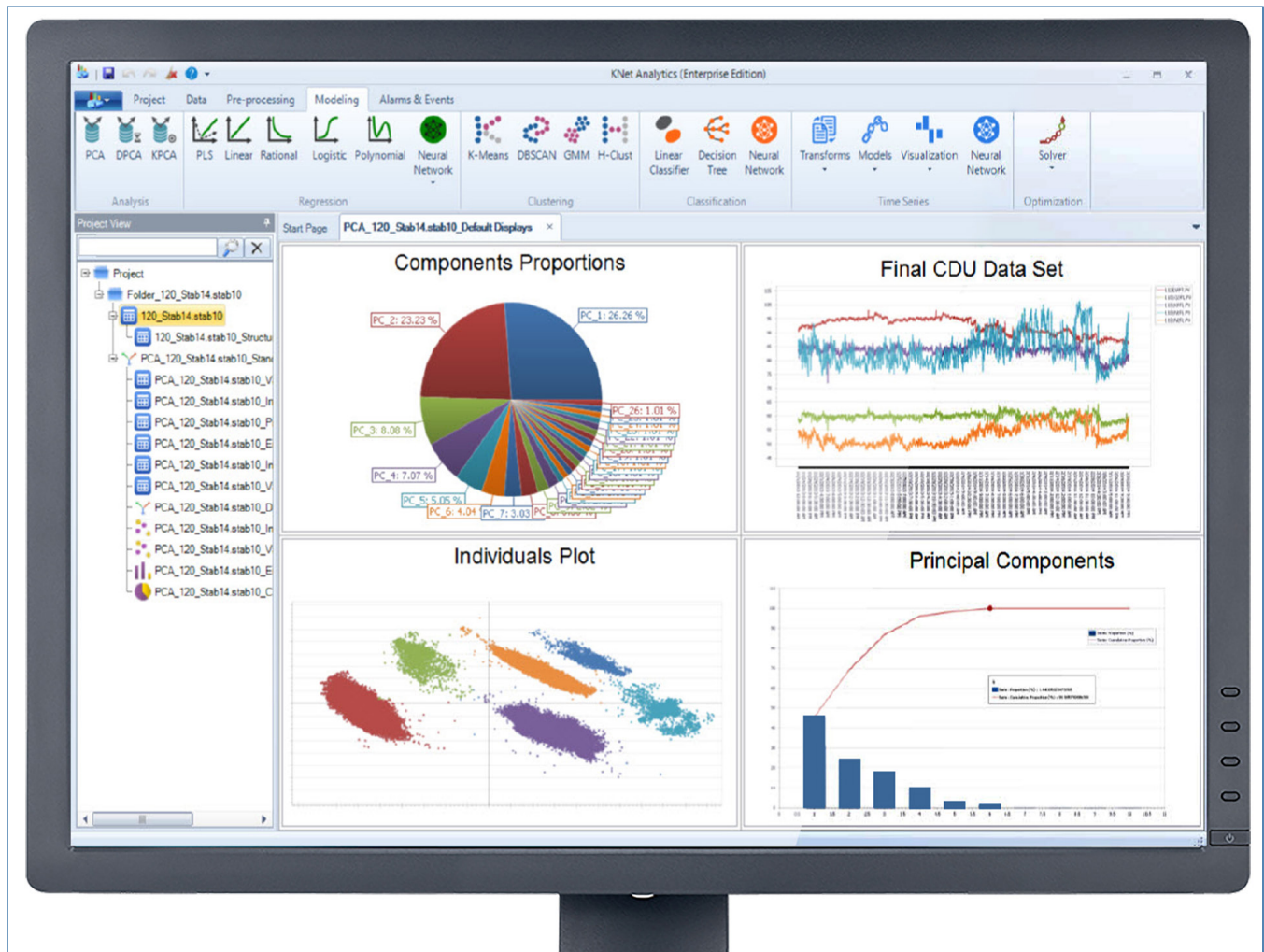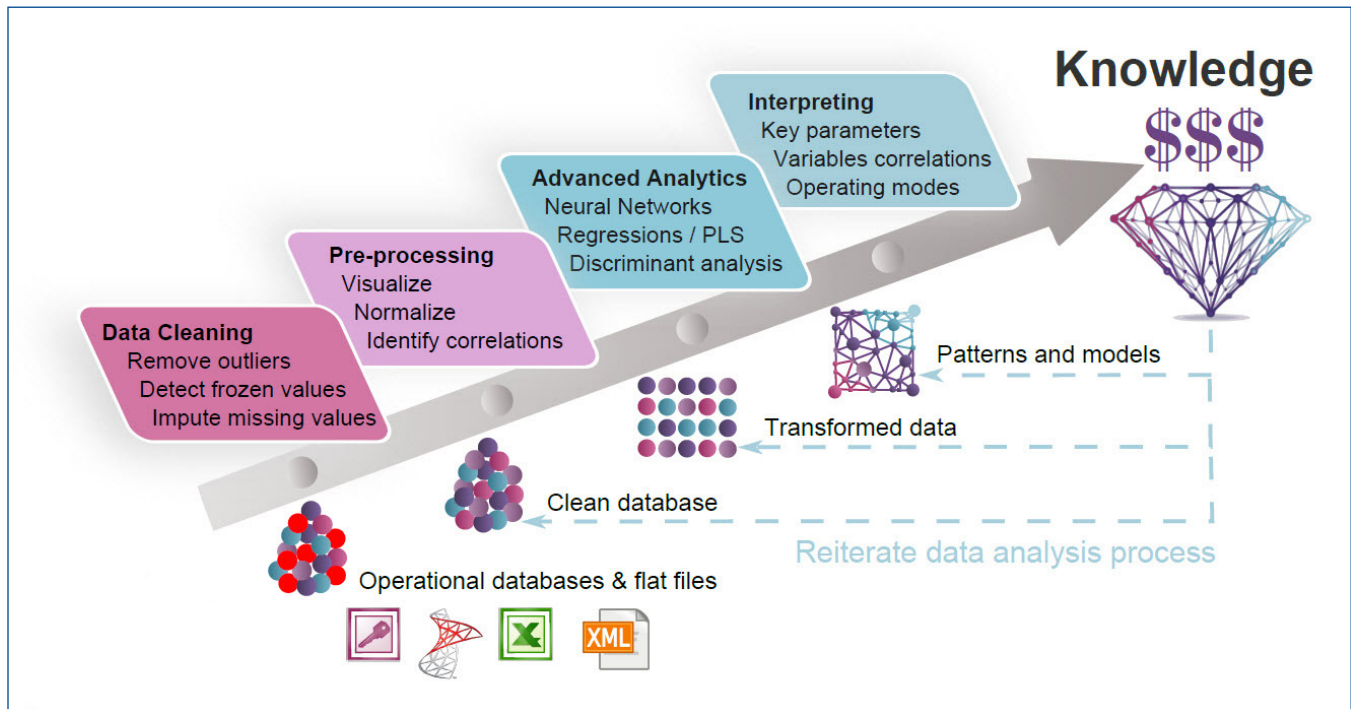# KnowledgeNet Analytics

