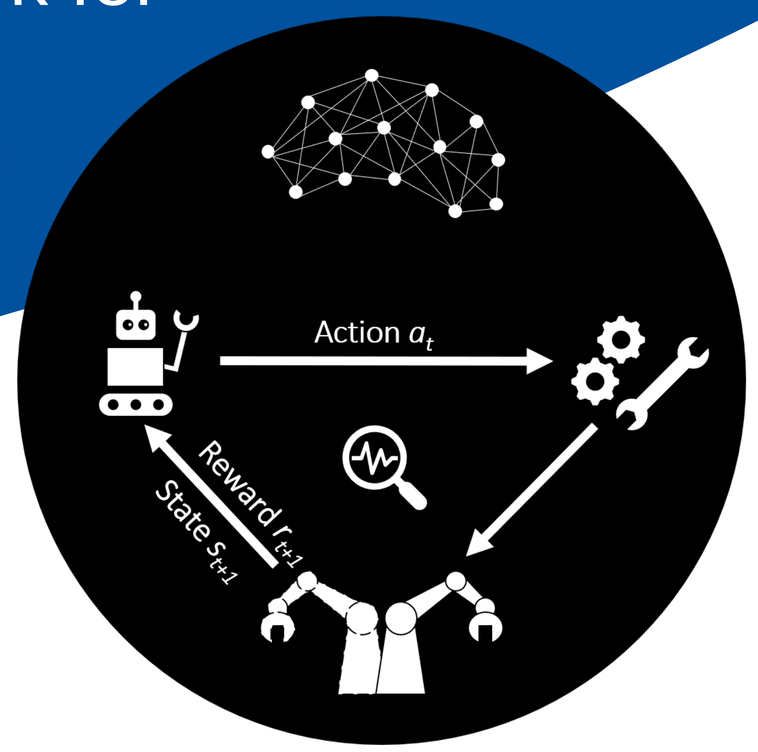
UNI STUTTGART

Fachbereich
Zuverlässigkeitstechnik

Development of a Framework for Adaptive Operational and Maintenance Strategies with Artificial Intelligence



Motivation

In the face of growing demands for resource efficiency, sustainability, and reliability, traditional operational and maintenance strategies are reaching their limits. Increasing digitalization and the use of modern technologies like digital twins and reinforcement learning are creating new potentials to dynamically and flexibly adapt operating conditions and maintenance measures. These approaches promise higher system availability, optimized resource utilization, and a reduction of costs and environmental impacts.

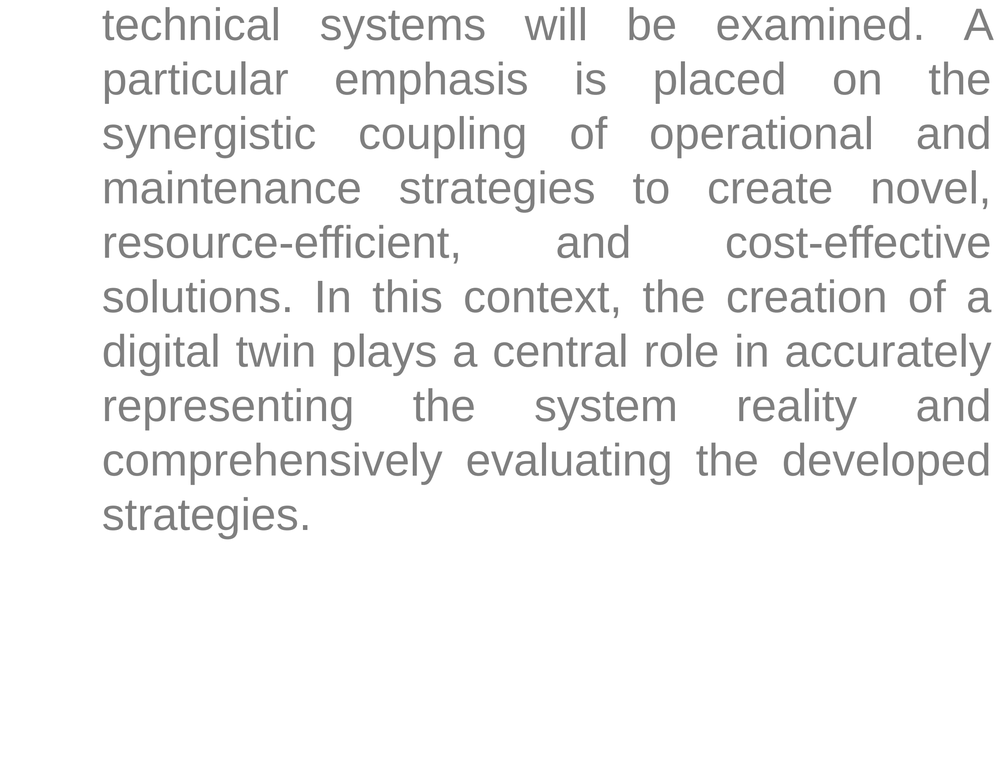
Challanges

Integrating real operational data into digital twins, adapting reinforcement learning agents to different application scenarios, and selecting appropriate network architectures present central challenges. Additionally, the scalability of the strategies and ensuring their efficiency and robustness are crucial concerns.

Research Objectives

The overarching research goal is the development of an innovative and flexibly deployable framework that dynamically controls adaptive operational and maintenance strategies using a reinforcement learning agent. The focus is on optimizing key objectives such as system availability, cost reduction, and sustainability.

The feasibility of this approach will be demonstrated through detailed simulation studies, while its transferability to various technical systems will be examined. A particular emphasis is placed on the synergistic coupling of operational and maintenance strategies to create novel, resource-efficient, and cost-effective solutions. In this context, the creation of a digital twin plays a central role in accurately representing the system reality and comprehensively evaluating the developed strategies.



Universität Stuttgart
Institut für Maschinenelemente
www.ima.uni-stuttgart.de

giuseppe.mannone@ima.uni-stuttgart.de
Institut für Maschinenelemente
Fachbereich: Zuverlässigkeitstechnik

Pfaffenwaldring 9, D-70569 Stuttgart, Germany

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DFG Deutsche Forschungsgemeinschaft