PhD Thesis/Thèse CIFRE Volvo (Lyon)/GIPSA-lab (Grenoble)

Titre: Modelling and optimizing predictive maintenance of multi-component systems under logistics, circularity and customers constraints : application to industrial vehicles

Laboratoire d'accueil : GIPSA-lab - Univ. Grenoble Alpes & CNRS - Grenoble
Entreprise : Volvo - Group Trucks Technology – Lyon (Saint-Priest)
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Candidature en ligne au lien/Application :
https://www.volvogroup.com/fr/careers/job-openings/139190BR.html

Maintenance management is a key activity for the customer to ensure the availability of his trucks at a good state and secure the profitability of his business. At Volvo, in Technology and Service Development (TSD) department, the team develops technology and services enabling innovative, efficient, and effective aftermarket solutions to ensure up-time and address maintenance problems.
Within the Volvo Group, the maintenance of the components can be handled on two different ways: preventive maintenance or predictive maintenance. For preventive maintenance, replacement intervals are defined based on the vehicle configuration and usage indicators. Predictive maintenance is based on predictive models that are developed using vehicle data to estimate the degradation level, and eventually the failure time.
However, decisions related to maintenance operation dates are still not fully optimized and are made by customer service representatives (CSR) in charge of the maintenance schedule at the workshop.
Optimizing the maintenance schedule by integrating both preventive and predictive maintenance is the main objective to reach in the coming years and other constraint must be considered as well:

- Logistic constraints. It encompasses the spare parts availability, the availability of the maintenance workshops and the maintenance teams.
- Circularity constraints: when replacing a component, we can have access to new spare parts or spare parts that have been through remanufacturing to restore their health state as best as possible. Replacing a failing component by either a new one or a remanufactured one has an impact on the maintenance cost and on the prediction of the next maintenance operation.
- The last one is related to customer constraints to consider unavailability time-period for the maintenance to be performed or constraint on the fleet that must remain available when one of the trucks is in maintenance.

The goal of this research project is to model and optimize maintenance schedules and maintenance decision-making in a quantitative way, that accounts for the different mentioned constraints and for the uncertainties related to vehicle usage and the predictive maintenance models.
Hard skills:

- Fluent in English and in French
- Data analysis in Python (Pyspark, pandas, numpy, plotly, seaborn, …)
- Optimization methods (linear programing, multi-integer problem, …)
- Reliability analysis and Degradation modeling (Weibull, Gamma process, Wiener process, …)
- Knowledge about Azure Platform would be a plus.

Soft skills:

- Critical thinking
- Autonomy and proactivity
- Good communication and capacity of explaining difficult concepts for non-technical audiences.