Github

Model-Structured Neural Networks for Road Condition Identification in AI-Enabled Digital Twin Architecture

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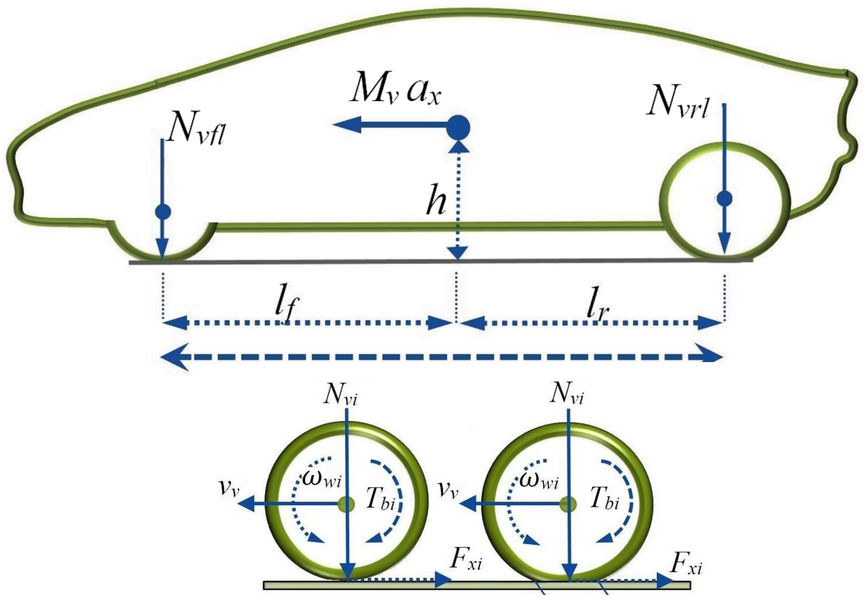
Team

