm used in the process, which decides the accuracy and processing time to define how adaptive the system is. To develop a robust and efficient algorithm for classification of road condition is the biggest challenge now.

Building up a component to foresee the constant traffic stream in urban areas that reduces the trip time utilizing data-mining calculations enhances the exactness, versatility, and flexibility of intelligent traffic applications. This technique consolidates a few versatile data mining strategies, for example, decision tree, association rules, and neural network applications. These methodologies utilize some traffic parameters and authentic information as input. Past traffic information was utilized to foresee the transient traffic stream utilizing the Artificial Neural Network (ANN) (Kumara et al., 2013). The model uses traffic volume, speed, thickness, time and day of the week alongside the speed of every class as data parameters. Video observation information is utilized by Dhingra et al., (2019) for grouping of street traffic and further used Convolution Neural Network (CNN) for classification. Traffic density estimation is acquired from traffic intersection pictures utilizing different artificial intelligence based techniques (Nubert et al., 2018) (combined with CV apparatuses with classes for the thickness of blockage). Another approach was followed by Diao et al., (2019) to create a classification model to foresee the momentary traffic volume in heavy transportation frameworks. The authors introduced a novel hybrid model to precisely figure the volume of travelling streams multi-step ahead. Far reaching factors were viewed as, for example, transient, origin-goal spatial, recurrence and self-likeness, and recorded probabilistic conveyance points of view.

Ke et al., (2019) proposed another model along with complete examination structure, which contains four phases that order and gauge the traffic stream boundaries (i.e., speed, thickness, and volume) from Unmanned Aerial Vehicles (UAV) video. The proposed structure includes some issues such as sporadic personality movement, low estimation exactness in thick rush hour gridlock circumstance, and high computational intricacy. Likewise, the authors openly gave a dataset that contains 20,000 preparing and testing picture tests as benchmark for analyst dealing with UAV. Trial results demonstrated that their proposed system can accomplish generally excellent precision results with high constant preparing speed in both free stream and blocked traffic situations. The task of counting and classifying turning vehicles as well as pedestrians at road intersection is an exhausting complex and despite using traffic monitoring systems for counting, human interaction is most essential part of it. Lingani et al. (2019) proposed an approach based on less invasive, requires no road dig up or costly installation in order to resolve traffic intersection turning-vehicles counting. For this purpose live stream or recorded videos can be used from already installed camera all over the cities as well as any camera including smartphones which is easily available. They built the models using Artificial Neural Network (ANN) and deep learning of object detection i.e. vehicles along computer vision technology. This method can also be employed on still images, recorded-videos, real-time live videos of the traffic content and can detect, classify, track and compute moving object velocity and direction using convolution neural network (CNN).

The traffic control system used by now a days in place in our country is non-flexible and non-adaptive to the ever increasing number of vehicles on the road. These systems do not have any functionality to take into account the dynamic change in density of traffic during various hours of the day. As a result the roads get congested frequently and sometimes the road intersections get blocked. Therefore two most important resources such as time and fuel, get wasted in such kind of inefficient working of the system. Maheshwari et al., (2015) proposed a dynamic system that overcomes all these issues. The cameras installed at the red lights and intersections are used by their system to monitor the traffic dynamically. Thereafter this information is processed using image processing techniques, the volume of the real time traffic is computed and update the timer of the signal accordingly. Simultaneously, it monitors the congestion at the intersection to overcome from it and the timer is adjusted to prevent it. The whole system works autonomously and consumes very less turnaround time, hence help in saving critical resources at every junction. This system is enough

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