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Against the background of improved computing power and digital data use techniques, application of big data has progressed rapidly in recent years, and accompanying this development, diffusion of IoT (Internet of Things), which links all types of data, has also accelerated.

JFE Techno-Research Corporation (JFE-TEC) actively utilizes rapidly-developing data science technologies such as AI (artificial intelligence) and machine learning to solve technical problems in manufacturing.

However, due to shortages of human resources who possess an adequate knowledge of data science, which affect not Japan but also other countries, the supply of capable people cannot keep up with demand. To cope with this shortage of human resources who are able to utilize big data, JFE-TEC provides data analysis methods and optimization methods necessary for problem solving in steel manufacturing, engineering and other fields by making full use of advanced data analysis technologies.

This paper introduces examples of anomaly detection and diagnosis and optimization and simulation applying data science technologies.

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Because abnormalities in equipment or operation have a large impact on the quality of production, products and services, minimizing trouble is a critical issue for all companies.

Conventional anomaly detection and diagnosis were performed by using an abnormality judgment logic, and specialized knowledge in connection with the quality of the logic and detection accuracy was necessary.

At the same time, it is also difficult to collect large amounts of data on abnormalities and malfunctions which have a low frequency of occurrence. Therefore, in the conventional method of judgment based on abnormality data, the boundary between the normal region and the abnormal region inevitably overlapped due to lack of data, and false positives were common ( ).

In contrast, abnormalities and trouble can be discovered easily by applying data science technology.

Since it is possible to obtain a large volume of time-series data for normal operating conditions and running conditions, the features of the normal data can be extracted automatically by applying machine learning to normal data, as shown in , and as a result, the machine learning discrimination device, which learns the features of normal operation, can judge that various normal data indicate the normal operational state.

However, if operational data containing anomalies are input to the learning discrimination device, the device can judge that this anomalous data represents “abnormal operation” because it “cannot be judged as normal.”

Although this is an example of judgment from time-series data, the same principle can also be applied to

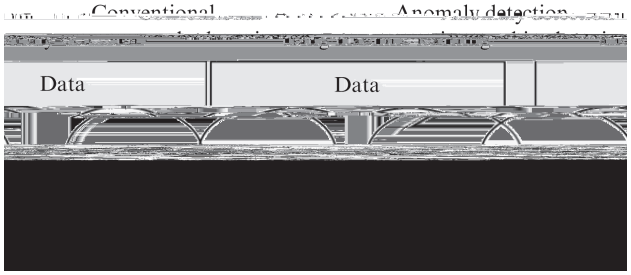

Fig. 1 Overview of anomaly detection

Fig. 2 Data anomaly detection using machine learning

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data in image form. In this case, judgment of a non-conforming product due to an abnormal part, contamination or a defect is possible by applying machine learning to image data of products and parts in a normal condition, for which a large volume of data is

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