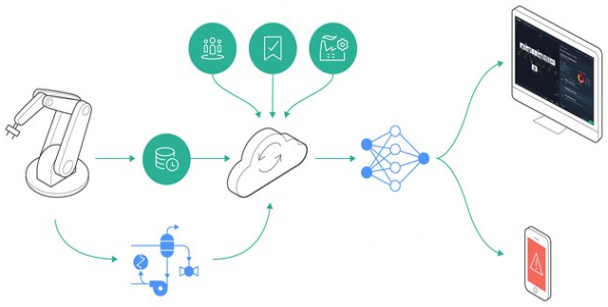
AI-based Predictive Diagnostics for Industry 4.0

A practical application on Roller Bearings



Abstract

This technical whitepaper is aimed at providing an overall overview of an **AI-based predictive maintenance** platform, developed by ZIRAK, applied to a Roller Bearing diagnostics environment. Through the usage of neural networks and machine learning methodologies, the platform is able to report the health status of the machinery in use and predict the foreseeable lifespan of the various components. This allows to optimize maintenance tasks and production processes within the factory, reduce losses due to unscheduled stoppages and minimize manufacturing-line downtimes.

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1. Introduction to maintenance techniques

1.1Legacy procedures

The maintenance practices that are commonly followed on industrial machinery, including those roller bearing based, are either reactive or preventive, that is to say, components are replaced either when they fail or after a certain amount of time that is a function of their expected lifespan.

This brings forth two main unhealthy scenarios: maintenance can happen **too late** or **too soon**:

- There's **no planning** associated with replacing components when they have failed, generating production stoppages and economic losses that are unaccounted for;
- Even though mechanical components are usually built to last a lifetime, the effect of external forces from the machines they are in leads to **seemingly** random unavoidable damage.

1.2.Impact of Industry 4.0

Industry 4.0 is aimed at creating intelligent factories where manufacturing technologies are upgraded and transformed by cyber-physical systems (CPSs), Internet of Things (IoT), and cloud computing.

The entire product life cycle can be facilitated by using various smart sensors, adaptive decision-making models, advanced materials, intelligent devices, **machine learning techniques** and **data analytics**.

By combining embedded production system technologies and intelligent processes, Industry 4.0 lays the foundation of a **new technological age**. Through these upcoming enhancements, industry and production value chains, as well as the associated business models, will be drastically transformed.

When applying **Industry 4.0** principles, the possibility of adequately scheduling maintenance for industrial machinery becomes reality. This allows maintenance operations to transition from reactive or preventive to **predictive**, ultimately leading to stoppage times and economic losses reduction.

Figure 1. Reactive, preventive and predictive maintenance comparison.

This whitepaper aims at demonstrating a practical application example of the usage of Predictive Maintenance and Artificial Intelligence techniques to the Industry 4.0, which is the **Damage prediction and diagnostics on Roller Bearings based machineries**.

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