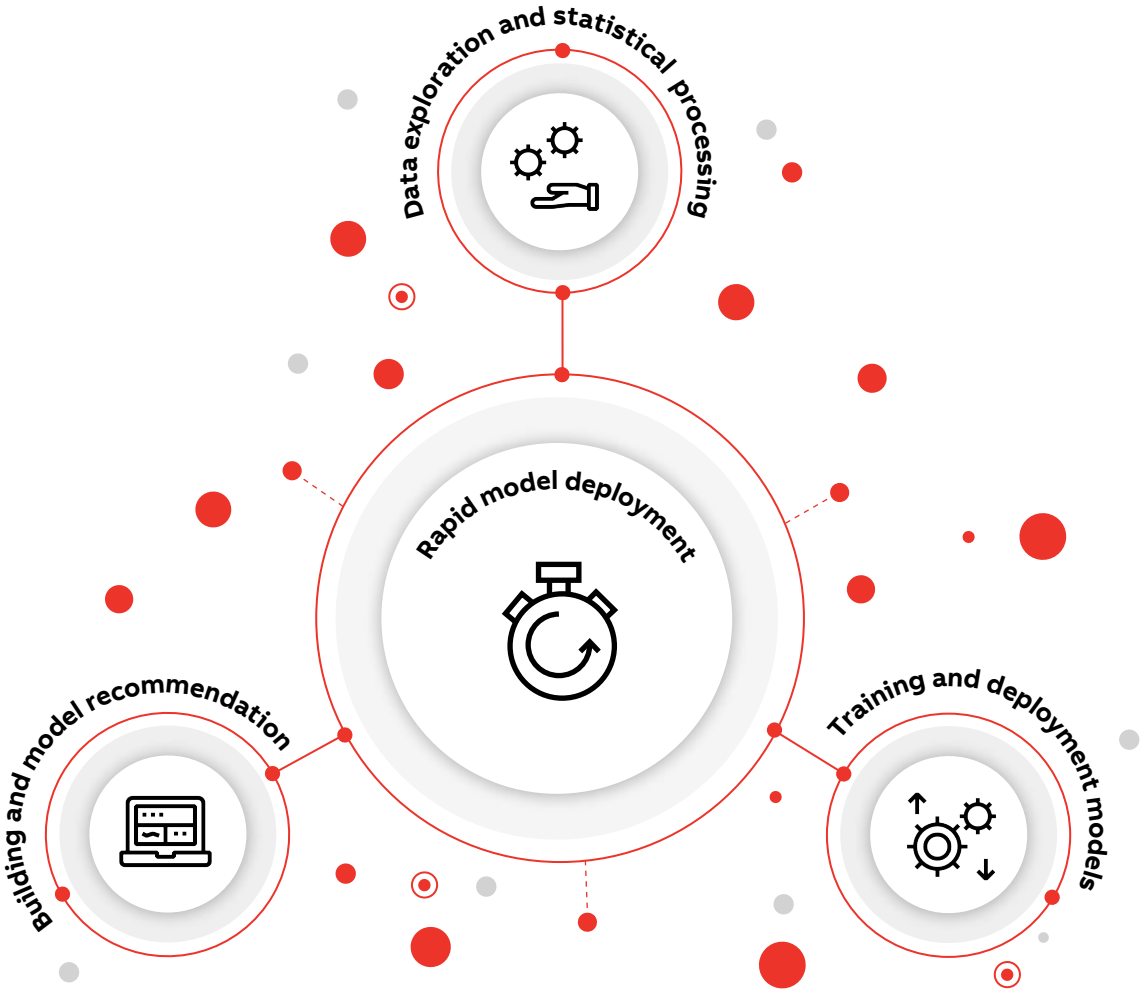
ABB ABILITY™ GENIX INDUSTRIAL ANALYTICS AND AI SUITE

Model Fabric

Advanced Analytics Made Easier for Citizen Data Scientists



Genix Model Fabric enables citizen data scientists to perform advanced analytics using in-house data with capabilities such as data exploration, statistical pre-processing, building / recommending models, deploying and training models – thereby enabling cross-functional insights for predictive, prescriptive, and optimization measures for your enterprise.

Organizations are increasingly deploying IoT devices, smart sensors and software solutions to run their industrial plants. This has led to an exponential increase in multiple data types - operational data, maintenance data, constructional / design and derived data. Process specialists are looking for meaningful ways to analyze this rich data for performing self service analytics driven by AI and ML in an objective manner. With this, they are able to optimize assets while also predicting and mitigating costly potential failures.

Enterprise challenges on digitalization

Process and asset-intensive organizations have multiple systems and functions to keep track of. This involves continuously monitoring operations and managing performance, maintaining assets for integrity and run-time, and undertaking analytics, both predictive and prescriptive, to prevent revenue leakage while improving maintenance.

Enterprises face a lack of skillset which understands both the industry domain and how analytics can be applied in that specific context. They are also looking for partners who understand their industry / domain, and have expertise in enterprise-wide data analytics with a portfolio of proven solutions.

