ReDi2Service

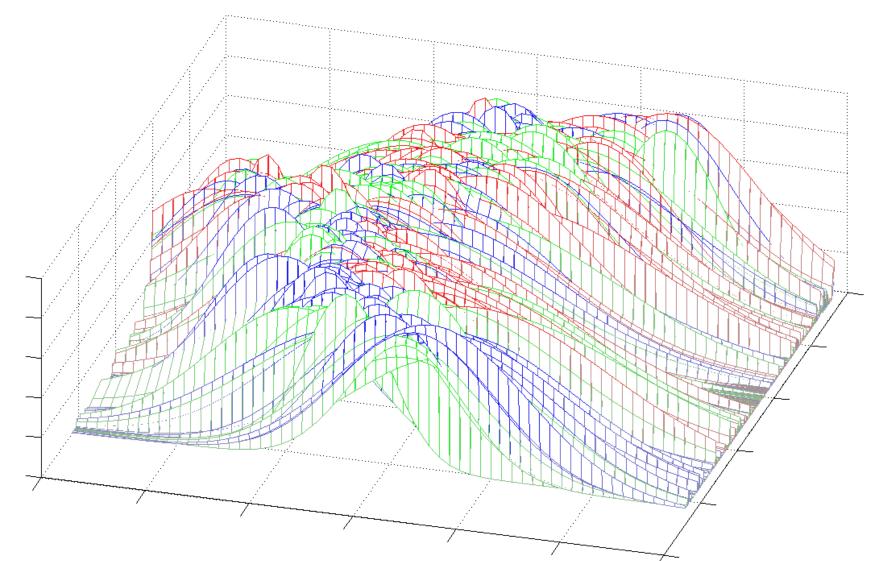
Remote Diagnostic Tools and Services

CAISR Centre for Applied Intelligent Systems Research

Knowledge Foundation

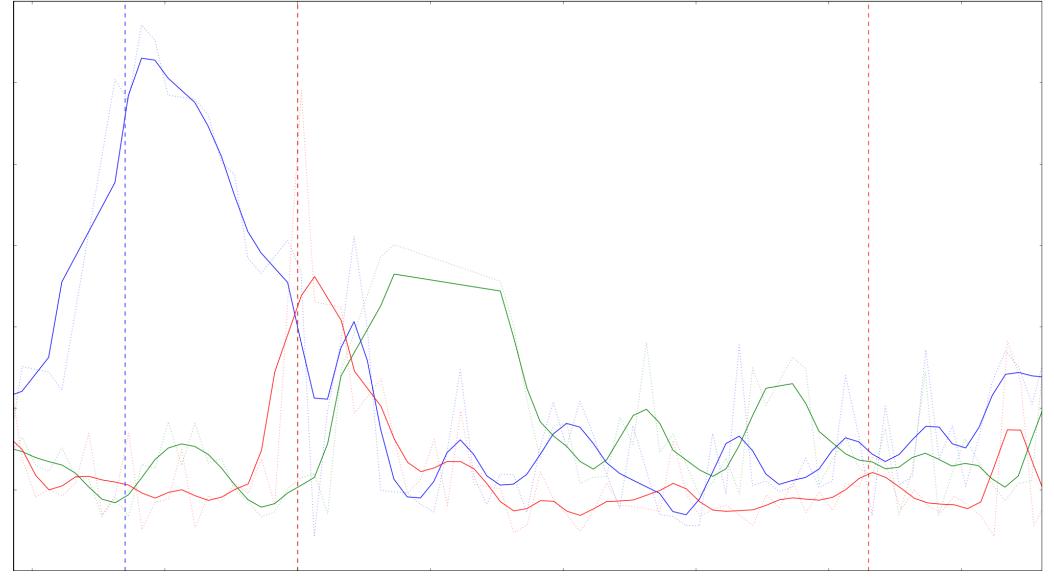
The main idea behind R2S project is to develop algorithms for self-monitoring vehicles, capable of discovering and describing their own operation, as well as detecting deviations from the norm.

By using data mining across many data streams available on-board a modern truck or bus, and by comparing discovered relations across the whole fleet, both faults and component wear can be discovered early and continuously monitored.