Transform data into knowledge and profits.

In the manufacturing and energy industries, new challenges are pushing managers to optimize and improve operational efficiency. From the obvious challenge of managing a finite resource to the ever changing environmental regulations and the competitive pressures, it is easy to understand why industry leaders are continually striving to find ways to maximize productivity. In order to sustain the performance and profitability of their plant operations, they have to make informed decisions which are dependent on the ever increasing massive amount of data scattered in many sources. The efforts of collecting, cleaning, aggregating and analyzing such data is laborious without the guarantee of any results.

To address this challenge, Emerson is pleased to offer KnowledgeNet® Analytics which takes away the burden of processing millions and trillions of data measurements such as sensor readings, lab data, simple and complex events, and automatically extract knowledge and predictive models, identify optimization opportunities and behavioral patterns.

EMERSON

KNet Analytics is an out of the-box process data analytics software that allows endusers without extensive domain expertise to:

- Inspect, clean and transform raw data into information and knowledge.

- Create predictive models that can be deployed in real time.

- Eliminate erroneous data and pinpoint problem areas.

- Perform proactive decision making to prevent abnormal conditions and identify opportunities.

- Recognize behavioral patterns and correlate data with events.

Benefits

- Maximize efficiency and profitability to gain competitive advantage.

- Discover new opportunities for time and money savings.

- Gain more flexibility in anticipating changes.

- Make efficient decisions with confidence.