Primarily, enterprises need to focus on business outcomes, rather than building data science models and analytical solutions. Data scientists and engineers end up spending close to 80% of their time going through voluminous data, and cleaning, preparing data to improve its quality to make it relevant and useful for analysis. Process specialists might have individually created multiple linear / semi-complex models, but from an enterprise level, these models lack integration with data flowing freely between them to unlock its true potential.

Considering the operational and asset integrity challenges which industrial enterprises face, there is an immediate need for an end-to-end analytics platform, which can help them extract the maximum value of their data – combined with self-service, AI/ML modeling capabilities.

ABB Ability ™ Genix Model Fabric

Genix Model Fabric empowers business users to act as citizen data scientists - developing, hosting, and deploying AI/ML models that can be used for operations, generating advanced analytics and insights. It provides an environment for domain specialists and data scientists to explore contextualized asset information and telemetry data, build and train AI/ML and analytical models, manage these models, and deploy them. It further helps in exploring and analyzing data from multiple sources, recommending the best models for the enterprise, and deploying models on single or multi-cluster nodes. These models can then be trained to generate output for consumption by various downstream applications and dashboards. It also provides a sandbox environment for testing algorithms and scenarios. Genix Model Fabric can host data from multiple sources – within the Genix environment and external third-party. Model Fabric uses MLflow as part of its tech stack to archive, compare and deploy ML models. It enables storing and comparing model performance metrics to select the best performing models and deploy them.

Models generated using the Genix Model Fabric can be deployed on cloud, edge, and on-premise systems – based on the use case and enterprise IT landscape.

With auto-ML workflows, users can manage and deploy AI/ML models without the need for coding or requiring high level of data science knowledge.

Model Fabric brings state-of-the-art technology to enterprises, with the ability to scale based on requirements, modularity for multiple roles and functions, in-built security features for better authentication and authorization. Customers can derive maximum benefits from AI/ML modeling and ABB expertise applied in the industrial context using Genix Model Fabric.

Model Fabric capabilities

Data Exploration

- Select datasets from external data source or from the Genix Data Lake / Genix Cognitive Data Model
- Perform statistical analysis on the selected dataset
- Data ingestion – capture data from external sources across multiple formats
- Get output for outlier information, missing data, statistical outputs such as uniqueness, mean, max, min, standard deviations, skewness, variations, etc.
- Verifies information content of the data, what is made available from the sensors and other sources

Data Pre-processing

- Data validation – validate accuracy and quality of available data
- Data cleaning by identifying missing data, duplication to ensure data quality
- Data transformation – convert data from one format to another
- Feature engineering – identify influential variables, avoid multi-col linearity, achieve bias-variance trade-off

Model Building / Recommendation

- Offers multiple options to build models based on the user's role within an organization
- Build the optimal model based on features extracted for the dataset
- Build, test, and compare models based on target objectives
- Run algorithms to choose best-fit model
- Auto AI/ML workflows for building models and deploying at speed
- Solve problems without coding, with minimal data science knowledge

Model Registry

- Database of all models with their attributes
- Model storage with versioning and governance
- Easy access to all models built in the Model Fabric
- Register pre-built or new models with relevant user documentation
- Ability to add configuration / registry notes while registering models

Model Deployment

- Easy deployment of models on deployment target(s)
- Facilitates seamless connection of models to downstream applications and dashboards for consumption
- Run and test the model

Prebuilt models available in Genix

ABB Ability™ Genix Model Fabric has a wide range of prebuilt models to support quick deployment. These prebuilt models can be rapidly customized to the specific requirements of the industry and of the enterprise.

Predictive maintenance universal models

Changepoint Detection

- Identify moments in time when the probability distribution of the stochastic process under observation changes
- Detects underlying process changes and changes in the condition of the assets under observation
  - Offline: Binary Segmentation
  - Offline: Pruned Estimated Linear Time (PELT)
  - Online: Change Finder

Time-series forecasting

- Forecast evolution of operating tags / features with time
- Discover unanticipated behaviors
- Find early warning signs of degradation
  - SARIMA: Seasonal ARIMA from statsmodels
  - TBATS (Trig. Exp. Smoothing State Space model with Box-Cox transformation, ARMA errors, Trend and Seasonal Components)
  - Facebook Prophet
- Holt-Winter Model

Prescriptive analytics models

Vibration analytics

The model library can be used to perform basic and advanced signal processing tasks to analyze high frequency vibration signals

- Acceleration-to-velocity transformation
- Acceleration-to-displacement transformation
- FFT transform and plot of vibration signal
- Identifying peak amplitude and corresponding frequency from vibration signal spectrum
- Rotational speed estimate from accelerometer signal
- Computation of baseline thresholds based on the operating zones defined by end user, automatic methods using unsupervised data exploration ML algorithms, estimation of broadband noise in vibration signal and identifying vibration signal side-bands

Generic optimization models

These models can be used to solve optimization problems

- Linear programming – solves linear programming convex solution space optimization problems where the objective function and the system constraints are linear
- Genetic algorithm – solves nonlinear global optimization problems

