iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 Issue: XI Month of publication: November 2023

DOI: https://doi.org/10.22214/ijraset.2023.56556

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue XI Nov 2023- Available at www.ijraset.com

Density Based Traffic Control Using Machine Learning

Prof. S. L. Tambe[1], Sarthak Gaikwad[2], Pravin Trimbake[3], Ranjit Mali[4], Shirish Kamble[5]
SKN Sinhgad Institute of Technology and Science, Lonavala, Maharashtra

Abstract: "Density Based Traffic Control Using Machine Learning" is a project that is designed to develop a density based dynamic traffic signal system. The signal timing changes automatically on sensing the traffic density at the junction. Traffic congestion is a severe problem in many major cities across the world. Conventional traffic light system is based on the fixed time concept allotted to each side of the junction which cannot be varied as per varying traffic density.
Keywords: Traffic Control , Machine Learning, Image Processing, Feature Extraction, Segmentation.

I. INTRODUCTION

Traffic congestion has become a serious problem in the major cities. Congestion is particularly associated with the motorization and the diffusion of the automobile, which has increased the demand for transportation infrastructure. However, the supply of the transportation infrastructure has often not been able to keep up with the growth of mobility. Traffic congestion problems consist of incremental delay, vehicle operating costs such as fuel consumption, pollution emissions and stress that result from interference among vehicles in the traffic stream, particularly as traffic volumes approach a road's capacity.

Across cities more people are spending more time sitting in traffic jams than ever before the Traffic congestion occurs when the demand is greater than the available road capacity. There are many reasons that cause congestion; most of them reduce the capacity of the road at a given point or over a certain length, for example people parking on the roads or increase in the number of vehicles. Traffic congestion also occurs due to traffic signal.

II. LITERATURE REVIEW

1) *Paper Name: Deep Reinforcement Learning for Traffic Light Control in Vehicular Networks.*

Author: Xiaoyuan Liang, Xusheng Du.

Description: In this paper, we study how to decide the traffic signals' duration based on the collected data from different sensors and vehicular networks. We pro- pose a deep reinforcement learning model to control the traffic light. In the model, we quantify the complex traffic scenario as states by collecting data and dividing the whole intersection into small grids. The timing changes of a traffic light are the actions, which are modelled as a high-dimension Markov decision process. To solve the model, a convolutional neural network is employed to map the states to rewards. The pro- posed model is composed of several components to improve the performance, such as network, target network, double Q-learning network, and prioritized experience replay. We evaluate our model via simulation in the vehicular network, and the simulation results show the efficiency of our model in controlling traffic lights.

2) *Paper Name: Multi-Traffic Scene Perception Based on Supervised Learning.*

Author: LISHENG JIN1, MEI CHEN 1, YUYING JIANG2, AND HAIPENG XIA1.

Description: In this system present vision driver assistance systems are designed to perform under good-natured weather conditions. Classification is a methodology to identify the type of optical characteristics for vision enhancement algorithms to make them more efficient. To improve machine vision in bad weather situations, a multi-class weather Classification method is presented based on multiple weather features and supervised learning. First, underlying visual features are extracted from multi-traffic scene images, and then the feature was expressed as an eight-dimensions feature matrix. Second, five supervised learning algorithms are used to train classifiers.

3) *Paper Name: Active Discriminative Dictionary Learning for Weather Recognition*

Author: Caixia Zheng, Fan Zhang,1 Huirong Hou, Chao Bi, Ming Zhang, and Baoxue Zhang.

Description: This paper presents a novel framework for recognizing different weather conditions. Compared with other algorithms, the proposed method possesses the following advantages.

Firstly, our method extracts both visual appearance features of the sky region and physical characteristics features. Thus, the extracted features are more comprehensive than some of the existing methods in which only the features of sky region are considered. Secondly, unlike other methods which used the traditional classifiers. We use dis- criminative dictionary learning as the classification model for weather, which could address the limitations of previous works.

III. WORKING OF PROPOSED SYSTEM

Density Based Traffic Control Using Machine Learning is used to solve the traffic problems. We bring in a slight change to the traffic signal system by making it priority based when there is a huge amount of traffic and then switching it back to the normal sequence after there is less amount of traffic.

The system counts the number of vehicles on each part of the road and after the analysis the system takes an appropriate decision as to which road is to be given the highest priority and the longest delay for the corresponding traffic light.

