

Stochastic optimization of predictive maintenance under uncertainty

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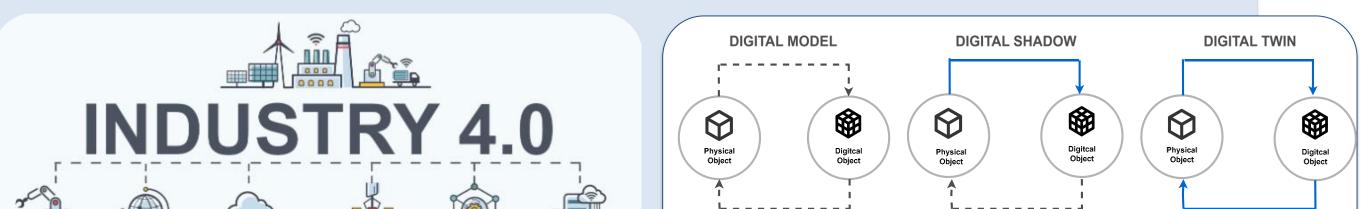
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Stochastic optimization of predictive maintenance under uncertainty

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- Industry 4.0: \bullet
 - Heightened complexity in industial systems
 - Need for real-time decision-making
 - Investigate data-driven optimizations



2 Objectives & Scientific Challenges

Uncertainty handling:



Data Uncertainty Missing data Unstable sensors

Environment Uncertainty Operating conditions External environment

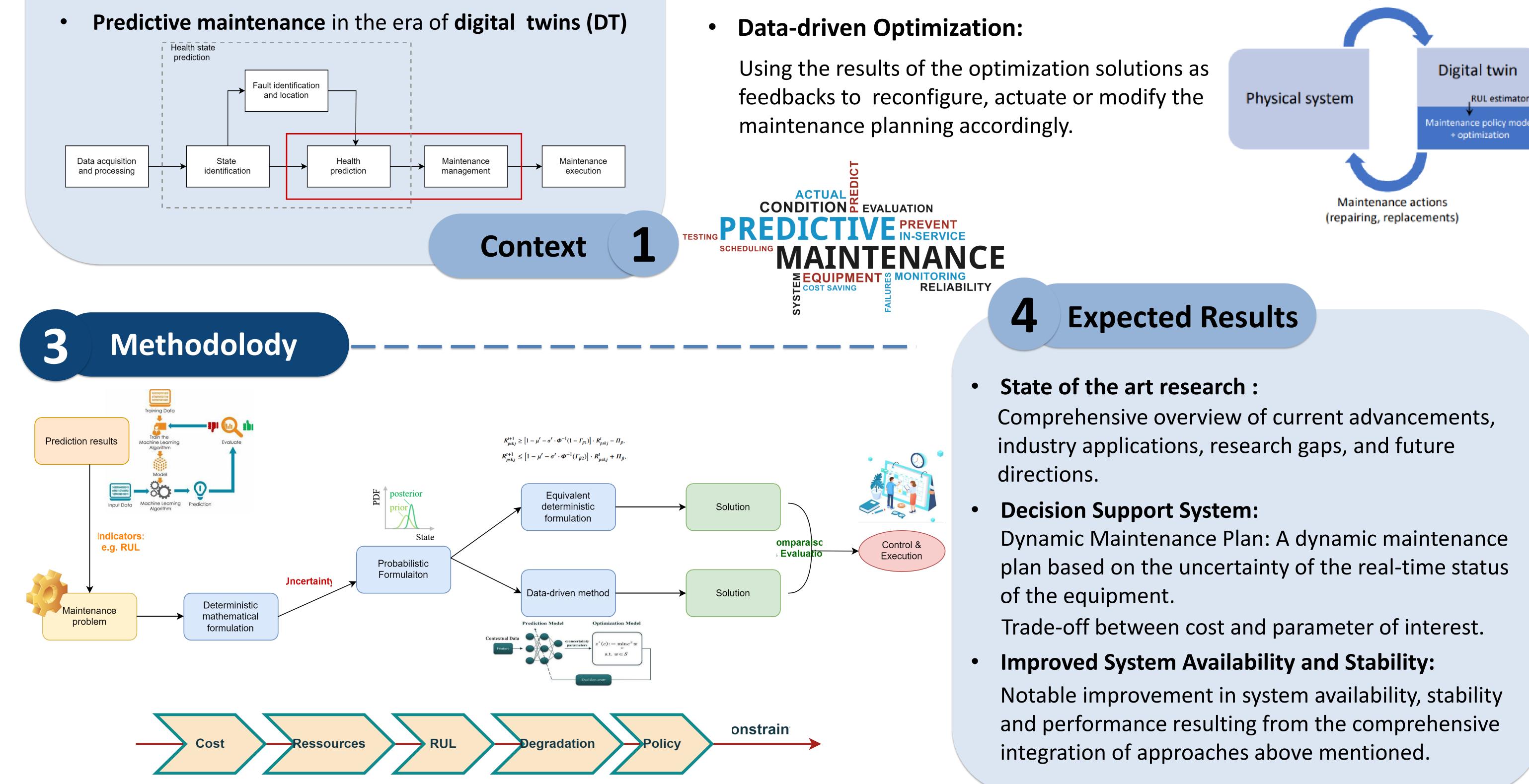
Performance & Deterioration Deterioration process Failure modes

Sensors, measurements



Data error

_ _ _ _ _ _ _ Manual Data Flov



plan based on the uncertainty of the real-time status

Trade-off between cost and parameter of interest.