Methodology

### Automated Knowledge Capturing

The procedure adopted by KNet Analytics consists in acquiring raw data from the plant, cleaning the acquired dataset, building models and interpreting them. This process can lead to the extraction of highly valuable knowledge in form of expert rules and hybrid models that detect special operating modes and states, abnormal plant behavior, and best operating conditions. KNet Analytics automates knowledge capturing without the need to interview the experts and document the knowledge manually.

Beyond Analytics

Not only can KNet Analytics help you uncover hidden process knowledge, build predictive models, correlate data but it also allows you to determine the relationship between the dynamic behavior of the plant and complex events.

Online Deployment

Uncovered knowledge and models built in KNet Analytics can be deployed online to deliver real-time visibility and insight into operations for optimized performance management, maximized throughput, efficient management of abnormal conditions, and tight control of operating costs.
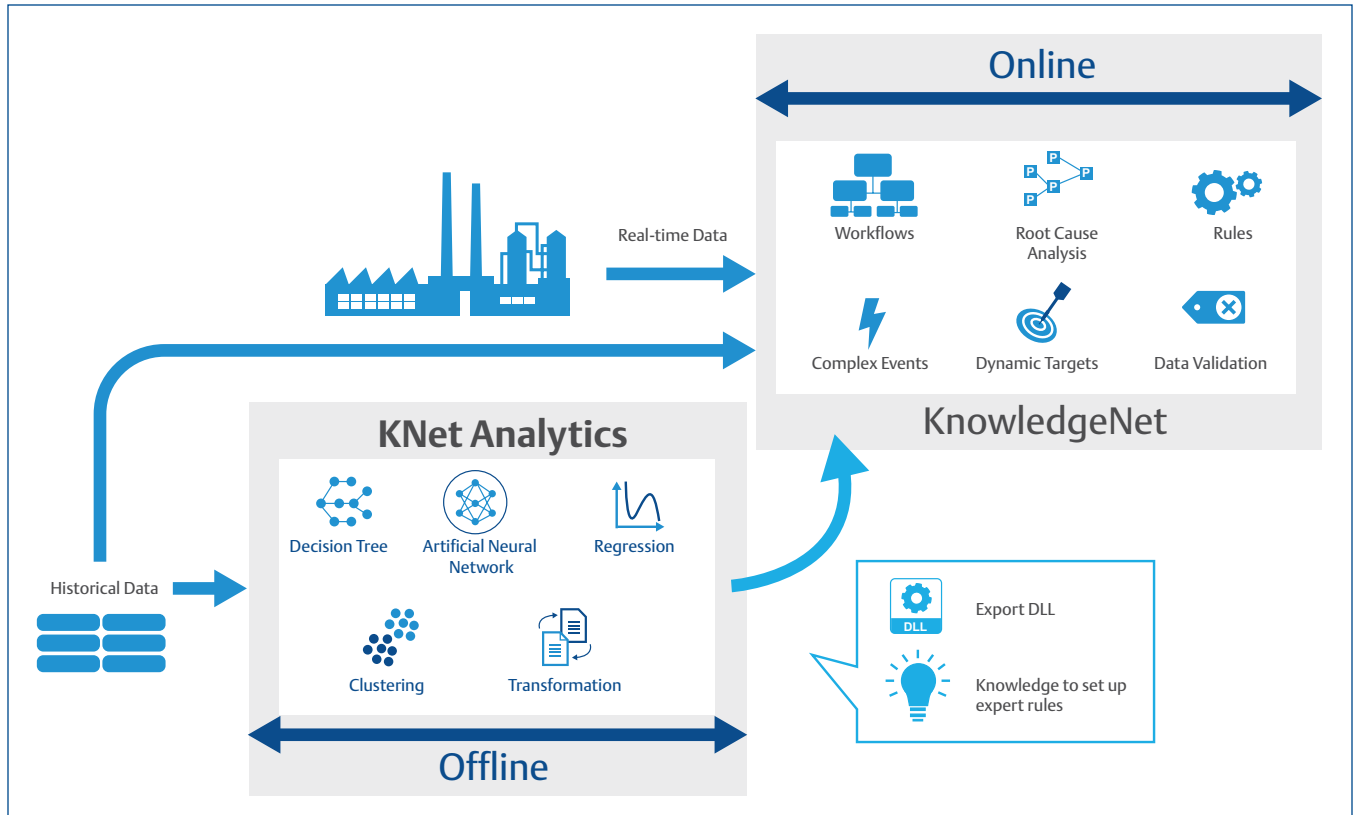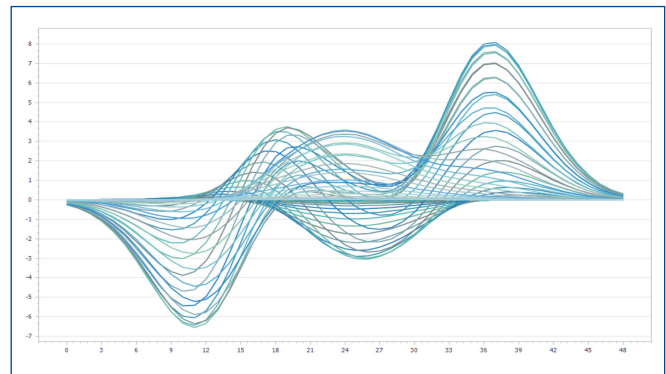
Features

