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**Crafting Highly Efficient & Optimal Machine Learning
Models For DSPs Using Assisted AI/ML Framework**

Credits

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Digital Service Providers (DSPs') Face Challenges With the Existing Auto AI/ML Frameworks



Zero transparency and explainability

Auto AI/ML frameworks like TPOT, H2O driverless AI, Microsoft AutoML are not flexible to see through what happens inside the black box, and do not have visibility into the decision-making process.



No feature customization to address specific need

Existing auto AI/ML frameworks comprise of domain agnostic features with generic functionalities. However, customization for specific business need is a real challenge.



Limited options for domain centric analysis

Existing auto AI/ML frameworks have limited options for data scientists to perform domain centric analysis to get insights from data.



Keeping accuracy attribute alone as the benchmark

Auto AI/ML frameworks mostly emphasize on the accuracy part alone. But in the real world, various other metrics such as precision, F1 score, recall etc., are covered in ML modelling.



Lack of tools to perform iterative optimization

Unavailability of tools and techniques to perform multiple trials for model optimization.



Limited control over modelling capability

Limited options to customize the hyper parameter values. This often results in an overfitting model.



Choosing the right framework

Difficulty in evaluating and choosing right auto AI/ML framework from large set of available solutions.

Business impact on DSPs

Impact on Customer Experience (CX)

Unable to provide the right personalized offerings to customers -Example: personalized billing based on historical usage and analysis.

Impact on Revenue

High OPEX and CAPEX due to inaccurate predictions and false positives.

Impact on Business Decisions

Difficulty in mining insights from the black box can result in inaccurate decisions -Example: Unable to find root cause for customer churn and lower NPS.

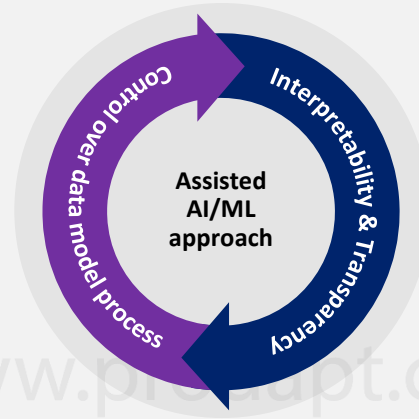
This creates an increasing demand for DSPs to use Assisted AIML Framework in-order to build more transparent and optimal ML model.

With Assisted Approach, DSPs Can Overcome the Limitations of Existing Auto AI/ML Frameworks



Assisted Approach in Data Modelling

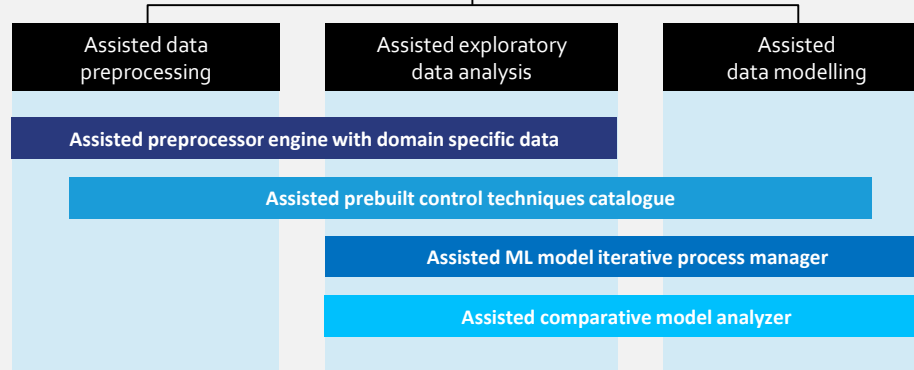
- Improve customization features
- Enrich modelling capability
- Enable best model outcome through flexible control techniques



