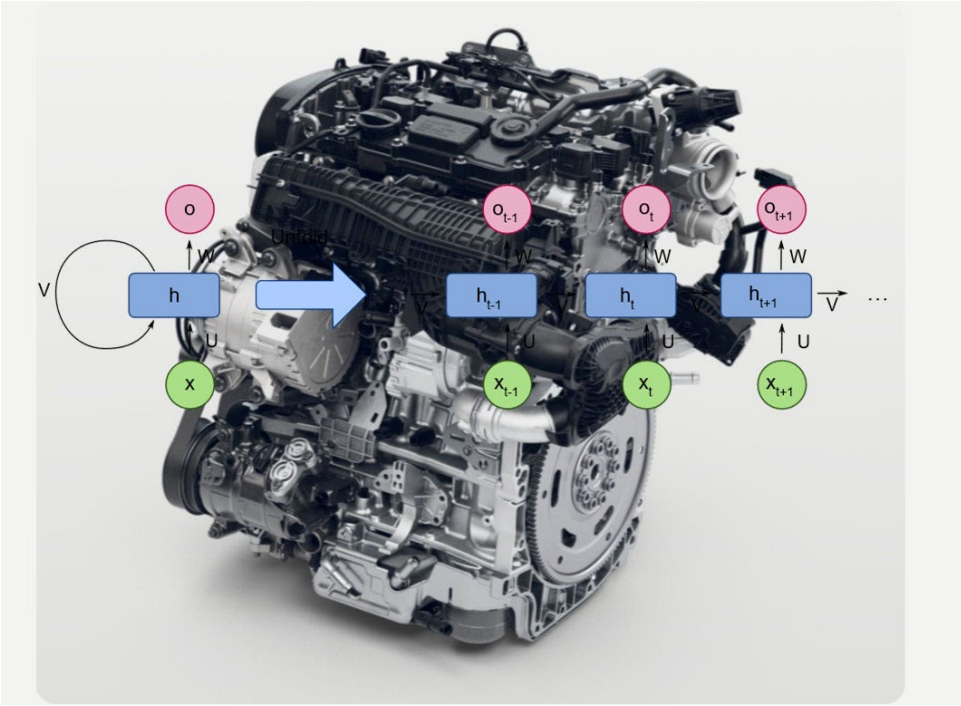
# Empirical Emissions Model using Machine Learning

## Background

At Aurobay, we power the future with sustainable engines and hybrid solutions. To make our work more efficient we develop model-based control and estimation algorithms largely by modelling observable physics. In certain cases, data-driven empirical models are used, both stand-alone and alongside physical models to ensure overall robustness. This thesis work aims at modeling the tailpipe emissions using a black-box or grey-box model using mainly – or only – high-level data such as engine speed, engine torque, and catalyst temperature, including history effects. The model is then compared to new training data that is measured on a powertrain emissions test bench.

Objectives and Activities

- A literature study on machine learning algorithms for time series models, such as NARX or Recurrent Neural Networks
- Select a useful set of input parameters
- Implement some of the approaches (preferably python using TensorFlow)
- Select applicable training and test data from our existing dataset, and identify missing drive cases
- Measure missing training or test data together with our test engineers
- Train the models and choose a good set of hyperparameters
- Benchmark the implemented models against each other, and summarize their pros and cons




RNN image source: https://en.wikipedia.org/wiki/File:Recurrent_neural_network_unfold.svg

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