Sensor Fault Detection using ML

Problem Statement

The Air Pressure System (APS) is a critical component of a heavy-duty vehicle that uses compressed air to force a piston to provide pressure to the brake pads, slowing the vehicle down. The benefits of using an APS instead of a hydraulic system are the easy availability and long-term sustainability of natural air.

This is a Binary Classification problem, in which the affirmative class indicates that the failure was caused by a certain component of the APS, while the negative class indicates that the failure was caused by something else.

Solution Proposed

In this project, the system in focus is the Air Pressure system (APS) which generates pressurized air that is utilized in various functions in a truck, such as braking and gear changes. The datasets positive class corresponds to component failures for a specific component of the APS system. The negative class corresponds to trucks with failures for components not related to the APS system.

The problem is to reduce the cost due to unnecessary repairs. So it is required to minimize the false predictions.

The total cost to be predicted by the model is the sum of *Cost_1* multiplied by the number of instances with type 1 failure and *Cost_2* with the number of instances with type 2 failure, resulting in a *Total_cost*. In this case *Cost_1* refers to the cost that an unnecessary check needs to be done by a mechanic at the workshop, while *Cost_2* refers to the cost of missing a faulty truck, which may cause a breakdown.

- `Total_cost = Cost_1 * No_Instances + Cost_2 * No_Instances.`

Mahesh Kankrale

Solution Proposed

From the looks of the problem statement it's very evident that cost due to unnecessary repairs has to be brought down to crest and as such the false predictions. More importantly, emphasis is to be placed on reducing the false negatives, as cost incurred due to them -- missing a faulty vehicle due to whatever reasons -- is 50 times higher than the false positives and also because if missed even by mistake, then the vehicle may have severe breakdown leading to much bigger problems.