University of Patras

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Diploma Thesis

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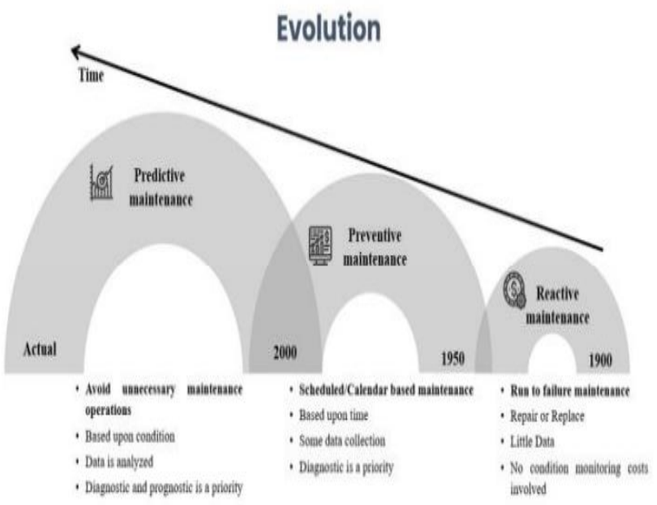
Patras,2025

Title: Predictive Maintenance and Lifecycle Assessment in Overhead Cranes.

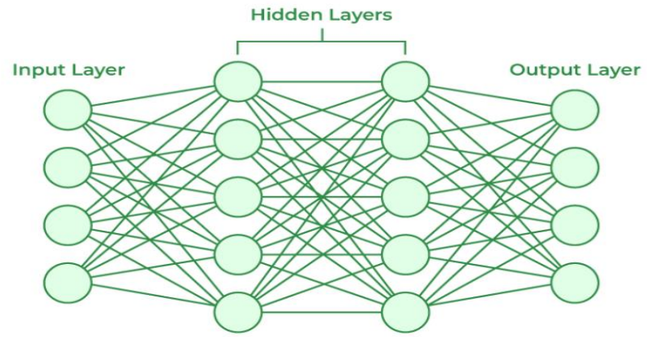
Abstract

This thesis examines the application of predictive maintenance in industrial equipment, highlighting its benefits compared to traditional maintenance methods and how technological advancements contribute to the efficiency and reliability of components. Specifically, it focuses on the environmental impact generated during the life cycle of hoists and the motors of an overhead crane, emphasizing the stages of use and maintenance. Data analysis using artificial neural networks allows for the extraction of mathematical relationships between variables such as pressure and wear, leading to accurate estimates of the remaining useful life of systems. These estimates are used to connect with two scenarios: the first examines traditional maintenance and its associated carbon dioxide emissions, while the second concerns predictive maintenance and the reduction of environmental impacts. With predictive maintenance, components do not reach the point of failure, thus reducing the need for the production of new spare parts and consequently the environmental burdens, enhancing the sustainability of industrial processes in overhead cranes.

Predictive Maintenance Evolution



Artificial Neural Networks

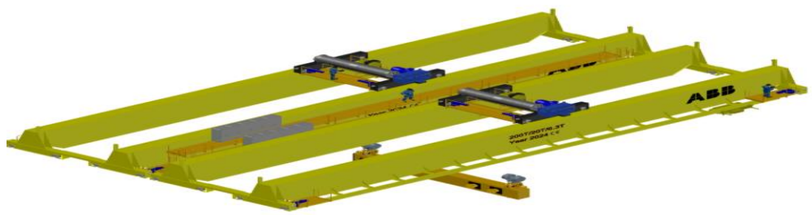


i) **Better Adaptation to Complex Data**: Nonlinearity allows for analysis and prediction in scenarios where relationships between variables are not simple or direct.

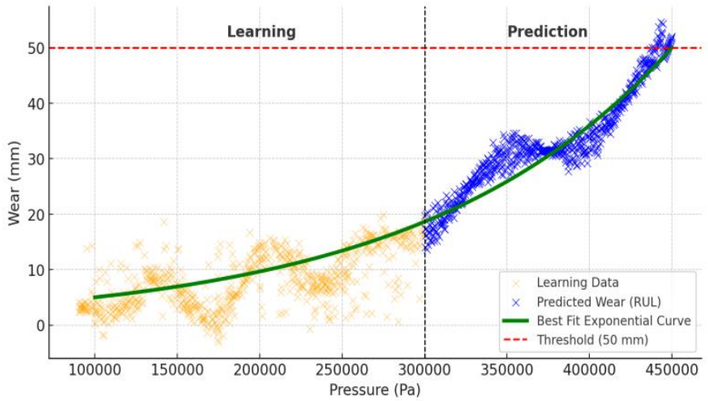
ii) **Improved Effectiveness in Predictive Models**: Models that account for nonlinear relationships can better adapt to the variability of data.

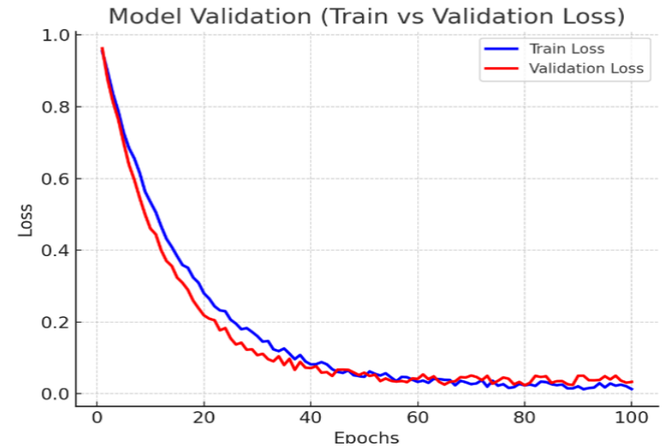
iii) **Flexibility in Data Exploration**: Nonlinear analysis techniques enable the exploration and discovery of new patterns or correlations in data that might not be apparent through linear methods.

iv) **Increased Accuracy in Performance Estimation**: Understanding and incorporating nonlinear relationships in models can help in more accurately assessing their real performance. Models that account for such dynamic relationships are often better suited to interpret complex data and real-world scenarios, avoiding oversimplification or underestimation of significant fluctuations.



Remaining Useful Lifetime Estimation





Conclusions

Predictive maintenance revolutionizes industrial equipment management by anticipating failures before they occur, significantly reducing downtime and maintenance costs. By utilizing advanced data analytics and machine learning techniques, it enables precise predictions of equipment failure, thus optimizing maintenance schedules and extending equipment life. This proactive approach not only enhances operational efficiency but also contributes to sustainability by preventing wasteful resource use. Also, improves safety standards by ensuring that potential hazards are identified and addressed promptly, thereby protecting workers and minimizing the risk of accidents in the workplace.