Qeios

Peer Review

Review of: "Advancing Autonomous Vehicle Safety: A Combined Fault Tree Analysis and Bayesian Network Approach"

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1. Contributions

- This paper proposes a framework that integrates Fault Tree Analysis (FTA) and Bayesian Networks (BN) to assess collision risk in autonomous vehicles (AV).

- By combining the systematic failure decomposition capability of FTA with the probabilistic reasoning ability of BN, the paper presents a method for dynamic risk quantification that aligns with the ASIL-B requirements under ISO 26262.

2. Comments for Improvement

- Unclear Basis for Failure Rate (Prior Probability) Assignment:

The paper mentions that the failure rates were "randomly assigned," which may undermine the credibility of the analysis.

As the results of the Bayesian Network-based risk assessment fundamentally depend on the initially assigned prior probabilities, the randomly assigned failure rates would raise concerns.

It would be necessary to clearly present the basis for the prior probability settings, whether through data-driven evidence, literature references, or other means, to enhance the reliability of the results.

- Absence of Sensitivity Analysis:

The paper does not systematically analyze how variations in the failure probability of key events, such as PF5 and PF6, affect the overall collision probability.

This paper estimates the final failure probability of each event through BN-based posterior probability updates and judges the influence of events based on the magnitude of these values (i.e., risk contribution

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analysis). However, a traditional sensitivity analysis — quantitatively assessing the system's response to changes in input probabilities — has not been conducted.

- Lack of Modeling Dependencies Between External Factors and Internal Systems:

The model does not consider the dependency where external environmental factors (such as weather conditions or communication failures) could influence the failure rates of the sensors and perception systems.

3. Further Questions

- How is the variability (e.g., standard deviation) in the failure rates (FIT) of each basic event reflected in the Bayesian inference process?

- Can the proposed methodology be effectively applied in highly dynamic operational environments (e.g., dense urban traffic scenarios)?

- Did the authors assume a memoryless (exponential) failure model for all basic events? If so, how can the model be extended to account for long-term degradation phenomena?

Declarations

Potential competing interests: No potential competing interests to declare.