IV. METHODOLOGY

Algorithm:

1) *Convolutional Neural Networks:* Convolutional Neural Networks specialized for applications in image and video recognition. CNN is mainly used in image analysis tasks like Image recognition, Object detection Segmentation. It has four types of layers in Convolutional Neural Networks.
2) *Convolutional Layer:* In a typical neural network each input neuron is connected to the next hidden layer. In CNN, only a small region of the input layer neurons connected to the neuron hidden layer.
3) *Pooling Layer:* The pooling layer is used to reduce the dimensionality of the feature map. There will be multiple activation pooling layers inside the hidden layer of the CNN.
4) *Flatten:* -Flattening is converting the data into a 1-dimensional array for inputting It to the next layer. We flatten the output of the convolutional layers to create a single long feature vector.
5) *Fully-Connected layer:* Fully Connected Layers form the last few layers in the network. The input to the fully connected layer is the output from the final Pooling or Convolutional Layer, which is flattened and then fed into the fully connected layer.

V. SOFTWARE INTERFACE

The software interface for the "Density Based Traffic Control Using Machine Learning" project ensures a user-friendly experience and it includes:

1) *Data Collection:* Gather traffic data from various sources, such as sensors, cameras, or GPS devices. It Stores the data in a suitable database for further processing.
2) *Data Preprocessing:* Clean and preprocess the collected data to remove noise and inconsistencies.it converts data into a usable format for machine learning models.
3) *Machine Learning Model:* Develop a machine learning model that can predict traffic density or congestion based on historical and real-time data.

Consider using algorithms like regression, decision trees, random forests, or deep learning techniques like neural networks.

VI. ADVANTAGES AND DISADVANTAGES

A. *Advantages*

1) ML models can analyze real-time traffic data to adapt to changing conditions.
2) It can optimize traffic signal timings and lane management to ensure smoother traffic flow.
3) This can reduce congestion, minimize waiting times, and lower fuel consumption. By optimizing traffic flow and minimizing congestion, ML-based systems can help reduce vehicle emissions.
4) This can contribute to safer road conditions.

B. *Disadvantages*

1) It is heavily depends on accurate and abundant data.
2) Developing and deploying ML-based traffic control systems can be technically challenging.
3) The collection of traffic data for ML may raise privacy issues.
4) This system may require human intervention.

VII. SYSTEM PROTOTYPE

Figure : Traffic Image

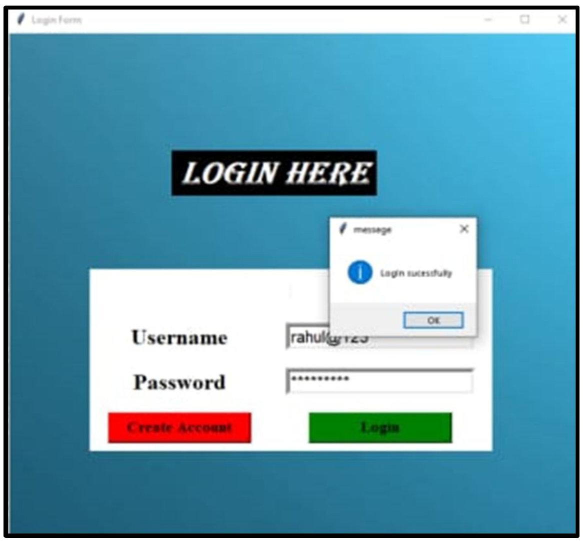

Figure : Login Page

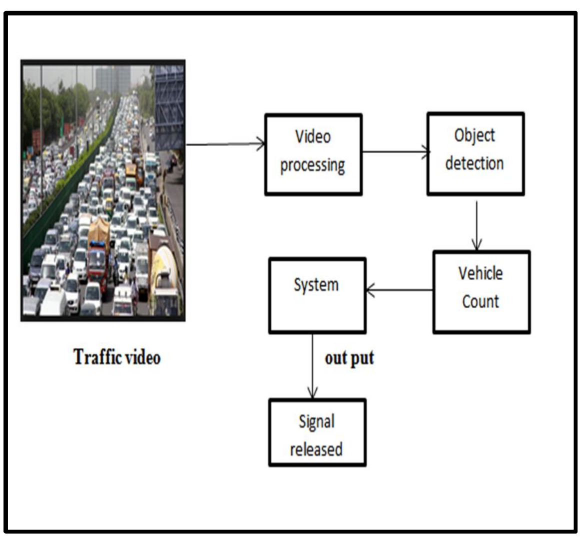

Figure : System Architecture

VIII. CONCLUSION

We can integrate our system with an application for analyzing the official traffic signal, so as to capture traffic condition notifications in real-time. Thus, our system will be able to signal traffic-related events in the worst case at the same time of the result display by the console on the web sites. Further, we are investigating in feature scope the integration of our system into a more complex traffic detection infrastructure. This infrastructure may include both advanced physical sensors and social sensors such as streams of social media. In particular, social sensors may provide a low-cost wide coverage of the road network, especially in those areas where traditional traffic sensors are missing.

