

Using machine learning for the early detection of anomalies helps to avoid damage

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The analysis of sensor data of machines, plants or buildings makes it possible to detect anomalous states early and thus to avoid further damage. For this purpose, the monitoring data is searched for anomalies.

By means of machine learning, anomaly detection can already be partially automated.

Machine learning methods first require a stable learning phase in which they get to know all possible kinds of regular states. For [wind turbines](#) or bridges, this is only possible to a very limited extent, as they are, for example, exposed to highly fluctuating weather conditions. In addition, there is usually only little information available on anomalous events. As a result, it is difficult for the system to identify and categorize exceptional states. However, this knowledge is important in order to find out how precarious the respective deviations from the norm really are. These problems are to be addressed in the project "Machine Learning Procedures for Stochastic-Deterministic Multi-Sensor Signals" (MADESI).

Numerical simulations can run through all conceivable scenarios. For example, it is possible to simulate what happens if strong squalls hit a wind turbine. The [monitoring](#) system can then be trained with data generated by these simulations and afterwards detect and interpret anomalies autonomously.

The researchers in the MADESI project develop methods that enable the utilization of simulation data in [machine learning](#). Here, the monitoring system needs to be designed in such a way that it can be trained using real sensor data and [simulation](#) data. Moreover, the consortium intends to increase the interpretability of the monitoring data. "For this purpose, we at SCAI work on data mining methods which can recognize patterns in the scenario data," explains project manager Prof. Dr. Jochen Garcke, head of the department "Numerical Data-Driven Prediction" at Fraunhofer SCAI. "Here, we also look for characteristic features of specific damages of wind turbine gear boxes or for ice on the rotor blades of a wind [turbine](#)."

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