

EDCC 2024: 1ST INTERNATIONAL WORKSHOP ON SAFE AUTONOMOUS SYSTEMS

PROVIDING EVIDENCE FOR THE VALIDITY OF THE VIRTUAL VERIFICATION OF AUTOMATED DRIVING SYSTEMS

Birte Neurohr, Thies de Graaff, Andreas Eggers, Tom Bienmüller and Eike Möhlmann

BTC

*embedded
systems*



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Research Question

How can the amount of needed real world data for the validation of simulated traces be decreased?

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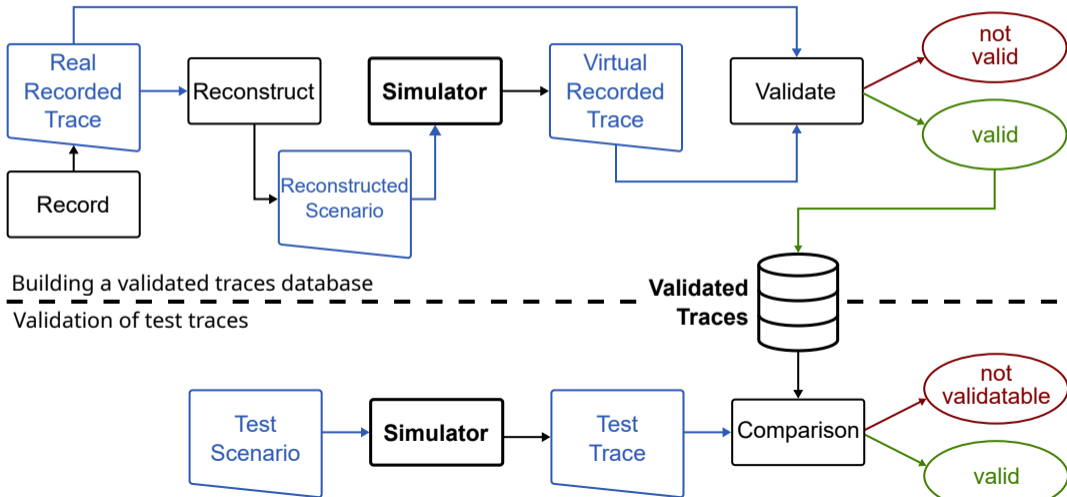
To address the aforementioned challenge we

- present a method to validate simulation traces based on real world data,
- propose two enhancements via decomposition and recombination of real world data along so called (1) validity aspects and (2) time, and finally
- demonstrate the effectiveness of these enhancements.

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2. Naive Validation
3. Snippet-based Trace Validation
 - Decomposition of Traces along Validity Aspects
 - Decomposition of Traces along Time
4. Proof of Concept
5. Conclusion

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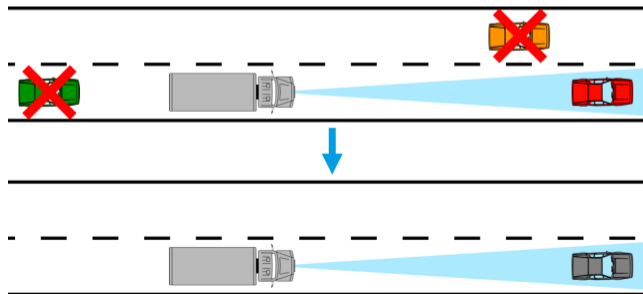
Naive Validation Pipeline



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- can now validate each Validity Aspect individually

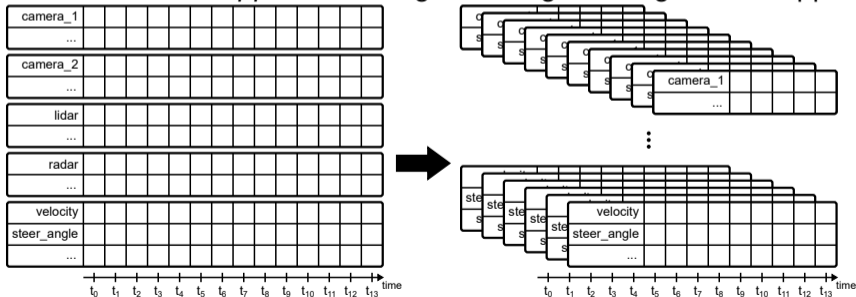
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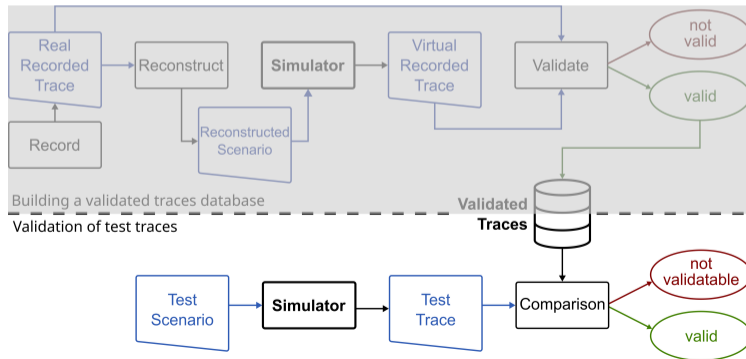
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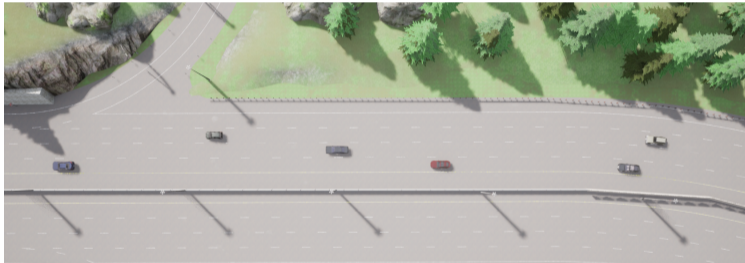
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- assume the validated traces to be valid without having comparable real world data as we focus on the second phase of the presented method



