**Manufacturing Industry 4.0 : Classification of Mechanical Faults using Machine Learning Techniques**

The advent of Industry 4.0 has revolutionized the manufacturing sector, emphasizing automation and data exchange in production technologies. In this context, the detection and classification of mechanical faults are critical for maintaining optimal operational efficiency. Statistics indicate that unplanned downtimes due to mechanical failures can cost manufacturers up to $50 billion annually. Accurate fault detection can mitigate these losses by enabling predictive maintenance strategies. As manufacturing systems become more complex, traditional fault detection methods struggle to keep up with the volume and variety of data generated. There is a pressing need for automated solutions that can analyze this data in real-time. Machine learning offers a promising avenue to address these challenges by leveraging historical and real-time data to predict and classify faults accurately. This shift towards data-driven maintenance can significantly reduce downtime and maintenance costs. Manual fault detection methods are often time-consuming and reliant on human expertise, which can introduce inconsistencies and errors. These approaches typically involve routine inspections and scheduled maintenance, which may not always align with actual machine health. Additionally, manual methods can fail to detect early signs of faults, leading to unexpected breakdowns. The subjective nature of human inspections also limits the scalability and repeatability of fault detection processes. Our proposed solution employs machine learning techniques to classify mechanical faults using a dataset of various operational parameters, including rpm, motor power, torque, and temperatures. By training ML models on this dataset, we can develop a predictive maintenance system that identifies potential faults in the radiator component before they lead to significant failures. This approach aims to enhance the accuracy and timeliness of fault detection, enabling more proactive and cost-effective maintenance strategies in the manufacturing industry.