INFRALERT

Linear infrastructure efficiency improvement by automated learning and optimized predictive maintenance techniques

INFRALERT Deliverable D3.3 **Summary Sheet**

DELIVERABLE TITLE:

D3.3 Hybrid methodology in different asset levels: Contribution to more accurate asset forecasting and nowcasting

WORK PACKAGE:	**Deliverable Leader:**
WP3. Asset Condition ○ **T3.4.** Hybrid models for the nowcasting and forecasting of asset condition	Luleå Tekniska Universitet **Contributing Partners:** Infraestruturas de Portugal, Universidad de Sevilla, CEMOSA, Fraunhofer IVI, DMA

EXECUTIVE SUMMARY:

The overall goal of INFRALERT is to improve the operability and functionality of linear asset transport infrastructures based on large-scale automated condition prediction, intervention alert management maintenance and renewal (M&R) planning to support decision making. An essential development to reach this goal is the development and implementation expert-based system (eIMS) with different toolkits. This report gives a summary of the asset condition toolkit that is designed to perform the fundamental nowcasting and forecasting operations required for alert management, maintenance planning and other decision making.

The aim of the asset condition toolkit is to develop methodologies for linear asset condition assessment and prediction by identifying, processing mapping and representing conditional information for nowcasting and forecasting. The nowcasting aspect focuses on what is known today while forecasting is the process of exploiting past and present data to make deductions about the future.

The key issues addressed in the report are: condition uncertainty, hybrid modelling for more accurate forecasting, and asset condition toolkit description. Various sources and types of uncertainty and relevant approaches for uncertainty modelling are discussed for linear assets. Also, INFRALERT implementation of a suitable model to address uncertainty is presented. Hybrid model entails integration of different prognostic approaches (e.g. physical models, data-driven and or symbolic models) in a systematic way. Generic framework and implementation examples of hybrid models are described. The selection of the approaches to be integrated depends on the amount of data available, existence of domain knowledge, level of known physical theories or model etc. Figure 1 shows possible combinations of different prognostic approaches based on the quantity of data and strength of physical model.

There are several challenges to implement a hybrid methodology approach, specifically:

- unavailability of the physical information/ degradation model for system due to complexity
- lack of conditional data over a longer period
- difficulty in extracting relevant information due to heterogeneity within existing data
- fusing relevant physical information with data-driven approach

- complexity in algorithm development to manage regular tuning of models for accuracy and precision.

To overcome these issues, there are several ways of implementing the hybrid methodology without involving all types of models. Some of them are:

- implementing physical/data-driven/symbolic models at different process steps in modelling approach
- tuning physical and data driven model and incorporate symbolic model wherever necessary.
- physical information assisting in supervising the data driven models

The final part of the deliverable gives a description of the asset condition toolkit with its building blocks, functionality and input-output data requirements.

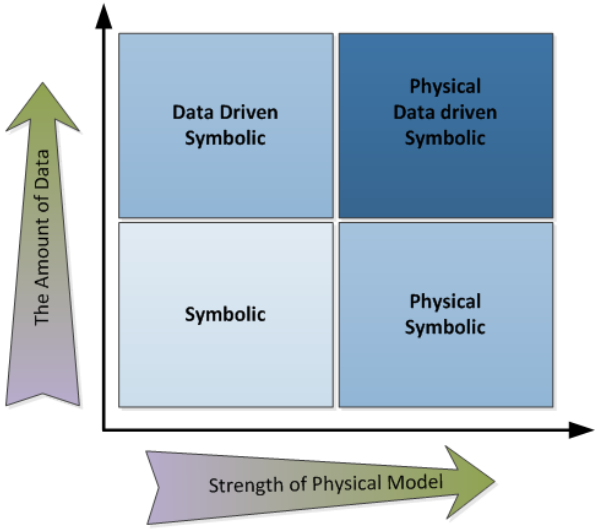

Figure 1: Combination of forecasting approaches

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