International Journal of Electrical, Electronics and Computer Engineering 13(1&2): 64-66(2024)

ISSN No. (Online): 2277-2626

Implementation of A.I. for Traffic Management

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(Received: 08 February 2024, Accepted: 21 April 2024)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: As the number of vehicles rises, traffic bottlenecks are becoming a regular occurrence not only nationwide but globally. Numerous person-hours are lost due to the regular traffic bottlenecks at busy intersections. It therefore necessitates the use of an effective traffic management system. Thus, we are going to put into practice a smart traffic control system that is predicated on the real-time video processing technique for measuring traffic density. We attempted to demonstrate advancements in the current manual traffic control system in this study. This study examines how well different machine learning algorithms manage traffic and examines practical applications. Modern transportation systems depend heavily on traffic management, which AI has the potential to greatly enhance. Although there is promise for using AI in traffic control in the real world, ethical issues need to be taken into account. All things considered, this study adds to the expanding corpus of research on artificial intelligence (AI) in traffic management and sheds light on the potential of machine learning algorithms to enhance traffic flow and lessen congestion.
Keywords: AI, traffic, Pollution, HD camera, YOLO, ANN,CNN

INTRODUCTION

Modern cities are becoming more and more populated, which increases the amount of vehicles on the road and exacerbates traffic congestion. We employed a video processing technology that made it simple to calculate the amount of traffic density on the road. Rather than employing electrical sensors placed in the pavement, the system will identify automobiles based on photographs. There will be a camera placed next to the traffic signal. It will record a series of images. A more effective method for managing the traffic light's status change is image processing (Rahman *et al*., 1996).

For a four-way road, our suggested system there calls for four cameras at a single intersection. These cameras will be connected to a CPU, which will handle the processing of videos.

This processing unit takes a picture using the camera, compares all of the pictures, and counts the number of vehicles that are on the road. Following a comparative analysis of the period allotted for that road's higher vehicle count, this process was repeated, resulting in a reduction of traffic congestion.

Benefits:

1. There is less heavy traffic congestion.
2. Reduce the pollutants.
3. Conserve energy and gasoline.
4. Avoid wasting time in traffic.

Definition of the problem. The conventional traffic light system is utilized in its entirety. These systems have numerous limitations, such as timing that is not dependent on the quantity of cars, which results in the following issues.

1. Heavy traffic jams.
2. Breaking traffic laws.
3. Everyday loss of person-hours.
4. Pollution in the same area has increased.
5. Give an empty road the green light.
6. Even when there is no traffic, pedestrians still have to wait.
7. Fuel and money lost.

Proposed system. The foundation of the system is the use of real-time video processing to measure traffic density. To intelligently regulate the traffic signal, the computed traffic density is compared with other segments of the traffic. For a four-way road, this model will have four cameras at a single intersection. The hardware that we will be utilizing includes an HD camera, a CPU for video processing, and n number of cameras that can be installed to alleviate traffic congestion on n highways (He *et al.,* 2010).

A high-definition camera mounted atop a pole will continuously monitor the movement of cars on a road before utilizing frame-by-frame Using real-time video analysis and the algorithm we built, we can determine the number of cars on the road.

We have created and put into place a sequential traffic timer system that is dependent on the quantity of vehicles identified. The sequential traffic light will begin when the microcontroller detects the signal from the CPU. The CPU will receive a signal from our micro controller or Arduino when the light phase changes from green to red.

For practical purposes, the HD camera will be mounted in the traffic light post 19–25 feet above the street. This camera will record roadside video in real time and transfer it to a computer for video analysis.

Using our created algorithm, the CPU will identify each automobile at a four-way intersection and count the number of vehicles on the road. Various object tracking techniques are implemented to generate trajectories for every observed object on the traffic scene at all times, allowing the system to be situationally aware. The aforementioned procedures are then integrated to extract various traffic flow data (such as traffic volume and occupancy) and track various traffic circumstances, including wrecks, queuing, and other abnormalities observed in the traffic scene. The AI-enabled traffic monitoring system can track various vehicle classifications, tally their numbers, identify and locate traffic jams, and track stationary cars in real-time.

Parameters used to evaluate the algorithms

1. Accuracy: This parameter assesses how well the system can forecast traffic patterns and circumstances. It is typically assessed by contrasting the algorithm's output with actual traffic statistics from the real world.
2. Efficiency: This metric gauges the algorithm's quickness and computational complexity. The algorithm's efficiency is a crucial factor to take into account because it dictates how quickly it can process vast volumes of data and generate precise predictions.
3. Robustness: This metric assesses how effectively the algorithm functions in various settings and circumstances. Since traffic patterns might differ greatly depending on location and time of day, it is imperative to assess the robustness of the algorithm.
4. Scalability: This parameter assesses the algorithm's capacity to manage bigger and more complicated datasets. It's critical to assess the algorithm's capacity to grow and accommodate more data (Chakraborty *et al.*, 2018).
5. Interpretability: This metric assesses the algorithm's capacity to offer clarifications and insights into its forecasts.

Algorithms

1. The Gaussian mixture model is a probabilistic model that can be used to depict the existence of subpopulations within a larger population without requiring that the subpopulation that each individual observation belongs to be identified in an observed data set.

