Chapter 5
FuzzyNet-Based Modelling Smart Traffic System in Smart Cities Using Deep Learning Models

Pawan Kumar Mall
Lovely Professional University, India

Vipul Narayan
https://orcid.org/0000-0003-4248-5782
Galgotias University, India

Sabyasachi Pramanik
https://orcid.org/0000-0002-9431-8751
Haldia Institute of Technology, India

Swapnita Srivastava
Galgotias University, India

Mohammad Faiz
Lovely Professional University, India

Srinivasan Sriramulu
Galgotias University, India

M. Naresh Kumar
Galgotias University, India

ABSTRACT

The current lockouts, climatic variations, population expansion, and constraints on convenience and natural resource access are some of the factors that are making the need for smart cities more critical than ever before. On the other hand, these difficulties may be conquered more effectively with the use of emerging technology. In smart cities, the number of cars on the road has skyrocketed over the years, resulting in severe problems such as gridlock, accidents, and a myriad of other issues. Increased travel time reliability, decreased congestion, more equitable distribution of green phase time, faster response to traffic conditions, timely assistance and support, and accurate prediction of traffic volumes, including timing adjustments for traffic signals; these are some of the benefits that can be achieved. It is possible that the current, conventional traffic management system isn't up to deal with the increased traffic congestion and traffic violations. Image processing is the foundation of the sophisticated traffic management system that is now in place.

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INTRODUCTION

A smart city improves the quality of life for its residents and other users by using a range of cutting-edge technologies for information communication and computation. Smart cities aim to meet the needs of their residents and users more effectively. This generic definition makes it possible for a wide variety of interested parties to participate in the construction of smart cities. These interested parties include scientists, engineers, businesspeople, developers, planners, and municipal establishments. It is challenging to create a consistent foundation for smart cities, and it is much more difficult to quantify the performance of a smart city in delivering on its goal. Both of these challenges are difficult to overcome (Faiz and Daniel, 2022). The first endeavours toward smart cities were undertaken in the early 90s, which led to the development of the present idea of smart cities. In addition, during the course of its history, it has developed into a city that, in order to accomplish the smart city strategic target, makes use of developing technologies like deep learning, machine learning, and fuzzy. A time-consuming and labour-intensive component of asset management for many different road authorities is the upkeep of a database that details the kind, position, and direction of traffic signals. Cell phones these days come equipped with high-quality cameras that are able to add location information (called EXIF) to the pictures they take. This makes the process of collecting big geo-located images files both efficient and affordable. Because there are now several high-quality open-source object-detection technologies available, identifying traffic signs from photography is likewise easier now than it was in the past. The control systems for autonomous vehicles have been undergoing rapid development as of late. A key component of these systems is an algorithm that can recognise different types of traffic signs. Sign recognition is utilised in a variety of systems, including driverless cars, driver support systems, and the automation of the operations involved in road maintenance services. Deep learning models are the foundation of modern approaches to the task of object identification in photographs. A dataset that is sufficiently tagged is often necessary in order to get a detection model of sufficient quality. The process of marking up datasets is laborious and time-consuming since it includes manual routine work, which has to be double-checked while taking into account the fact that there will always be mistakes made by humans. The intricacy of data collecting may be simplified with the use of synthetic data. They can be acquired rapidly, without cost, without the presence of mistakes in the annotation, and in virtually an infinite size range, all of which contribute to a significant reduction in the cost of acquiring data. Object identification and picture categorization are both examples of tasks that fall within the purview of machine vision and machine learning. The categorization of road signs is a challenging job in the field of machine vision since it involves a significant amount of processing work in addition to an algorithm that is appropriate, consistent, and accurate. Because of the availability of their exact and straightforward design, DNN is able to address issues of this kind. These days, machine learning algorithms are becoming more important. Machine learning (Dushyant, K. et al., 2022 and Bhattacharya, A., et al., 2021) may be used in a variety of contexts, including the elimination of spam, the comprehension of speech, the identification of faces, and the detection of traffic signs. In areas with heavy traffic, technology that recognises and classifies traffic signs may be put to use to enable automated sign identification. When the traffic sign is recognised by the system and its name is shown, the system will do this task mechanically for you automatically. This means that even if the driver momentarily loses focus or misses a sign, it will still be picked up by the system. This serves to notify the drivers in the appropriate manner and restrict specific acts like exceeding the speed limit. The ease of the driver's job is improved as a result of this since they are relieved of some of their responsibilities. Therefore, making sure to verify and maintain a check on the traffic signs, and then