Name: Michael Osarodion Okoh

Report: Research Questions and Hypotheses

Student ID: 18022563

Context

There are various means of transportation such as planes, cars, and trains. In the United Kingdom, transportation by road has become the most popular means of movement (Akimura, 2015). This has led to a rise in the number of cars on the road with multiple accidents occurring daily. According to GOV. UK (2020), there were about 14266 reported accidents involving vehicles in 2018. There have been many attempts to reduce this alarming number of road accidents. For example, the introduction of traffic lights and traffic signs. Traffic sign serves as a guide to safeguard pedestrians, vehicles, and nearby buildings from impending danger. With recent advancements in technology, the current method being research on and implemented is the advanced driver assistance systems (ADAS) (Swathi and Suresh, 2017). The ADAS supports the driver by automatically detecting traffic signs, recognising speed limits, detecting lane lines with the help of sensors and cameras installed in the car (Swathi and Suresh, 2017).

This study aims at detecting and classifying traffic signs using machine learning (ML) algorithms. For this to be accomplished, the following research questions have been developed: (a) Which datasets are used for traffic sign detection and classification? (b) Which ML algorithms have been used for traffic sign detection and classification?

(a) Which datasets are used for traffic sign detection and classification?

There are various datasets used for traffic sign detection. These are German traffic sign recognition benchmark (GTSRB) dataset (Stallkamp, et al., 2012), German traffic sign detection benchmark (GTSDB) dataset (Houben, et al., 2013), and Belgium traffic sign dataset (BTSD) (Mathias, et al., 2013).

(b) Which ML algorithms have been used for traffic sign detection and classification?

Several ML algorithms have been identified by researchers for detecting and classifying traffic signs. However, before this, computer vision techniques were used for this purpose. Computer vision is an interdisciplinary field of computer science, robotics, and artificial intelligence (Ramprasath, Anand, and Hariharan, 2018). Its goal to enable computers to interpret images or videos. Swathi and Suresh (2017) identified three methods for detecting traffic signs based on colour, shape, and learning. Colour based detection works by removing irrelevant objects in the background utilising colour segmentation. Shape detection extracts the image contours and identifies edges in the image. Learning-based combines both the shape and colour detection methods. Other techniques involving ML algorithms for detection and classification are Support Vector Machines (SVMs), Artificial Neural Network (ANN), and Convolutional Neural Network (CNN) (Shustanov and Yakimov, 2017; Swathi and Suresh, 2017; Zhang, et al., 2019).

Reference

1. Akimura, S. (2015) ‘Transportation statistics that can contribute to policies and social infrastructure development aimed at ensuring the healthy growth of cities and providing support for smooth economic activity’. *IATSS research*. 39(1) pp.9-18.
2. GOV.UK. (2020) *Reported accidents, vehicles and casualties (RAS40).* Available at: <https://www.gov.uk/government/statistical-data-sets/ras40-reported-accidents-vehicles-and-casualties>. [Accessed 1st July 2020].
3. Houben, S., Stallkamp, J., Salmen, J., Schlipsing, M. & Igel, C. (2013) ‘Detection of Traffic Signs in Real-World Images: The {G}erman {T}raffic {S}ign {D}etection {B}enchmark’*. International Joint Conference on Neural Networks (IJCNN)*. pp.1-8.
4. Mathias, M., Timofte, R., Benenson, R. & Van Gool, L. (2013) ‘Traffic sign recognition - How far are we from the solution?’. *In The 2013 international joint conference on Neural networks (IJCNN).* pp.1-8.
5. Ramprasath, M., Anand, M.V. & Hariharan, S. (2018) ‘Image classification using convolutional neural networks’. *International Journal of Pure and Applied Mathematics*. 119 (17) pp.1307-1319.
6. Shustanov, A. and Yakimov, P. (2017) ‘CNN design for real-time traffic sign recognition’. *Procedia engineering*. 201 pp.718-725.
7. Stallkamp, J., Schlipsing, M., Salmen, J. & Igel, C. (2012) ‘Man vs. computer: Benchmarking machine learning algorithms for traffic sign recognition’. *Neural Networks*. 32, pp.323-332.
8. Swathi, M. & Suresh, K.V. (2017) ‘Automatic traffic sign detection and recognition: A review’. *International Conference on Algorithms, Methodology, Models and Applications in Emerging Technologies (ICAMMAET).* pp.1-6.
9. Zhang, J., Wang, W., Lu, C., Wang, J. & Sangaiah, A.K. (2019) ‘Lightweight deep network for traffic sign classification’. *Annals of Telecommunications*. pp.1-11.