Machine Learning

Machine learning generates models that can capture and mimic the behavior of a plant. These models can be used to predict failures and recognize operating modes. KNet Analytics offers several algorithms for machine learning such as Neural Networks, Decision Trees, Linear Classifier, and others.
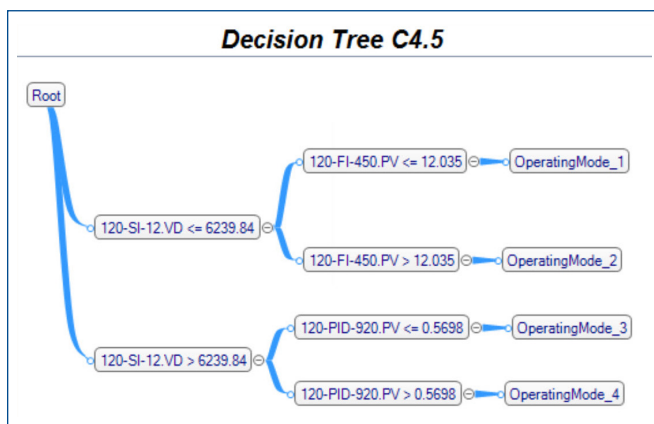

Optimization

Optimization consist of finding the best available values of an objective function given a set of constraints. With this feature, KNet Analytics helps operations maximize productivity and optimize costs.

Workflow

Workflow in KNet Analytics is a powerful feature that allows you to build and automate sequential process made of data analysis, learning, clustering, and modeling. Once the workflows are built, they are automatically memorized and can be later deployed generically and applied on multiple data sets without the need of human intervention.
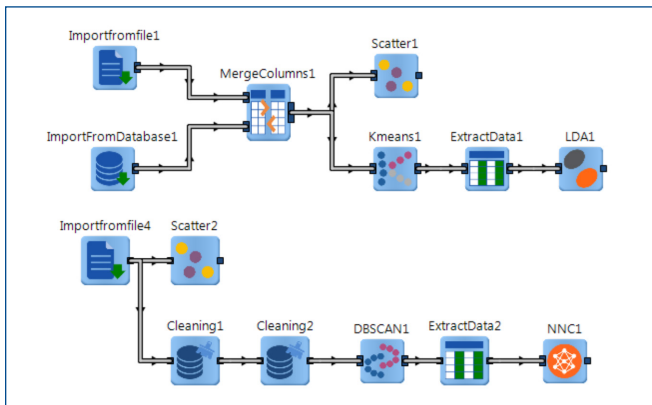

Graphical Environment

Unlike traditional data analytics technology, KNet Analytics offers a highly intuitive and user-friendly environment with a Microsoft look and feel featuring drop down menu, drag and drop graphical icons without the need of scripting or programming.


Modeling

KNet Analytics offers tools to perform descriptive and predictive models based on actual data. Descriptive models are used to better understand the process behavior by identifying key variables and their relationships, while predictive models are used to predict the system behavior using hybrid models and combining multiple techniques.
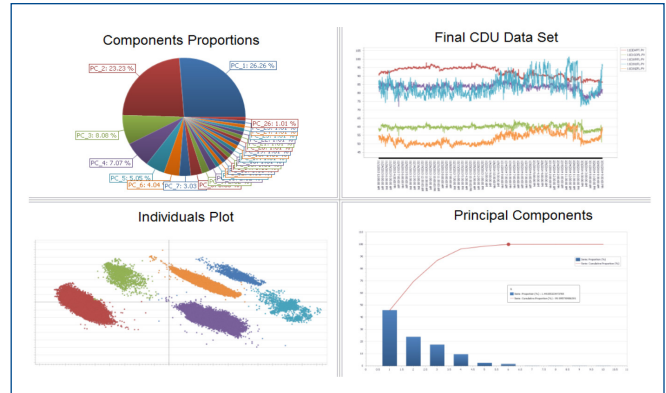

