Decisions:

- Scheduling predictive maintenance tasks
- Ordering parts for replacement which are predicted or already needed to be done
- Adjusting machine operating parameters to correct value
- Stopping the machine for immediate repair whenever needed

Making Predictions:

- Real-time dashboards displaying predicted failure probabilities
- Automated alerts for maintenance technicians
- Automatic warning when predicted timeline is close
- Integration with computerized maintenance management systems
- Visual alerts of defects on a screen

ML Tasks:

- Predictive maintenance
- Predicting remaining useful life based on output data
- Predicting failure probability within a timeframe by processing signals
- Identifying deviations from difference between i/p signals and desired o/p
- Object detection by visual data.

Offline Evaluation:

Metrics based evaluation of-

- Mean squared error (MSE), root mean squared error (RMSE).
- Precision, recall, F1-score, AUC.
- Cross-validation

Value Propositions:

Identifying unplanned machine downtime due to damaged parts, leading to production losses and increased maintenance costs.

Its important because minimizes downtime,optimizes maintenance schedules, reduces costs, and improves overall equipment effectiveness.

Users of system are maintenance technicians, plant managers, production supervisors

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Benefits of this are proactive identification of at-risk parts, enabling timely maintenance and preventing costly breakdowns.

Data Source:

Some raw data we can use are:

- Sensor data for different measurements
- Previously performed maintenance records for quick identification
- Machine operational data for checking performance
- Environmental data
- Visual data

Features:

- Extraction of statistical features from sensor data
- Frequency domain analysis of vibration data
- Creation of time-series features Feature scaling and normalization.
- Image processing to identify visual defects.

Data Collection:

We can collect data from:

- Installation of IoT sensors on critical machine parts
- Integration with existing machine control systems
- Digitalization of maintenance records
- Implementation of a data acquisition system.

Building Models:

- With the help of different algorithms
- Useful life: Linear regression & random forest regression.
- Predicted failure in timeframe: logistic regression, support vector machines, deep learning like RNNs, LSTMs
- Anomaly detection: isolation forests, autoencoders.
- Object detection: YOLO, or other convolutional neural networks.
- Model training and validation using historical data.
- Thus, continuous model retraining with new data.

Evaluation and Monitoring:

- Tracking actual failure rates vs. predicted failure rates based on previous records
- Monitoring sensor data for anomalies
- Measuring the impact of predictive maintenance on downtime
- Monitoring the accuracy of visual defect detection