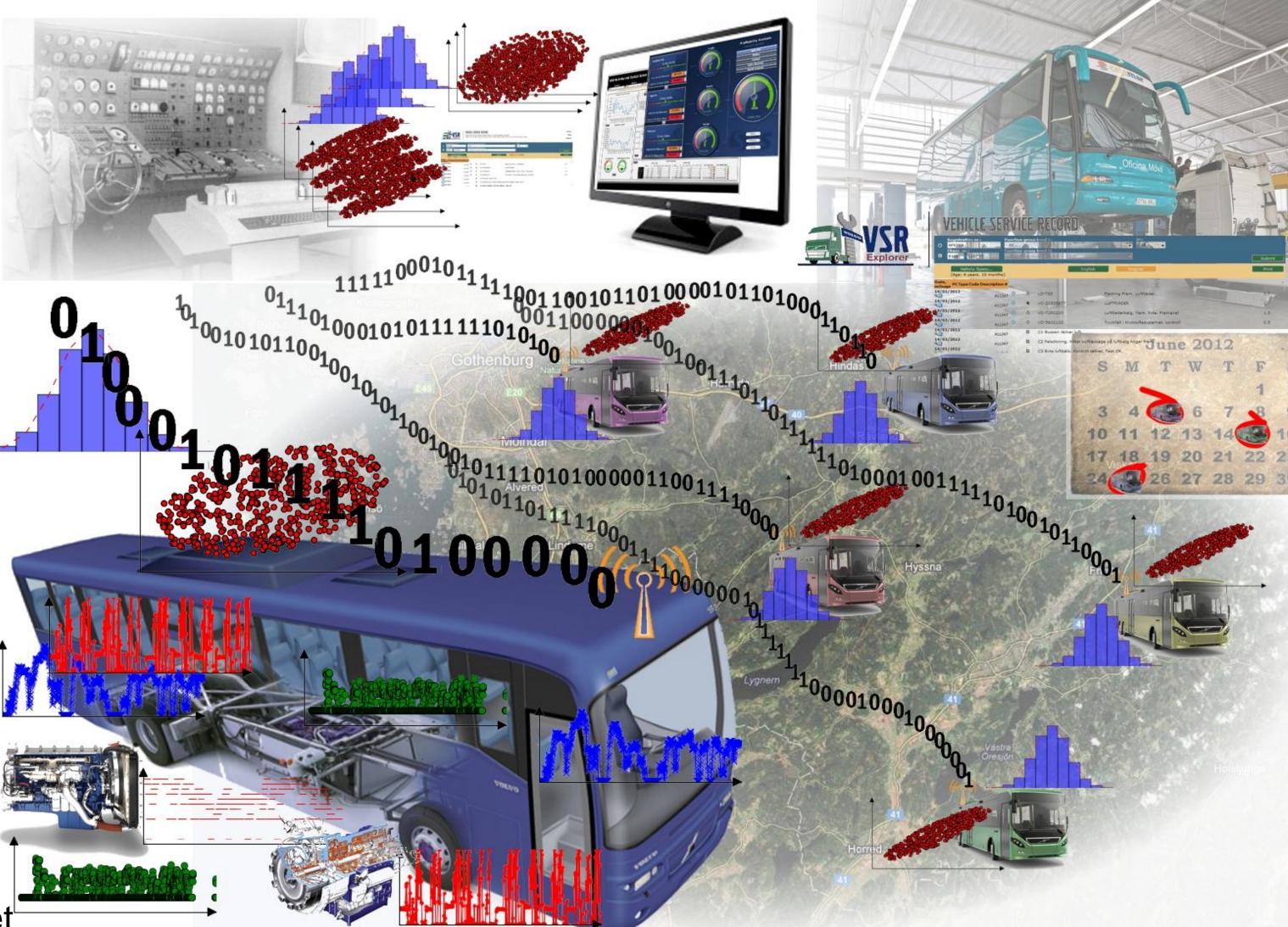


Our research is based on taking advantage of the fleet aspect, since modern trucks as systems are way too complex to be accurately modelled as a whole.

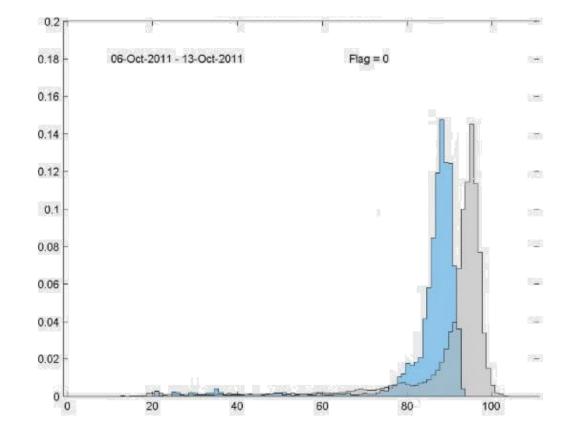
However, if we are focusing on differences between similar individuals, we are able to abstract away a lot of complexity: a good example is the plot above, showing a clear trend in EngineAirInletTemperature histogram. It could indicate a number of problems, but as all vehicles display the same behaviour, it is reasonable to attribute it to ambient conditions, i.e., outside temperature.



It is natural to split the data mining process of discovering how the buses work into two parts. First is unsupervised modelling: finding good descriptions of the data alone. The other part, guided search, is about relating these models to the available external information, such as service records, driver comments and engineering expertise from the vehicle manufacturer. This is definitely a non-trivial task, since the available information is plentiful, but unreliable and typically difficult to use. The plot shows differences in Oil Pressure signal between subsequent days (solid lines), and workshop visits (dotted lines), for three buses. Clearly there is relation, but difficult to capture.



The goal is to model and characterize operation of those vehicles, and to predict their maintenance needs over a lifetime of typically several years. The histogram below shows how the oil temperature deviates in one of the vehicles (blue) compared to the rest of the fleet (grey).



By analysing such deviations across multiple signals and over time, we are able to detect problems with a vehicle (red/yellow area in the table below) and repairs that fix them.



Our system continuously mines the on-board data streams, looking for interesting relationships in them. When non-random relations are found, their parameters are sent to central server or to other vehicles in the fleet. By comparing these parameters and connecting observed deviations with available reference data, we are able to detect faults early and estimate component lifetime.

Project consists of two parts:

Technical part: Development of data collection system, installation in a bus fleet, collection and analysis of data, combining data with various sources of knowledge.

Service development part: Identification of possibilities for service innovation through business analysis, workshops and interviews with different stakeholders.