Pattern Recognition

This feature allows the recognition of patterns and regularities in data. It consists, for example, in identifying operating modes by detecting clusters with related data in scatter plots or in discovering recurrent sequences in alarms and events databases.
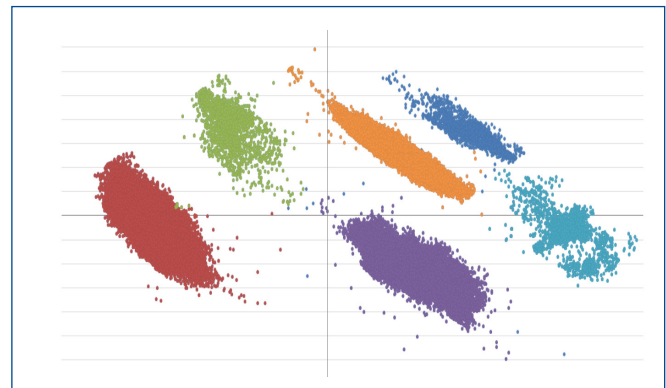

Exploration

The exploration step is important to clean the input data set before performing advanced analysis. KNet Analytics provides different tools to explore data such as cleaning, sampling, smoothing, correlation, and others.
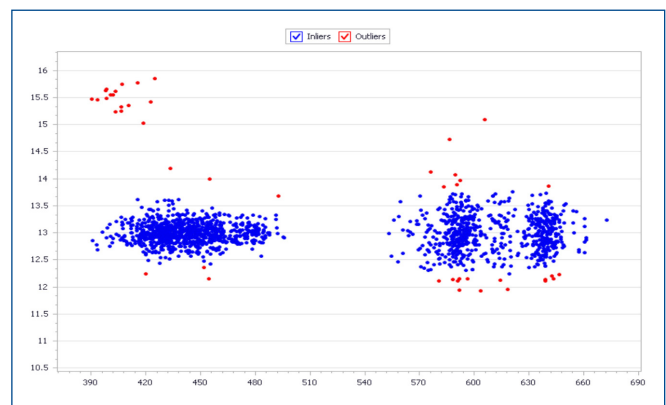
Time Series

Time Series features in KNet Analytics allow transforming time series and analyzing their behavior for trends, seasons, and correlations with past values. Time series models include AR, MA, ARMA and GARCH models as well as time series Neural Networks.
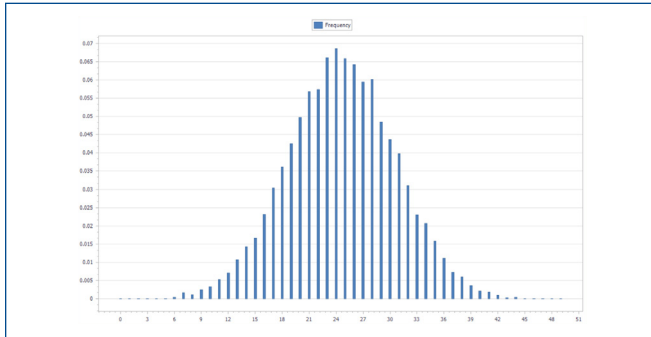
Visualization

KNet Analytics embeds different tools offering efficient data visualization such as scatter plot, line chart, pie chart, area chart, box plots, radar chart, and polar chart.
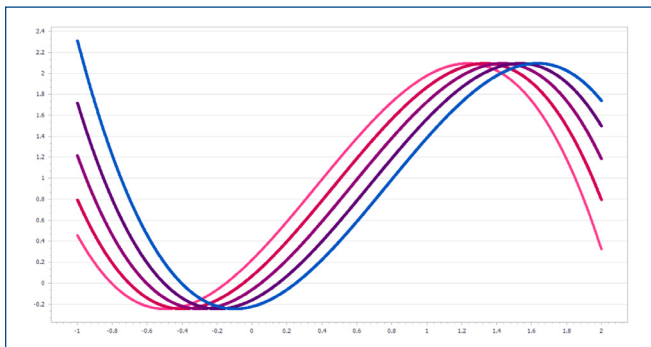
Applications

Automatic Identification of Plant Operating Modes and States

KNet Analytics combines clustering methods with classification and modeling to build expert rules. These expert rules can be deployed online to automatically identify plant operating modes or to detect and predict abnormal situations, for example drop in RON (Research Octane Number) and high energy consumption.

