Roadside measurements of L-vehicle noise for tampering detection

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L-vehicles Emissions and Noise mitigation Solutions

Contents

Roadside measurements of L-vehicle noise for tampering detection

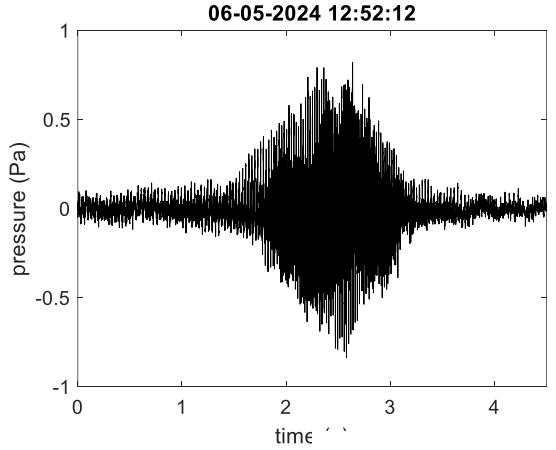
- Commercial roadside measurement systems exist for detecting and identifying loud vehicles
- Tampered L-vehicles are usually louder, but also other factors affect absolute noise levels
- Tampering changes the dynamics of the L-vehicle and – as a result – also the way it sounds
- Tampering detection using roadside noise measurements within LENS:
  - Can tampering be detected based on the characteristics of the sound of a passing L-vehicle?
  - Can the combination with emission factors improve the tampering detection?

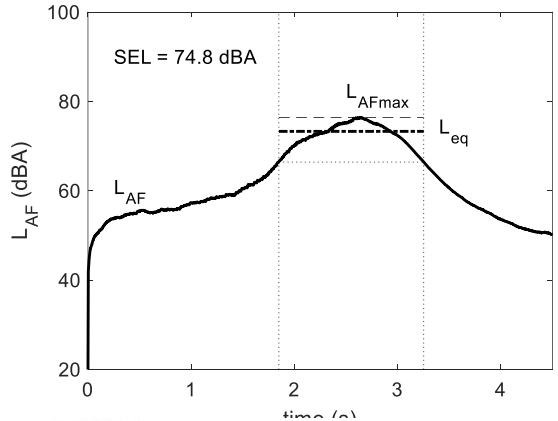
Measurement setup

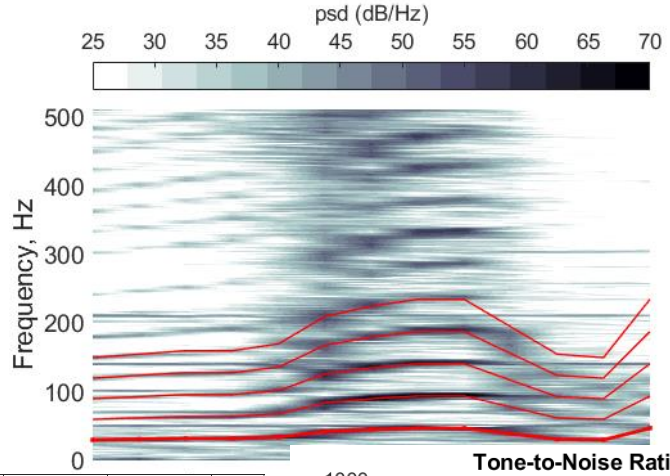
- Linear array with 5 microphones at optimised positions for angle of arrival estimation
- Vehicle detection based on continuous monitoring of sound pressure level (L_{AF})
- Data logging starts and stops automatically when sound pressure level exceeds a threshold
- Battery powered operation
- Alignment to roadside emission measurements via timestamp

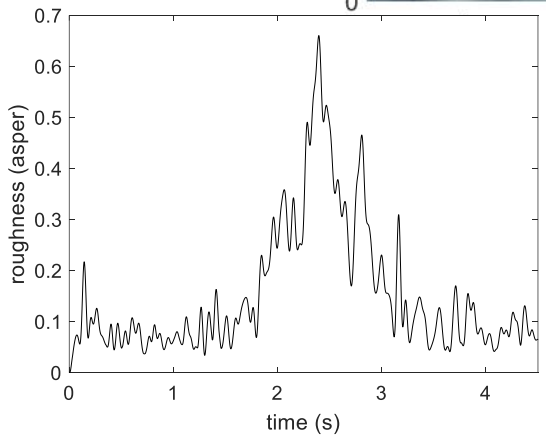
Data processing

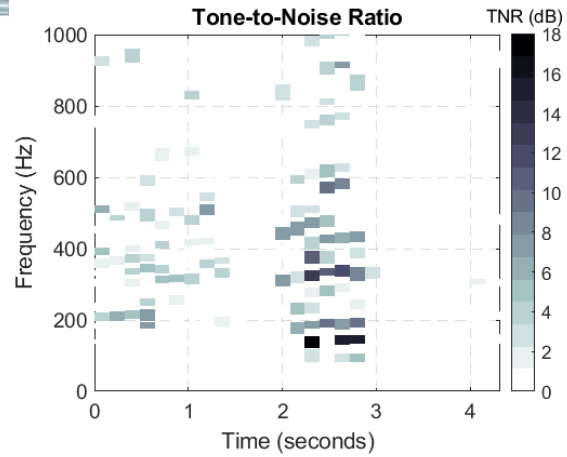
- Measured time signals
- Computation of engineered signal features
  - sound pressure level: L_{AFmax}, SEL, …
  - spectral content and tracking of engine orders
  - psychoacoustic metrics: tone-to-noise ratio, roughness, …
  - signal statistics: rms, variance, kurtosis, skewness, …
- Automatic feature extraction using AI methods











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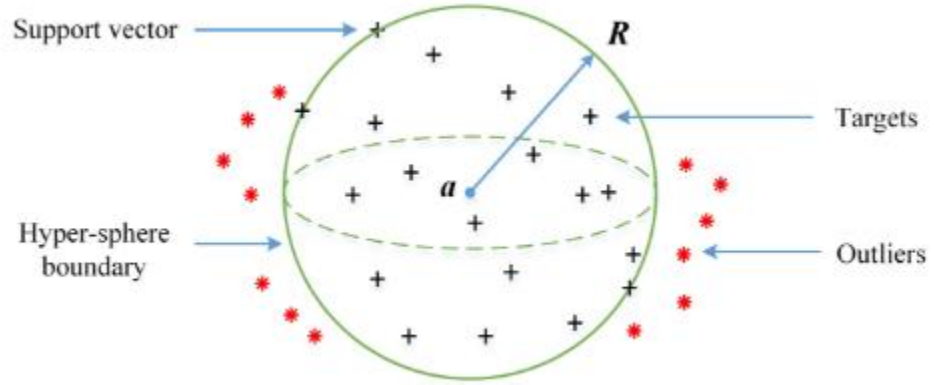
Data processing

- Anomaly detection using semi-supervised learning methods (e.g. (Deep) SVDD, GAN, …)



Liu, C., & Gryllias, K. (2021). A Deep Support Vector Data Description Method for Anomaly Detection in Helicopters. PHM Society European Conference, 6(1), 9. https://doi.org/10.36001/phme.2021.v6i1.2957

Thank you!

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