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Detecting Malicious Cyberattacks on Adaptive Cruise Control Vehicles: A Machine Learning Approach

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Abstract

The emergence of vehicles with driver-assist features, such as adaptive cruise control (ACC) introduces the possibility of cyberattacks, where a select number of automated vehicles (AVs) or ACC vehicles are compromised to drive with adversarial controls. While obvious attacks that force vehicles to crash may be easily detectable, more subtle ones are harder to detect and could change vehicle driving behavior, resulting in a network-wide increase in congestion and fuel consumption.

To address this problem, we first introduce three typical scenarios of potential cyberattacks, namely malicious attacks on vehicle control command, false data injection attacks on sensor measurements, and denial-of-service (DoS) attacks. Under these scenarios, we examine and quantify the impacts of cyberattacks on traffic flow characteristics, vehicle fuel consumption, and emissions. Furthermore, a generative adversarial network (GAN)-based anomaly detection model is proposed for real-time detection of such attacks. Finally, extensive numerical results are presented to show the effectiveness of the proposed approach, using both synthetic vehicle trajectory data and real-world ACC trajectory data.