ML-based solution for hydraulic system

Solution highlights

- ML-powered solution for predicting degradation levels in the hydraulic system
- Average prediction accuracy of 98% in the ML models
- Achieved lower probability of unexpected downtime by the hydraulic system and, thus, better maintenance
- Training sessions with the personnel to teach how to use the solution in their everyday work

Business challenge

A large manufacturing company reached out to us in search of a solution for the repeated malfunctioning of the specific components of their hydraulic system (cooler, valve, pump, and hydraulic accumulator). The four components used to breaking down periodically, disrupting the whole hydraulic system and stopping the operation of the entire facility. As a result, the manufacturer experienced heavy financial losses.

Solution

Within the scope of our cooperation, Intelliarts implemented a **machine learning-based system** that could predict the degradation level of specific components with a high level of accuracy. The solution was composed of four separate ML models for each of the components with an **average prediction accuracy of 98%.**

| Reservoir | Pump / Motor | Valves | Actuator |
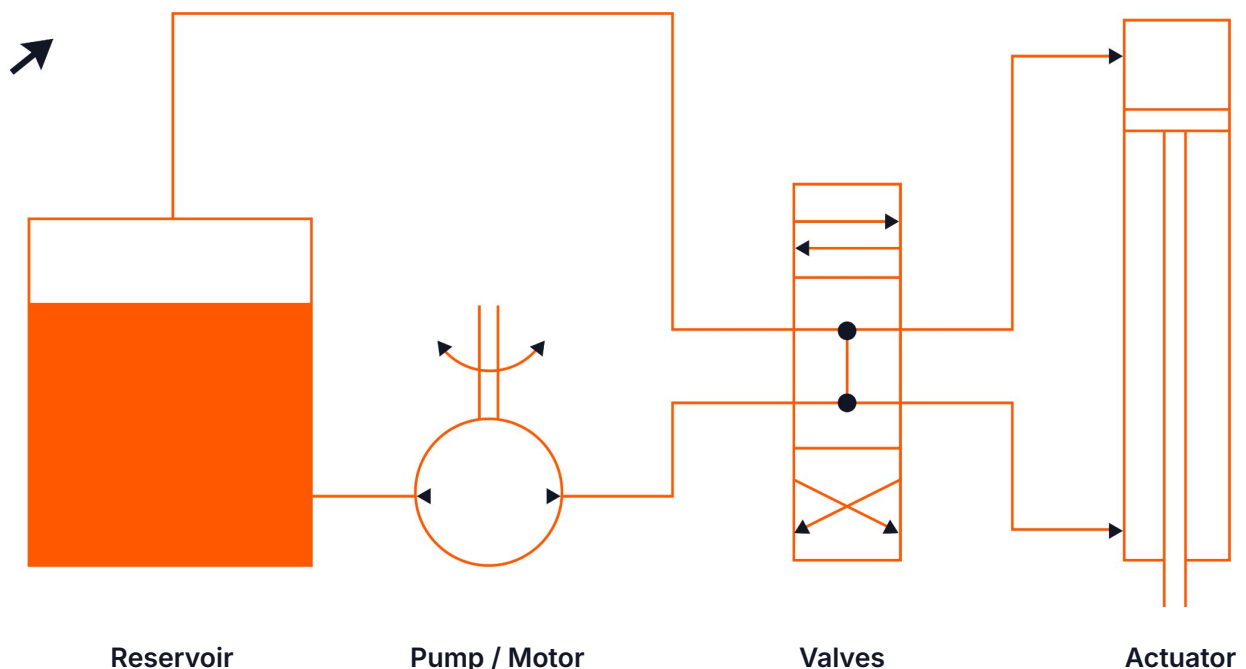
As the project progressed, we:

- Processed the records from IIoT sensors in the dataset and conducted detailed data analysis to make sense of the data by uncovering trends and patterns

- Solved the problem of model overfitting caused by a huge amount of features in the system. This issue was critical to solve because it could affect the model's ability to generalize

- Experimented with different algorithms until we chose the XGBoost classifier, StratifiedKFold, and RandomForestClassifier algorithms. These proved to be the best fit for the prediction models

- All these actions allowed us to increase the prediction accuracy on test sets to 98% for each of the four ML models

After deploying the models, our team also developed API endpoints, triggered after each load cycle of the system. This should help the customer with the model monitoring to identify when the performance drops, and the model requires retraining or tuning.

Results

Our customer was completely satisfied with the results. Here are some of the project outcomes:

- At the end of the project, we provided the customer with the efficient ML solution that could help the manufacturer predict malfunctions of the components of the hydraulic system and, thus, ensure proper equipment maintenance.

- The solution proved to be almost 100% accurate in the results.

- The implemented ML system helped to lower the probability of unexpected downtime experienced by the hydraulic system.

- Together with the management of the company, we conducted training sessions to educate the personnel on how to use the ML solution in their day-to-day procedures.

The Intelliarts team continues to keep in touch with the company so if they notice any significant changes in the data, we're always ready to assist and retrain the models.

Related reading: Machine learning solution for a Hydraulic system

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