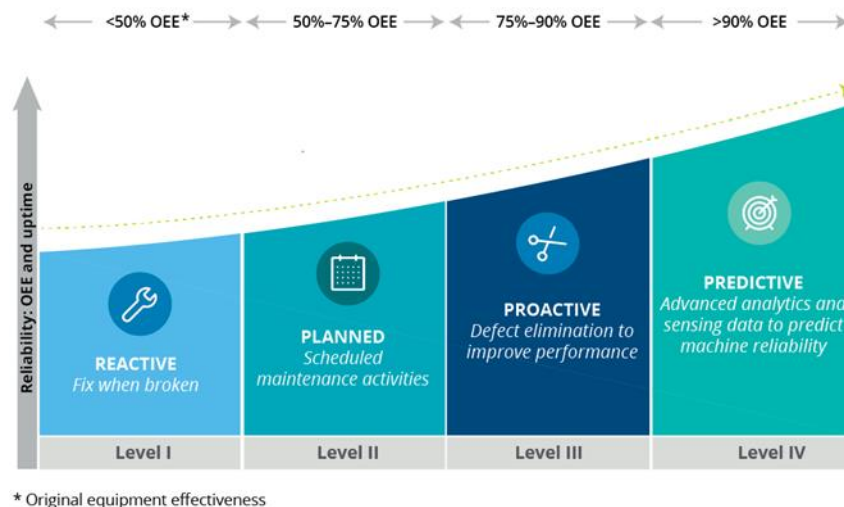


INDUSTRY 4.0 PREDICTIVE MAINTENANCE

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Background The mechanization of the manufacturing industry powered by the steam engine announced the arrival of Industry 1.0. This was followed by Industry 2.0 with the invention of the assembly line, and Industry 2.0 was in turn followed by Industry 3.0 with the application of computers automating the control and operation of manufacturing machines. Industry 4.0 leverages the data from the sensors connected to these computers to gain insight in how best to optimize overall equipment effectiveness or OEE.



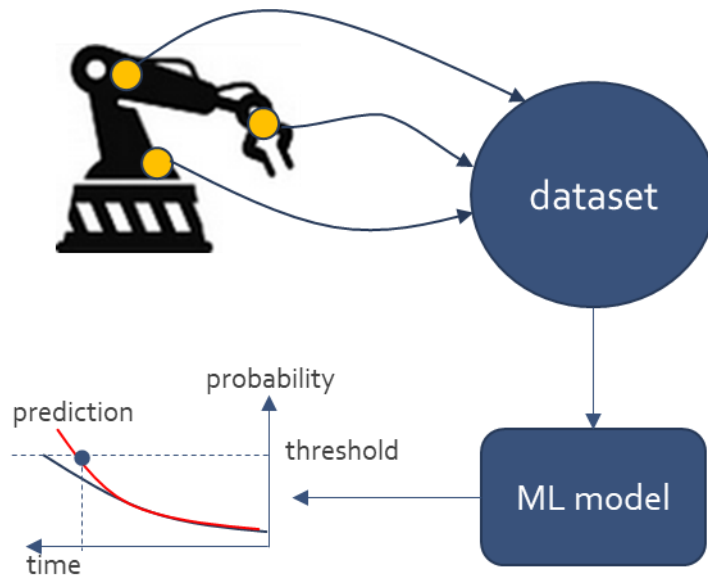
Predicting when exactly to schedule maintenance of a piece of manufacturing equipment optimizes its availability, performance, and yield, the three components by which OEE is measured. The higher the accuracy, the higher the OEE percentage and since predictive maintenance uses sensor data from the machine, e.g., vibration, noise, temperature, etc., it can optimize OEE better than reactive, planned or proactive maintenance strategies.

The Challenge The client needed to predict the date at which a machine in a production plant will need maintenance at an accuracy at least as good as an experienced machine operator.

The Process The set of attributes that affected the operation of the machine were identified and the machine was equipped with appropriate sensors to acquire the data. A data set was generated that covered the range of normal to abnormal machine operation. An ML model was trained on a training dataset and a validation dataset was used to validate the trained model. Senzo Labs provided guidance to the client's engineers on generating the datasets, the model selection, training, and validation.

The Solution Under ideal conditions the ML model's predictions would follow a predictable path. However in practice the conditions keep changing and therefore the model must be trained constantly. This is not always practical. Therefore Senzo Labs enhanced the ML model with an innovative

algorithm that can react in real-time to changes in conditions without the need for extensive model retraining.



The Outcome This practical ML model implementation resulted in an accuracy of 99.99%, among the highest in the industry and better than humanly possible. Equally important, the ML model could be trained in far shorter time than the years it takes for a human operator to internalize the signals emitted by the machine to make accurate predictions.