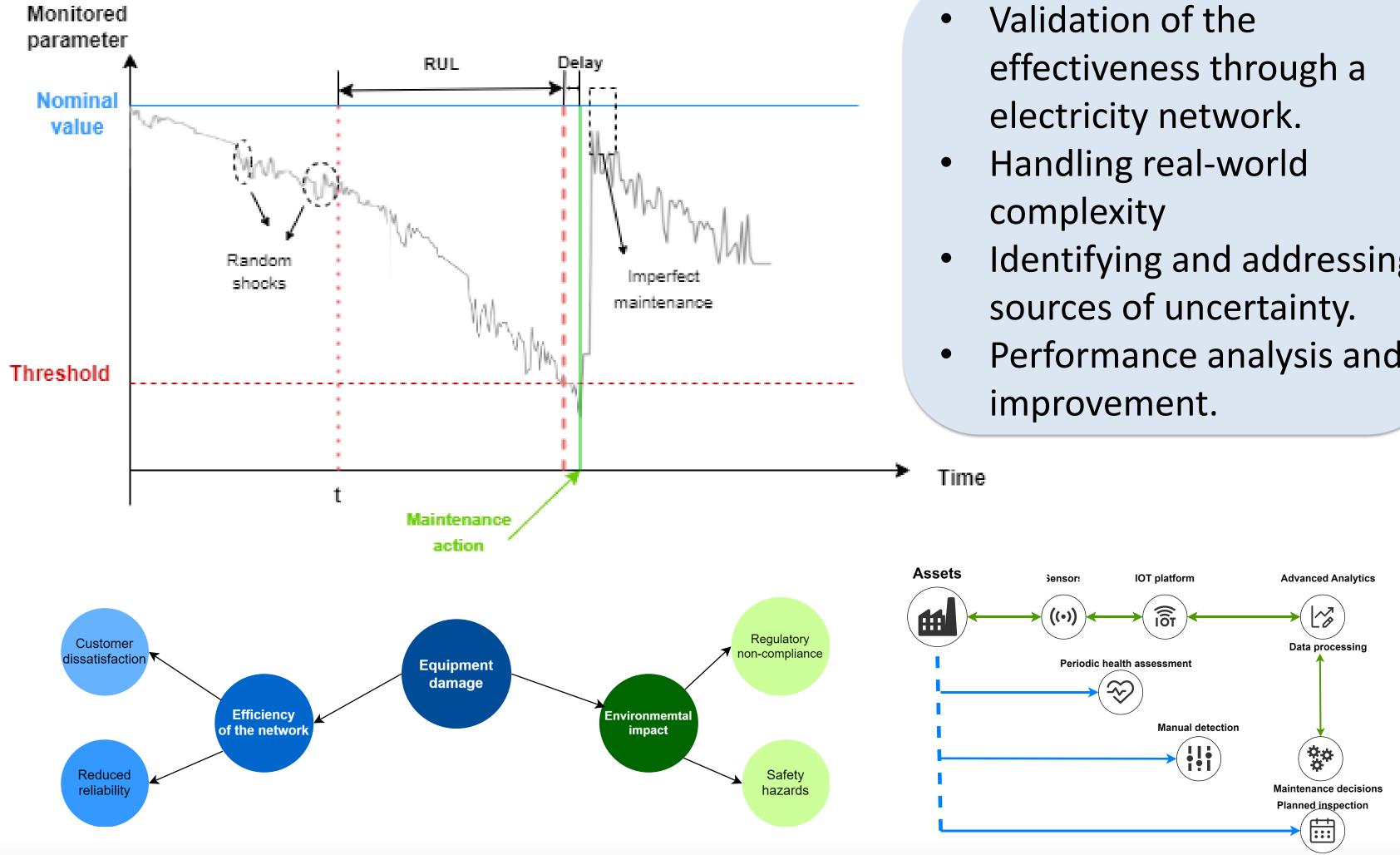
Notable improvement in system availability, stability and performance resulting from the comprehensive

- Explore exact mathematical models through a probabilistic optimization approach, focusing on small and medium problem instances.
- Explore new data-driven optimization approaches (e.g. Predictthen-optimize, Reinforcement learning etc.) to improve considerably the accuracy of the decision.
 - References 6

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[2] A.N., Elmachtoub et al, Smart "Predict, then Optimize", Management Science Volume 68 Issue

Use Case Study



- Identifying and addressing
- Performance analysis and

101, January 2022, pp 9–26

[3] S. Khebbache, M. Hadji and M. Batteux, "Stochastic Maintenance Optimization of Complex Industrial Systems under Uncertainty of Repair Time and Resources,"2022 6th International Conference on System Reliability and Safety (ICSRS), Venice, Italy, 2022, pp. 512-518, doi: 10.1109/ICSRS56243.2022.10067835.

[4] Zhang, Beikun et al. "Remaining Useful Life Based Maintenance Policy for Deteriorating Systems Subject to Continuous Degradation and Shock." Procedia CIRP 72 (2018): 1311-1315.

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