In recent years, there has been considerable attention given to the field of object detection and classification. This is primarily because of potential usage of computer vision applications and the expensive research studies image recognition within the context of intelligent vehicle recognition systems (IVRS), the majority of applications pertaining to vehicle detection and classification place significant emphasis on areas such as traffic monitoring, logistic management, auto inspection of insurance claims, and related fields. Vehicle model detection, color analysis, damage and scratch evaluation, and cost estimation have all seen significant advancements through the utilization of digital image processing techniques. Additionally, the computational power available for such tasks has greatly increased. Modern computational devices are now capable to perform high-core processing and graphics processing units (GPUs), which enable the real-time detection and classification of objects. Machine Learning (ML) and Deep Learning (DL) have also played a crucial role in advancing computer vision research. Deep convolutional neural networks (DCNN) with their diverse architectures, have proven to be effective in various areas of computer vision research, including object detection, image classification, vehicle tracking, and object pose estimation, among others.

An image refers to a digital representation, consisting of two dimensions, that is defined by finite numerical values assigned to pixels. These pixels are identified on the x-y spatial coordinate axis. Digital image processing is a term used to describe the manipulation of an image or video frame, which serves as input, through a series of distinct phases that involve various parameters and experimental configurations. For instance, the identification of a vehicle would necessitate that images or video frames clearly exhibit its presence, as well as its specific location within an image. In this particular context, the detection of vehicles is closely intertwined with the classification of vehicles, as it entails the delineation of the presence and positioning of the vehicle within an image. Nonetheless, the image itself holds no value unless it is meticulously scrutinized in order to extract meaningful insights. The application of hand-crafted features, specifically HOG, Haar, and LBP, proves to be the most fitting techniques for vehicle detection, although they fall short in providing a comprehensive solution, necessitating some adjustments to the classifiers to adapt to varying parameters. Furthermore, a shallow neural network is also employed for vehicle detection, however, its performance has yet to yield the desired level of quality. Coping with the vast amount of data necessitates the development of an innovative approach capable of swiftly, accurately, and consistently executing the task. Enhancing the efficiency of vehicle detection and the precision, accuracy, and robustness of classification through deep learning techniques, such as RCNNs, DCNNs and DNNs, serves to boost the effectiveness of techniques in recognition of vehicles from images or videos.