A distribution constructed using weighted multivariate Gaussian* distributions is known as a Gaussian mixed model. Weighting factors determine the relative importance of each distribution. A superposition, or overlap, of bell-shaped curves is the resultant model. Models with Gaussian mixtures are semi-parametric. It is implied by the term "parametric" that the model originates from a known distribution, in this example, a collection of normal distributions. The model can have additional components added to it, potentially from unknown distributions, making it semi-parametric.

2. Shortest job first (SJF) chooses the waiting process with the quickest execution time to run next. An algorithm that isn't preemptive is SJN. Among all scheduling algorithms, the Shortest Job algorithm has the advantage of having the lowest average waiting time. The algorithm is greedy.

In the event that shorter processes continue, hunger may result. The idea of aging can be used to solve this issue. It is practically possible since the operating system might not be able to sort them because it doesn't know when to explode. There are a few ways to estimate a job's execution time even when it cannot be predicted; one such method is to use a weighted average of the job's previous execution times.

3. YOLO, or You Only Look Once, is the most advanced object detection algorithm available. YOLO examines the image only once to determine whether any objects are there, in contrast to conventional object detection algorithms. YOLOv4 was utilized in this study to detect vehicles, count them, and compare the outcomes in order to create traffic queues. In order to make detections, the majority of modern object detection algorithms modify CNN Classifiers. For example, these methods use a classifier for the item and test it at several scales and locations in the test image in order to accomplish object detection. Nevertheless, YOLO reframes object detection; that is, it makes accurate object predictions after only one glance at the image, as opposed to examining it a thousand times to accomplish detection (Bochkovskiy *et al.,* 2020).
4. Decision Trees: Recursively segmenting the input space into areas linked to certain outcomes is how decision trees, which are used to model decisions, operate.
5. Random Forest: Combining several decision trees, random forests are an ensemble learning technique. The mode of each tree's individual forecasts is the result of the random forest.
6. Support Vector Machines: SVMs are a well-liked method for tasks involving classification. To find a hyperplane that divides the incoming data into two classes is how they operate.
7. Artificial Neural Networks (ANNs): These algorithms, which are modeled after biological systems, are utilized to represent intricate interactions between inputs and outputs. They are made up of layers of networked nodes that communicate with one another through signals.
8. Gradient Boosting: This machine learning technique builds a model iteratively by adding weak learners. Every weak learner makes an effort to fix the mistakes made by the preceding learner, producing a model that is more correct.
9. Convolutional Neural Networks (CNNs): A particular kind of ANN utilized for picture classification and recognition is the CNN. In order to extract features from the input photos, they employ convolutional layers.

CONCLUSION

In summary, the incorporation of artificial intelligence (AI) into traffic management systems has the potential to completely transform how we think about transportation infrastructure and enhance sustainability, safety, and overall efficiency. Artificial intelligence

(AI) can optimize traffic flow, decrease accidents, and reduce congestion with sophisticated algorithms, machine learning models, and real-time data analysis. Traffic management authorities can forecast hotspots for congestion and proactively deploy resources to minimize potential interruptions by utilizing AI-powered predictive analytics. AI algorithms may also automatically modify speed limits, lane layouts, and traffic signals in response to the flow of traffic, which helps commuters get to their destinations more quickly and smoothly.AI-enabled traffic management systems can also improve safety by instantly recognizing and reacting to possible threats like accidents, blockages on the road, or inclement weather. By taking a proactive stance, accidents are less likely to occur and emergency response times are shortened, which ultimately saves lives (Ma *et al.,* 2015).

Furthermore, ridesharing services, bicycles, and public transportation can all be effortlessly integrated with AI technologies to build a more coherent and effective transportation network. By increasing sustainable transportation options and decreasing the use of single-occupancy automobiles, this all-encompassing strategy lessens its negative effects on the environment and increases urban liability.

However, in order to successfully integrate AI into traffic management, government organizations, stakeholders in the commercial sector, and technology companies must work together to address issues with data privacy, cybersecurity, and equitable access. To ensure fair and equal outcomes for all members of society, continuous research and development is also essential for boosting accuracy, removing biases, and refining AI algorithms.

To put it simply, artificial intelligence (AI) has the power to change traffic management into a responsive, dynamic system that improves sustainability, safety, and mobility in our towns and cities. In the years to come, smarter, more effective, and more livable urban settings may be achieved by embracing these developments in AI technology.

REFERENCES

Bochkovskiy, A. Wang, C. Y. Liao, H. Y. M., YOLOv4: Optimal Speed and Accuracy of Object Detection. arXiv preprint arXiv:2004.10934 2020.

Chakraborty, P. Adu-Gyamfi, Y. O. Poddar, S. Ahsani, V., Sharma, A. and Sarkar, S. (2018). Traffic congestion detection from camera images using deep convolution neural networks. Transportation Research Record 2018, 2672, (45), 222-231.

He, K. Sun, J. and Tang, X. (2010). Single image haze removal using dark channel prior. *IEEE transactions on pattern analysis and machine intelligence, 33*(12), 2341-2353.

Ma, X. Yu, H. Wang, Y. and Wang, Y. (2015). Large-scale transportation network congestion evolution prediction using deep learning theory. *PloS one, 10*(3), e0119044.

Rahman, Z. U. Jobson, D. J. and Woodell, G. A. (1996). In Multi-scaleretinex for color image enhancement, Proceedings of 3rd IEEE *International Conference on Image Processing, IEEE: 1996*, 1003-1006.