Roadside measurements of L-vehicle noise for tampering detection

Hervé Denayer



This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101056777



Contents

- Introduction
- Setup
- Data Processing



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

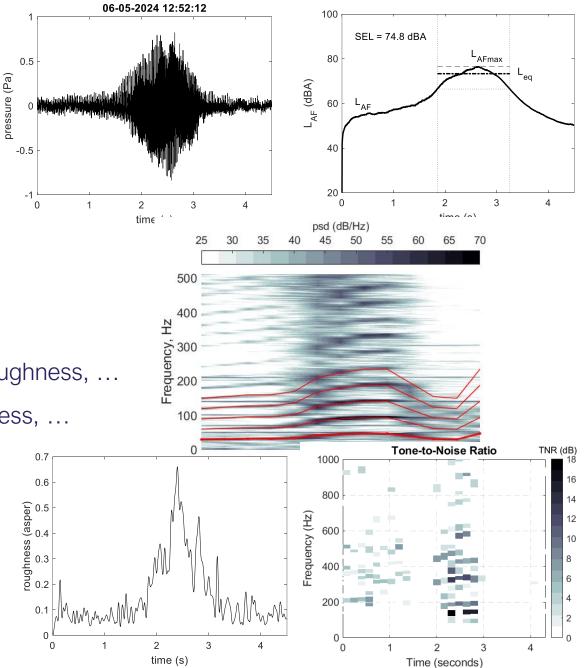
- Linear array with 5 microphones at optimised positions for angle of arrival estimation
- Vehicle detection based on continuous monitoring of sound pressure level $({\rm L}_{\rm AF})$
- Data logging starts and stops automatically when sound pressure level exceeds a threshold
- Battery powered operation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





Data processing

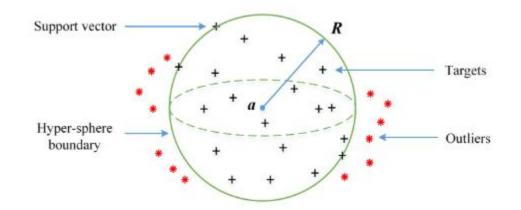
- Measured time signals
- Computation of engineered signal features
 - sound pressure level: L_{AFmax}, SEL, ...
 - spectral content and tracking of engine orders
 - psychoacoustic metrics: tone-to-noise ratio, roughness, ...
 - signal statistics: rms, variance, kurtosis, skewness, ...
- Automatic feature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





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!



Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ac minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.

Contacts

Hervé Denayer KU Leuven herve.denayer@kuleuven.be Konstantinos Gryllias KU Leuven konstantinos.gryllias@kuleuven.be Hongxun Gu KU Leuven hongxun.gu@kuleuven.be

Disclaimer

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the granting authority. Neither the European Union nor the granting authority can be held responsible for them.

Any communication or dissemination activity related to the action must use factually accurate information.



This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101056777

