Temasek Defence Systems Institute

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Modeling of Engine Parameters for Condition-Based Maintenance for MTU series 2000 Diesel Engine

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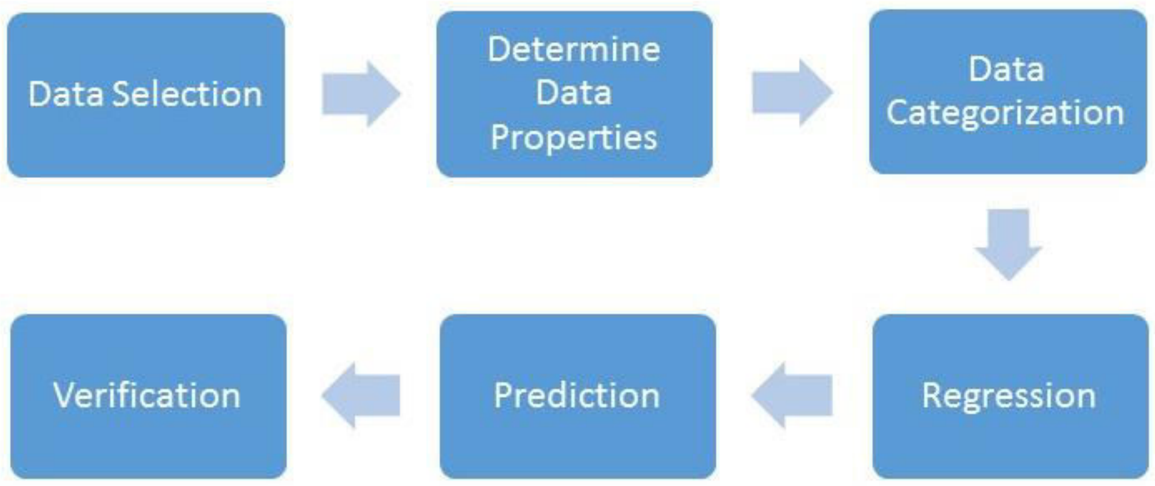
Condition-based maintenance (CBM) entails performing maintenance only when needed to save on resources and cost. Formulating a model that reflects the behavior of the marine diesel engine in its “normal” operating conditions would aid in making predictions of the behavior of a condition monitoring parameter.

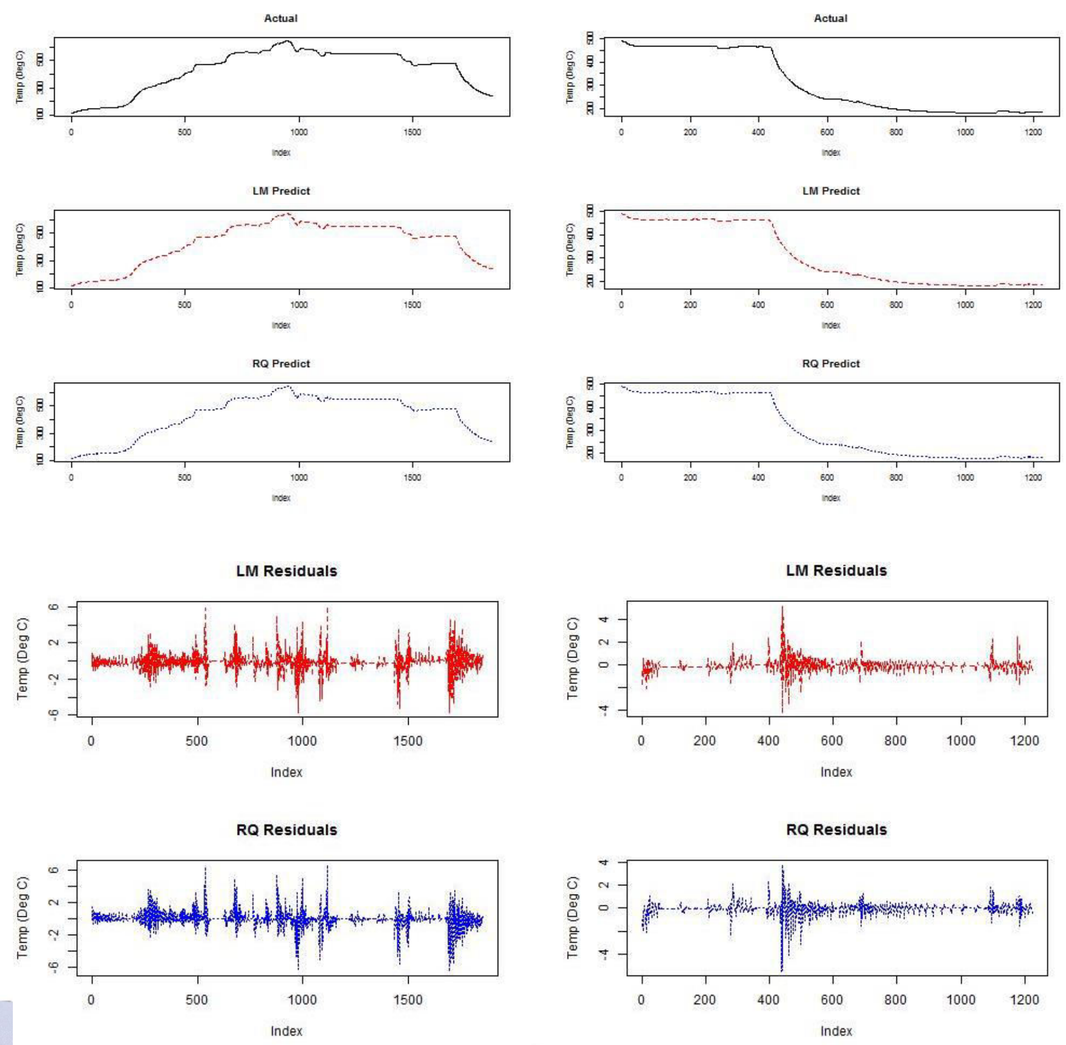


Modeling for CBM is a data-dependent process. Data acquisition, processing, and analysis are required for modeling the behavior of the “normal” operating conditions of the diesel engine. This thesis leverages on existing data collected through sensors on a diesel engine to describe these conditions using regression analysis. The proposed data selection criteria ensure that data used for modeling are suitable.

To model the behavior of the engine, an autoregressive distributed lag (ARDL) time series model of engine speed and exhaust gas temperature is derived. The lag length for ARDL is determined by whitening of residuals using the autocorrelation function.

$$Y_t = \mu + \sum_{i=1}^{p} \gamma_i Y_{t-i} + \sum_{j=0}^{r} \beta_j X_{t-j} + \varepsilon_t$$

Due to non-normality of the residuals, a nonparametric quantile regression approach is adopted, and the derived model allows us to predict the parameter (exhaust gas temperature) that we consider.



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