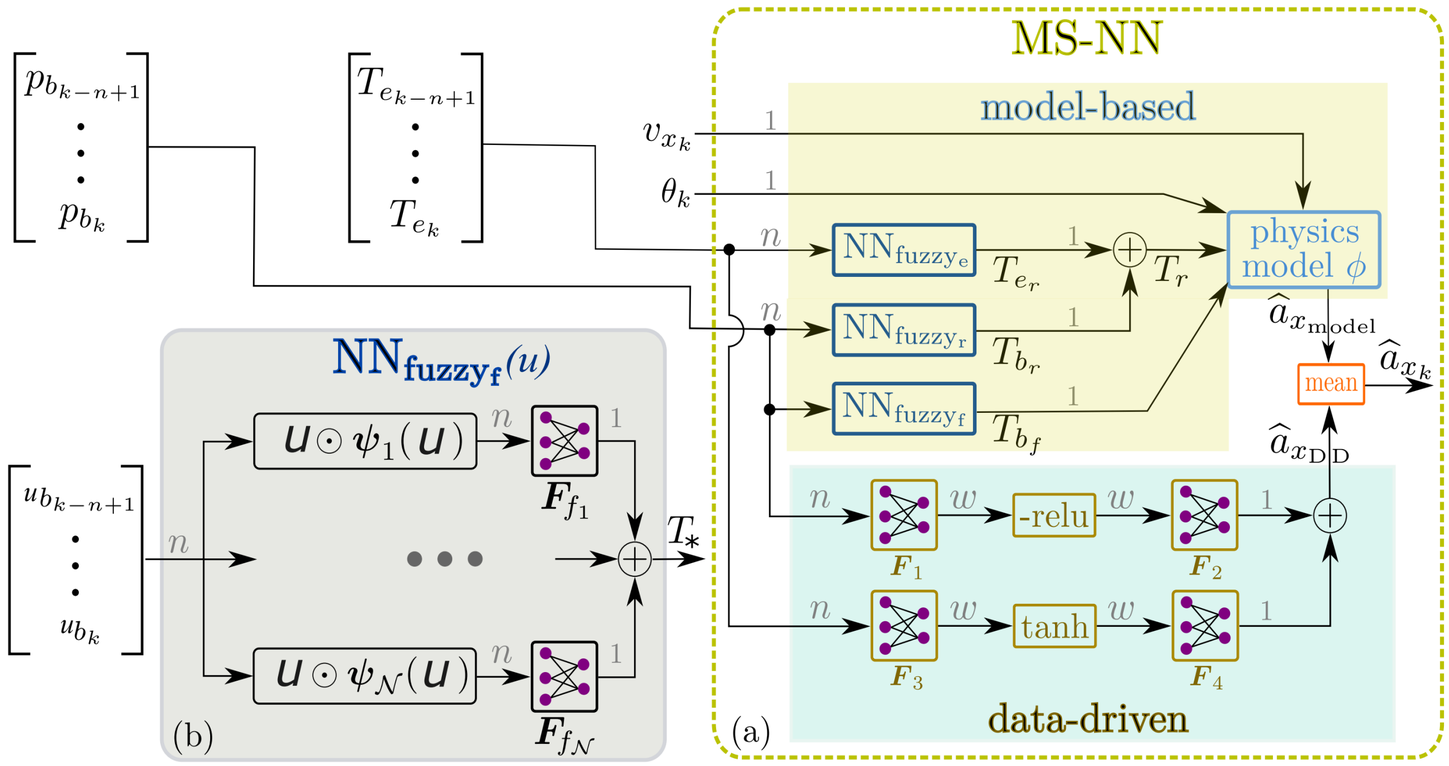
Overview

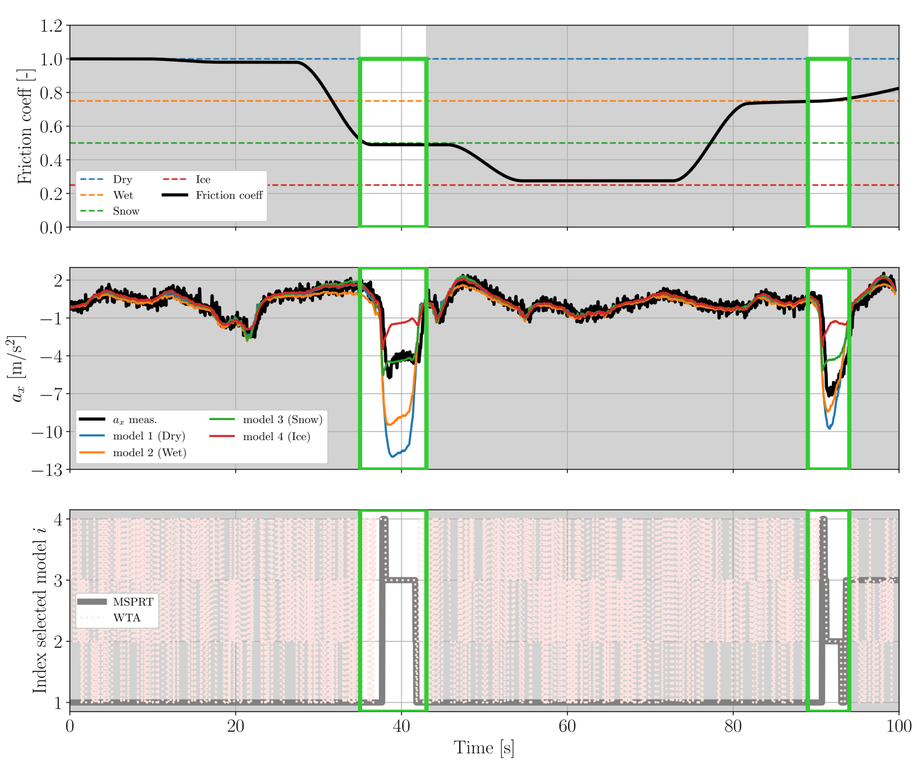
- AI-based framework for **real-time** road condition **identification** using MS-NNs.
- Designed for integration within **digital twin**-enabled vehicle architectures.
- **Multiple MS-NNs** are already trained and then selected online during operation using real-time signals.
- Within a digital twin context, the approach enables continuous synchronization between physical and virtual representations

Motivation, Methodology and Results

- We use **MS-NNs** to model the problem within the ***nnodely*** framework.
- Each MS-NN combines physics-based data-driven components to capture unmodeled effects while preserving physical consistency.
- The framework follows a digital twin **perspective improving predictive capabilities** and system-level decision-making.







(a) The MS-NN Architecture
(b) Local neuro-fuzzy models

Results for road condition identification in a green-highlighted period of reliable identification.

Future Directions

- Integrating the proposed MS-NN framework with **LuGre friction model-based** Non-linear least squares (NLLS) structure within the ***nnodely*** environment.

References

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