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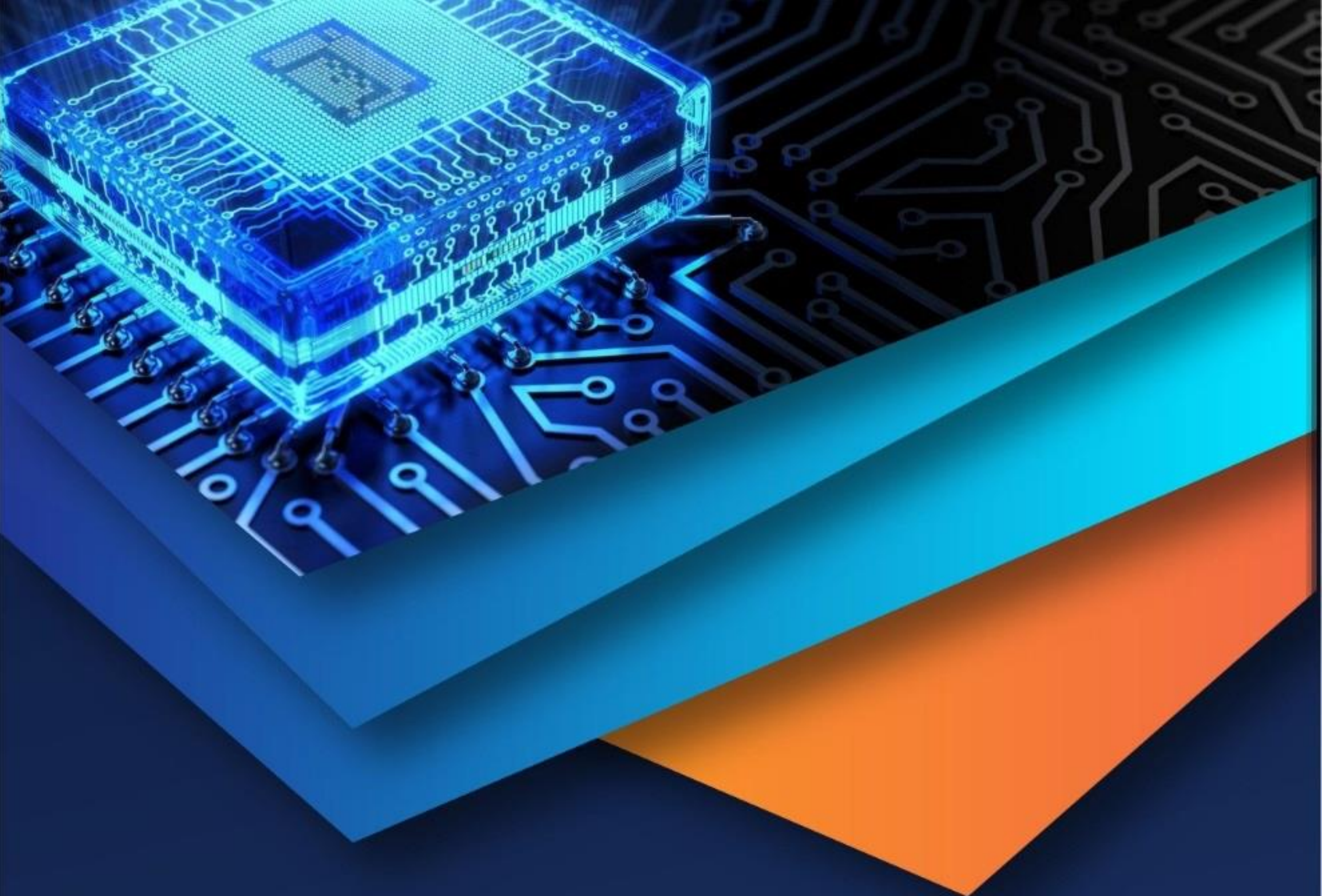

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