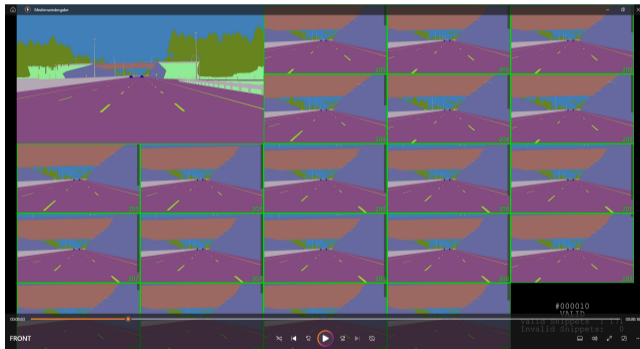
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- we used the simulator CARLA 0.9.13 and designed parameterizable highway scenarios:

	N_{MIN}	N_{MAX}	V_{MIN} [km/h]	V_{MAX} [km/h]	O_{MAX} [m]	l_c
easy	0	3	80	80	100	0
medium	0	5	80	90	150	1
complex	0	10	60	100	500	1

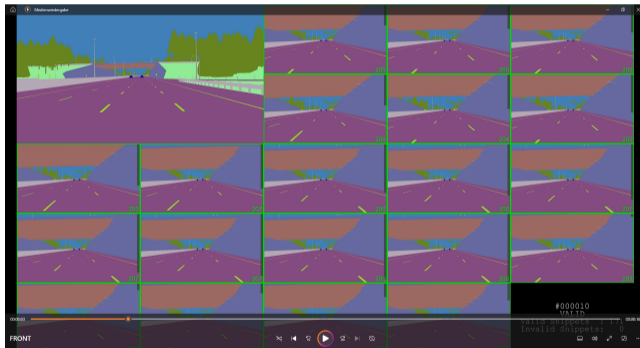




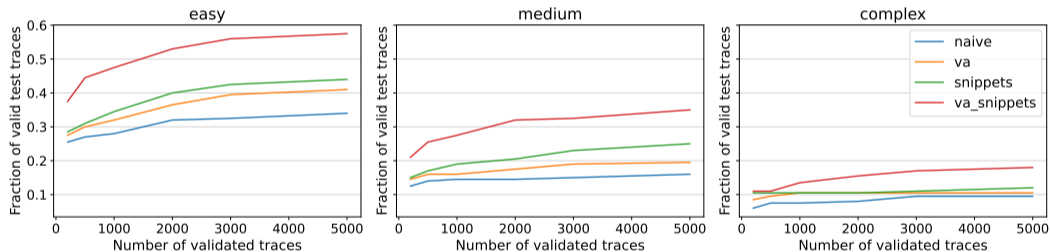
Showcase PoC: Test Trace Validatable



Showcase PoC: Test Trace Not Validatable



Results from Proof of Concept



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Key Takeaways

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- relies on generalizing from traces that were observed in reality and validly replayed in the simulation

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- Snippet based trace validation provides evidences for the validity of simulation traces while reducing the amount of needed real world data
- relies on generalizing from traces that were observed in reality and validly replayed in the simulation
- proof of concept exemplary showed, that our different strategies help to increase the generalization of observed scenarios to multiple similar scenarios
- approach should be applied with great care as wrongfully declared valid traces, have the potential to lead to catastrophic events

Thank you for the attention.

Contact:

Birte Neurohr, M.Sc.
German Aerospace Center (DLR) e.V.
Institute of Systems Engineering for Future Mobility
birte.neurohr@dlr.de

