SOLUTIONS FLYER

DETECT ANOMALIES IN MANUFACTURING EQUIPMENT AND SYSTEMS

Identifying unusual behaviors or patterns in machine components using sensor data can prevent small glitches from creating major operational problems. In cases where large numbers of sensor feeds are involved, challenges emerge due to the sheer volume and velocity of data streaming off the equipment. In addition, meaningful analysis from the data is a nontrivial task, since slowing or shutting down production in order to examine a machine carefully should only be done when truly necessary. For these reasons, simple threshold-based alerting is normally unsuitable as it will generate too many false positives. More advanced analytics methods can, however, be easily implemented and will flag potentially serious issues without reducing overall equipment effectiveness (OEE).

Anomalies Defined

In manufacturing operations, there are typically three types of anomalies that may impact production quantities, output quality, and plant efficiency:

- Point anomalies: These are single deviations from the rest of the same dataset. A defect in a piece of raw steel being fed into a computer numerical control (CNC) machine is an example of a point anomaly.
- Contextual anomalies (also referred to as conditional outliers): These are similar to point anomalies except they are usually only cause for concern within a specific context. For example, the dimensions for a piece of steel will fluctuate slightly based on ambient temperature; a measurement that may appear out of spec under nominal environmental conditions will be acceptable in the context of extremely hot weather.
- Collective anomalies: These result from combinations of multiple measurements that, while in themselves are within tolerance, when taken together can indicate a problem.

A single CNC machine failing due to a wiring fault is a point anomaly since properly installed and already-functioning machines very rarely suffer from such issues. All the CNC machines in a single plant stopping due to loss of power is a contextual anomaly if the plant has dual-redundant power supplies and a highly reliable source of primary power. All CNC machines in a plant failing at the same time for different reasons is a collective anomaly since, while individual machines may fail from time to time, it's very unusual for all machines to fail except for a single cause like a power failure.

STREAMING DATA IS CRITICAL TO DETECTING ANOMALIES

ENGINEERS MUST BE ABLE TO BUILD THEIR OWN APPLICATIONS

STREAMING ANALYTICS AND MACHINE LEARNING CREATE ROBUST ANOMALY DETECTION SYSTEMS

Anomaly Detection with Machine Learning

Leveraging machine learning (ML) for detecting anomalies is often the most effective solutions, especially in a manufacturing plant with many different types of production equipment. These systems can apply one or more statistical measures to the sensor data (including Mahalanobis distance, clustering, and other multivariate techniques familiar to data scientists that can isolate anomalous data with high degrees of accuracy and without requiring human interpretation of the data).

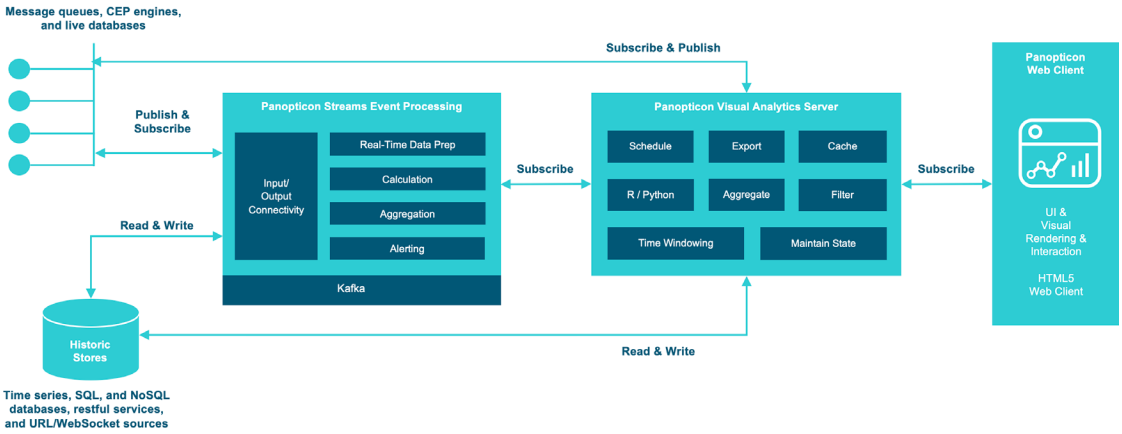
> Effective detection of anomalies requires real-time visibility into sensor data streaming in from the plant floor. It's as simple as that.
>
> Sam Mahalingam, CTO, Altair

Real-Time Streaming Analytics

In many cases, processing sensor data in real time is the best way to detect anomalies quickly. Streaming data is fed into an event processing engine along with historical time series data of previous sensor readings. The engine can apply a range of functions to the data on-the-fly and with extremely low latency, including conflations, comparisons, and aggregations. The engine can also produce alerts based on any type of anomaly found in the sensor data.

The real-time output of the engine can then be stored in a time series database for further analysis by a machine learning algorithm if desired or fed into a set of data visualization capable of managing and displaying real-time data.

Real-Time Streaming Feeds



The Altair Panopticon streaming analytics platform enables business users to connect directly to real-time data sources, develop complex event processing applications, and build interactive dashboards that make it easy to spot anomalies in massive amounts of data streaming in from sensors and other sources.

Altair Data Analytics for Anomaly Detection

Altair enables manufacturing engineers to develop, manage, and deploy accurate predictive maintenance models that help keep costs and downtime under control, improve productivity and quality, and increase the profitability of their operations.

Data Preparation: Access, cleanse, and format warranty and service utilization data from CRM, ERP, and systems managed by channel partners, as well as PDF and Excel reports and big data sources without any manual data entry or coding.

Machine Learning: Altair's industry-leading visual approach to data analytics enables businesses to build and deploy ML models in almost any analytic infrastructure. Altair's automated ML and explainable artificial intelligence (AI) functions eliminate repetitive tasks, makes data scientists and business analysts more productive, and enable managers to create profitable, attractive service packs.

Streaming Analytics: Build stream processing applications and sophisticated analytical dashboards without writing any code. Solve difficult problems quickly, understand complex relationships in seconds, and identify issues requiring further investigation with just a few clicks.

Learn more about Altair Data Analytics at altair.com/data-analytics