Impacts of a Hidden Layer Design on CNN for Traffic Sign Recognition

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As society becomes more advanced with technology, an increasingly popular subject matter is autonomous vehicles. Specifically, the ability for autonomous vehicles to detect and recognize different traffic signs in order to abide by the driving rules and promote a safe driving environment. This study focuses on traffic sign recognition, the image classification aspect, and how the increase in hidden layers of CNNs can lead to a significant decrease in performance at a certain point but a significant increase in computation time. In order to do this, three models were built: a one-hidden layer model, a three-hidden layer model, and a five-hidden layer model. Data was recorded for each model's accuracy, loss, and computation time. Using one-tailed T-tests, the hypotheses were tested with a significance level of 0.05 ($p = 0.05$). Results showed that the performance in the three-hidden layer model was significantly higher than the one-hidden layer model, but the five-hidden layer model outperformed the other two models in accuracy and loss. This was most likely caused by the large amounts of data in the GTSRB dataset, so the point where the performance decreases could be even larger than the five-hidden layers used. Additionally, results showed that in certain cases, there was a significant difference between the computation time of models, but this result was not consistent throughout. Nevertheless, future studies can be conducted to find where the point of decrease occurs using the same dataset and look further into the issue of computation time.

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