Evaluation of Distributed Lightweight Deep Learning Model for Pothole Detection

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Abstract:

The use of distributed deep learning approaches for image detection in traffic systems and self-driving cars is examined in this research. Neural networks' accuracy and precision can be affected when used on edge devices, like CCTV cameras for traffic surveillance. This is especially true when working with tiny datasets, which could result in mistakes in target recognition. The study utilizes TensorFlow to implement a lightweight approach to tackle this challenge. Although this technique showed promise, it also revealed communication bottlenecks and speed inefficiencies. To address these issues, a distributed model was introduced, which includes model parallelism and data parallelism, aiming to reduce gradient communication errors. The proposed approach was tested in an edge environment notably on a Google clolab, and demonstrated enhanced performance and reliability compared to traditional methods necessary performance measures were assessed, including total loss over epochs, accuracy, and precision. The results indicate that the lightweight distributed model in tensor flow using mobile net outperformed other configurations, providing a more reliable and efficient solution for image detection tasks in edge and distributed environments.

Keywords:

Data parallelism, Distributed deep-learning, Image detection, Self-driving vehicles, Model parallelism, Mobile-Net.