KPI Dynamic Targeting

KNet Analytics offers methods to set dynamic targets that consider process behavior in terms of operating modes, equipment availability, valves line-ups, special process scenarios, and others.

Sensors Validation

KNet Analytics includes a sensor validation module that allows fagging the faulty sensors and validating the values. In addition, KNet Analytics enables determining soft sensors for complex measurements such as analyzers or labs.

Optimization

Based on the system configuration, KNet Analytics provides users with appropriate configuration for an optimal system performance and reduced downtime.

Asset Performance Modeling

KNet Analytics allows modeling the performance of the asset as a function of key process inputs. This model might be used to identify the reference performance curve to be used to identify performance gaps.

Alarm Analytics

The new alarm analytics module combines several data analytics and advanced techniques allowing end users to extract knowledge from alarm data and go beyond classical alarm management. This module allows the user to:

- Audit the performance of alarm systems and pinpoint nuisance alarms such as frequent, chattering, stale and standing alarms.

- Identify alarm correlations and clustering to remove redundant alarms and reduce alarm floods.

- Use pattern recognition tools such as sequence mining and association rules to predict the future behavior of alarms for increased safety and reliability.

- Correlate alarm data and process data for a better troubleshooting and root cause analysis.
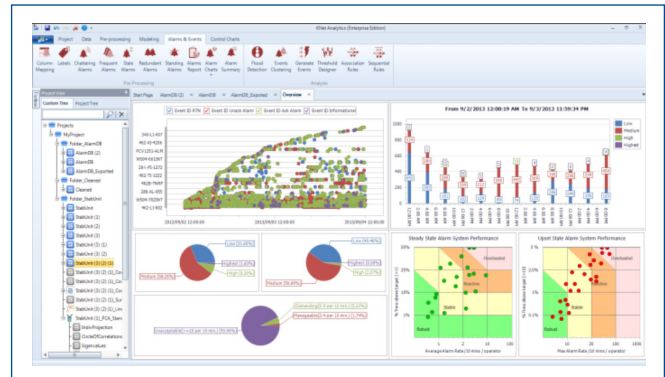
KNet Analytics Available in Prefessional vs Premium Editions

Features	Professional Edition	Premium Edition
Load historical data from flat files	✓	✓
Manipulate data tables (add/remove rows/columns, filter, merge, file, sort, duplicate, transpose, etc.)	✓	✓
Basic trending and visualization: scatter, line areas, bar, pie, radar and polar charts, box plots, and custom plots	✓	✓
Exploration: summary, covariance, correlation	✓	✓
Analysis: PCA	✓	✓
Basic Control Charts (variables & attributes control charts, process analysis)	✓	✓
Clustering: manual using visualization tools, K-Means	✓	✓
Classification: decision trees, linear classifier, neural network	✓	✓
Regression: linear, rational and polynomial	✓	✓
Regression: PLS, logistic, neural networks		✓
Load historical data from relational databases		✓
Advanced trending and swift plots		✓
Analysis: DPCA, KPCA		✓
Exploration: cleaning, variables preparation, cross correlation, normalization, smoothing, sampling, two sample tests, matrix decomposition, frequency distribution		✓
Clustering: DBSCAN, GMM, H-Clust		✓
Time series: transforms, models, visualization, neural network		✓
Optimization: solver		✓
Workflows		✓
Expert models for online deployment		✓
Advanced alarm analytics, correlate the process data to the alarms history		✓

Minimum Hardware/Software Requirements

Operating System	Windows 7, Windows 8, Windows 8.1, Windows 10	Windows Server 2008, Windows Server 2008 R2, Windows Server 2012, Windows Server 2012 R2, Windows Server 2016
Processor Speed	3 GHz (higher recommended)	3 GHz (higher recommended)
Memory	8 GB	16 GB
Disk Space	10 GB	10 GB

Part Number	Description
PAS-ANA-ML-PRFF-P	Machine Learning Analytics Software Professional Edition
PAS-ANA-ML-PRM-P	Machine Learning Analytics Software Premium Edition

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