Process reliability model

This model helps in determining reliability of the process based on production

Existing data pre-processing models

Deployed as Microservices in the Model Fabric

- Time synchronization and resampling service
- Outlier detection and removal service
- Missing value imputation service

System anomaly detection models (BVA app)

- Unsupervised multivariate distance-based anomaly detection model
- Correlation analysis model
- Time series classification for anomaly detection model

Heat Exchanger Predictive Maintenance (AIPM Core)

- Fouling estimation of shell and tube heat exchangers
- Lifing model of shell and tube heat exchangers

Multi-role accessibility for different users

Basic (limited/no data science knowledge)

- Process specialists use known data files from their plant environment and start ML lifecycle
- Perform pre-processing, visualization, model training and deployment within Genix Model Fabric
- Choose from available and recommended training algorithms
- Quick modelling and deployment

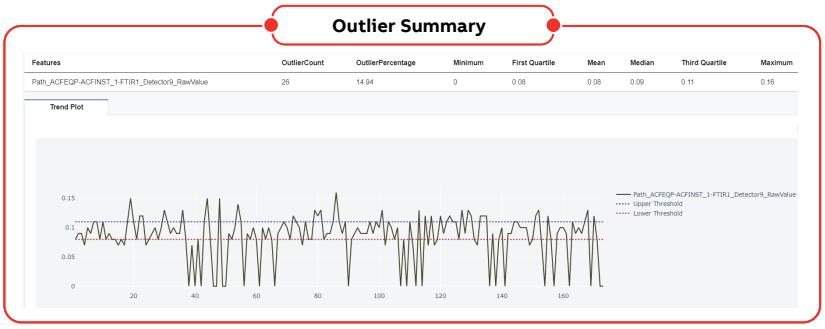
Medium (users with basic/moderate data science knowledge)

- Citizen data scientists can use internal as well as external AI/ML models (ONNX & non-ONNX supported)
- Upload models with Model Fabric UI
- Save models in the registry with Model Registry
- Deploy models on Model Fabric with Model Deployment to consume it from business applications

Advanced (users with advanced/competent data science knowledge)

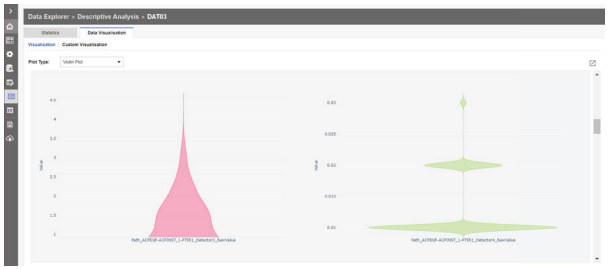
- Seasoned data scientists can build their own models using custom algorithms
- Upload and score scripts and related artifacts with Model Fabric UI
- Use docker image built from uploaded files to deploy models

Outlier Summary

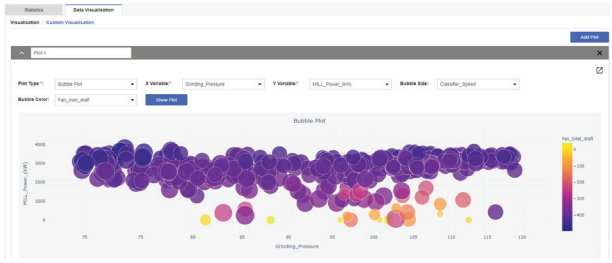


Missing Summary

Data Visualization



Custom Data Visualization



Benefits

ABB Ability™ Genix Model Fabric makes it easier for business users and citizen data scientists to build, manage and deploy industrial AI/ML and analytical models. Built-in auto-ML capabilities in the Model Fabric facilitate ease of use, helping reduce dependency on coding and technical skills to build models and have them ready to be integrated with downstream services such as analytics, dashboards and other AI/ML operations. It helps in verifying the accuracy of data from different sources – analyzing it for outliers, missing data, standard deviations etc. A recommendation feature suggests the best models based on your requirements. It also has a Model Sandbox, which provides an environment for testing algorithms with contextualized asset information and telemetry data, allowing greater flexibility to experiment by building and testing different models.

Organizations can leverage the Model Fabric with a wide range of published industry and function-based AI/ML models which can be used for further optimization of operations, harnessing predictive analytics together with other downstream capabilities to capture and gain insights from enterprise data easily.

The Genix Model Fabric is available as part of the Genix suite, as an independent module on subscription or perpetual license. We can provide analytics based advisory services using Genix Model Fabric.

- Up to **75%** reduction in data exploration time
- Up to **50%** reduction in data pre-processing time
- Up to **75%** reduction of effort in model building
- Up to **75%** reduction in time for model registry and deployment

- These numbers are based on data available on Genix Platform, or in Excel
- Numbers may vary based on third party platforms and the availability of connectors
- Reduction figures compared to models built by users with manual and repetitive effort to get required information and insights on each stage of model building to proceed further

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