TrendMiner
A SOFTWARE AG COMPANY

INDUSTRY
Petrochemical

PROCESS TYPE
Continuous Processing

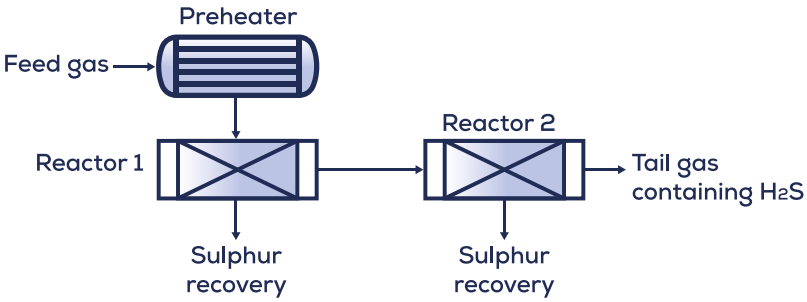
ANALYTICS TYPE
Prescriptive Analytics

KEY OBJECTIVE
Contextualize Prescriptive Information

Creating Contextual Prescriptions from the Root Cause Analysis of a Sulfur Recovery Unit

BACKGROUND

The most common way to convert H_2S gas coming from petroleum during refinement is by using the Claus process. The process has multiple stages because of its chemical equilibrium. A feed gas containing a high concentration of H_2S must be pre-heated using steam. The gas then enters the first converter, where it undergoes partial conversion toward pure sulfur. Part of the sulfur is removed from the gas stream before entering the second converter. In the final stage, the pure sulfur is removed and the remaining gas containing small amounts of H_2S goes downstream to a treatment plant.



CHALLENGE

While viewing recent trends of a sulfur recovery unit on a TrendHub dashboard, engineers noticed that the amount of sulfur produced in the recovery unit, represented as tons per day, has dropped significantly. Process experts also discovered that the sulfur yield is declining, which indicates a lower conversion in the plant. As a result, the higher amount of H_2S remaining in the gas stream puts too much load on the gas treatment plant. This anomaly could have environmental and regulatory consequences, so engineers want to save the results of the analysis so they can be used as a prescription for solving a similar problem in the future.

SOLUTION

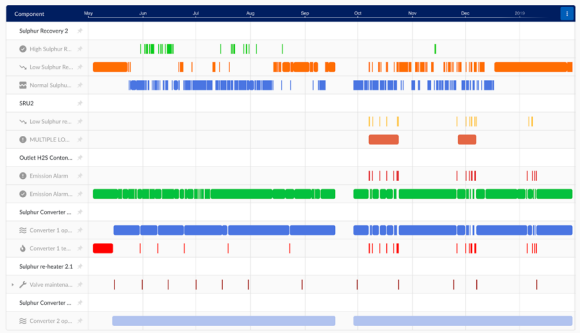
- Identify the root cause of the low sulfur recovery using TrendMiner
- Create monitors to identify anomalous periods in the data and track those periods by saving them into events
- Apply filters to the structured time-series data to create a report with contextual views
- Extend the report to add tags that note measurements of sulfur yield, H_2S concentration, chemical converter parameters, and other relevant data

Challenges

Several factors could cause low sulfur recovery. Engineers might find an issue with the catalyst in the converters, temperature of the converters, temperatures of the condensers, or the control systems themselves.

RESULT

- Using TrendMiner, process experts determine that periods of low sulfur recovery corresponded with cooler temperatures in the converter
- Engineers discover that the root cause was a malfunctioning temperature control valve upstream from the converter
- Process experts now can create monitors to identify anomalous periods in the data and track those periods by saving them as contextual events that can be used by other engineers in the future



- The prescription for the root cause analysis is available to everyone in the organization

TRENDMINER FEATURES USED

SIMILARITY SEARCH/CONTEXT ITEM SEARCH

Using pattern recognition technology, TrendMiner uses a similarity search feature to find similar past patterns. The most important part of the pattern can be emphasized with a graphical weighing factor to improve accuracy of the search results. Search for similar past annotations by analyzing automatically, manually, or externally created context items.

GANTT VIEW OF CONTEXT

All contextual information has a start and end time which is used to represent the events in a sequence diagram or Gantt chart. Per asset, all related tags are grouped and vertically listed, and for each tag, all context types are represented in a time series fashion. This view gives a different starting point for operational performance analysis and provides new insights.

ALERTS & NOTIFICATIONS

Process experts can use TrendMiner to create batch fingerprints and monitor production processes in relation to these fingerprints. Automatic notifications can be inputted into our software to alert engineers and operators when patterns of interest are detected. TrendMiner supports various notification mechanisms, including embedded inbox and email alerts. These notifications also include suggested courses of action and can be designated to trigger a webhook to fire a workflow in other business applications, such as the maintenance management system.

DATA VISUALIZATION MODES

TrendMiner offers various visualization modes for analyzing time-series data. Besides the common time trend, time-series data of multiple tags can be shown in a stacked mode for specific time sequences or can be grouped together in a “swim lane.” For multivariate analysis, our software offers a multi scatter plot that shows tag histograms and multiple histograms of each pair of the selected tags.

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