Evaluating the Viability of Computational Offloading for Vehicles Under Adverse Network Conditions

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Introduction

This is an abstract for my submitted paper for the *IAVVC2025* conference. I intend to present this at SWITS2025 as a presentation.

Abstract

The safe and efficient operation of automated vehicles requires processing massive amounts of sensor data. However, the computational capabilities of vehicles are often limited. Recent results point to computational offloading as a promising solution for transferring raw sensor data to be processed elsewhere. This alleviates vehicles from performing costly computations while increasing their perception of complex environments. The work in this paper evaluates the resilience of such solutions, specifically focusing on adverse network conditions, which are often overlooked when evaluating computational offloading. To emulate adverse network conditions, we use synthetic network interference that includes, e.g., packet loss, throughput rate limiting, packet corruption, and RF attenuation. We conducted experiments with a real vehicle on a test track, where object detection was offloaded to an edge server. An optical camera, one of the most common perception sensors, was mounted on the vehicle to scan the environment. The experimental results indicate that network conditions can significantly impact the object detection performance. Packet loss and packet corruption proved to be especially impactful on the accuracy of detections. During the scenario of 5% packet corruption, the median value of false detections reached as high as 20%. The results emphasize the need for resilience and robustness to poor network conditions when designing computational offloading strategies.