

Artificial Intelligence for Traffic Signal Control and Data Collection

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Abstract : Traffic accidents and traffic signal optimization are correlated. However, 70-90% of the traffic signals across the USA are not synchronized. The reason behind that is insufficient resources to create and implement timing plans. In this work, we will discuss the use of a breakthrough Artificial Intelligence (AI) technology to optimize traffic flow and collect 24/7/365 accurate traffic data using a vehicle detection system. We will discuss what are recent advances in Artificial Intelligence technology, how does AI work in vehicles, pedestrians, and bike data collection, creating timing plans, and what is the best workflow for that. Apart from that, this paper will showcase how Artificial Intelligence makes signal timing affordable. We will introduce a technology that uses Convolutional Neural Networks (CNN) and deep learning algorithms to detect, collect data, develop timing plans and deploy them in the field. Convolutional Neural Networks are a class of deep learning networks inspired by the biological processes in the visual cortex. A neural net is modeled after the human brain. It consists of millions of densely connected processing nodes. It is a form of machine learning where the neural net learns to recognize vehicles through training - which is called Deep Learning. The well-trained algorithm overcomes most of the issues faced by other detection methods and provides nearly 100% traffic data accuracy. Through this continuous learning-based method, we can constantly update traffic patterns, generate an unlimited number of timing plans and thus improve vehicle flow. Convolutional Neural Networks not only outperform other detection algorithms but also, in cases such as classifying objects into fine-grained categories, outperform humans. Safety is of primary importance to traffic professionals, but they don't have the studies or data to support their decisions. Currently, one-third of transportation agencies do not collect pedestrian and bike data. We will discuss how the use of Artificial Intelligence for data collection can help reduce pedestrian fatalities and enhance the safety of all vulnerable road users. Moreover, it provides traffic engineers with tools that allow them to unleash their potential, instead of dealing with constant complaints, a snapshot of limited handpicked data, dealing with multiple systems requiring additional work for adaptation. The methodologies used and proposed in the research contain a camera model identification method based on deep Convolutional Neural Networks. The proposed application was evaluated on our data sets acquired through a variety of daily real-world road conditions and compared with the performance of the commonly used methods requiring data collection by counting, evaluating, and adapting it, and running it through well-established algorithms, and then deploying it to the field. This work explores themes such as how technologies powered by Artificial Intelligence can benefit your community and how to translate the complex and often overwhelming benefits into a language accessible to elected officials, community leaders, and the public. Exploring such topics empowers citizens with insider knowledge about the potential of better traffic technology to save lives and improve communities. The synergies that Artificial Intelligence brings to traffic signal control and data collection are unsurpassed.

Keywords : artificial intelligence, convolutional neural networks, data collection, signal control, traffic signal

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