Get Value From Domain Data

Get more business value by deriving accurate insights from domain specific data

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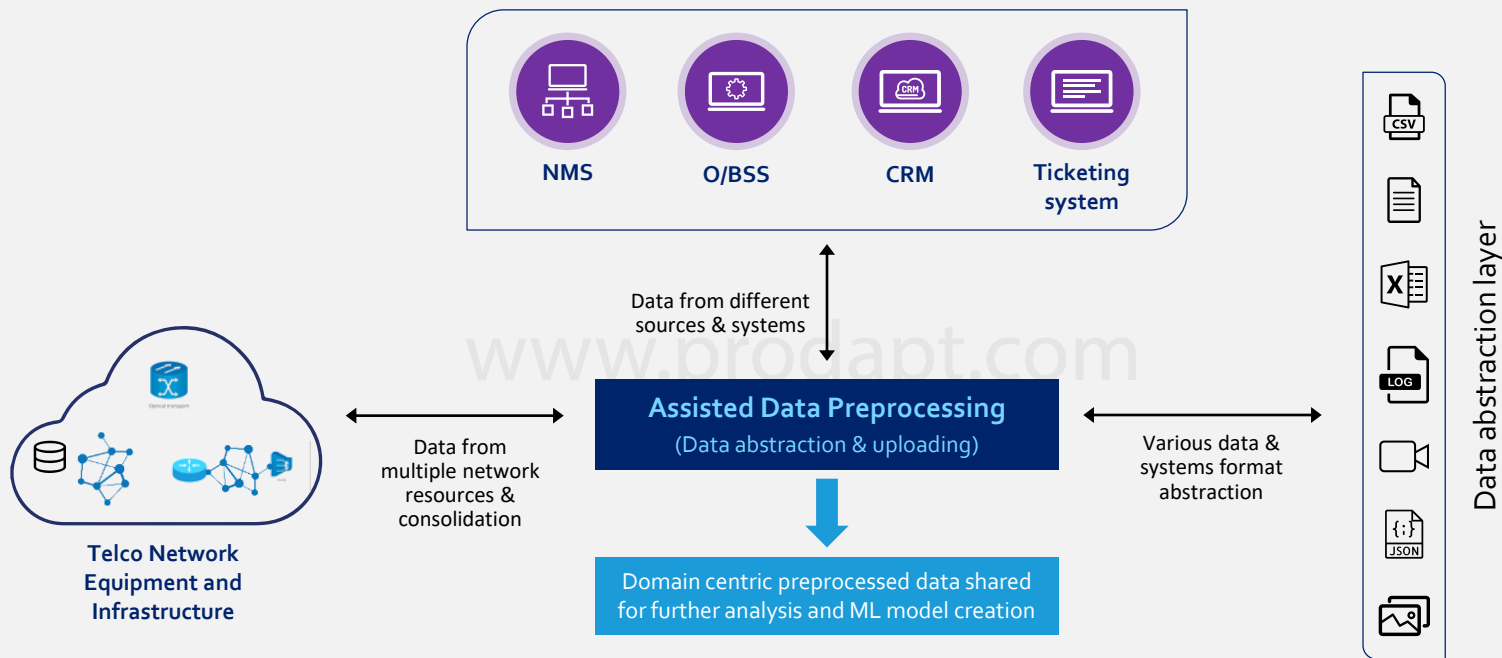


Key elements of the assisted AI/ML framework

It enables data preprocessing, exploratory data analysis and data modelling - all in assisted mode

Assisted Preprocessor Engine With Domain Specific Data

Infusing domain characteristics improves overall performance of the model



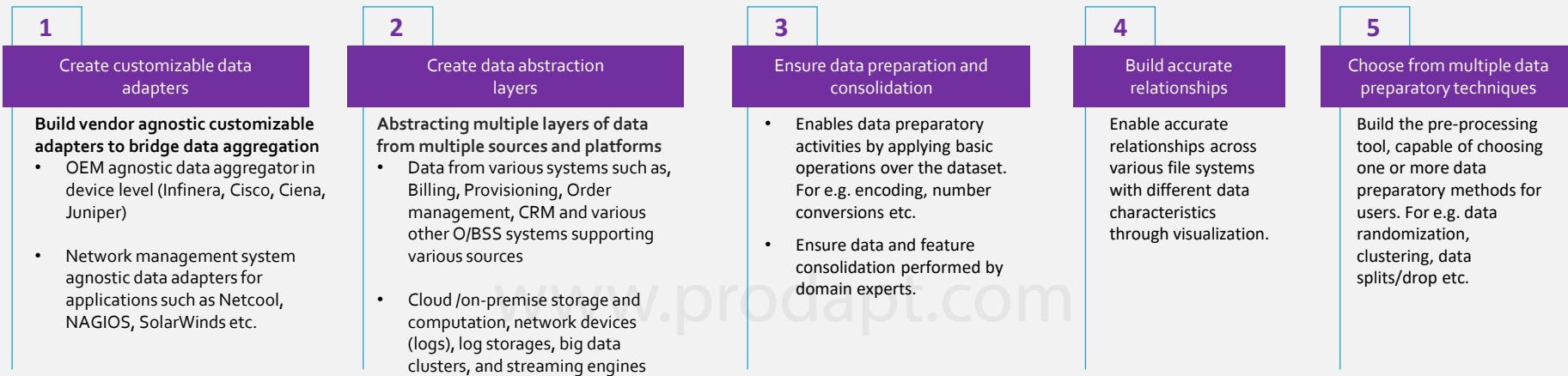
Treating device level datasets, analyzing the statistical characteristics, domain driven clustering, data visualization dashboards and applying assisted data processing techniques will improve the data quality

Assisted Preprocessor Engine With Domain Specific Data

Building customizable data preparation & visualization improves the data quality



Key capabilities that needs to be built on assisted preprocessor engine



Assisted preprocessing workflow | Sample use case: Network fault prediction for optical domain

Event & Alarm data from NMS

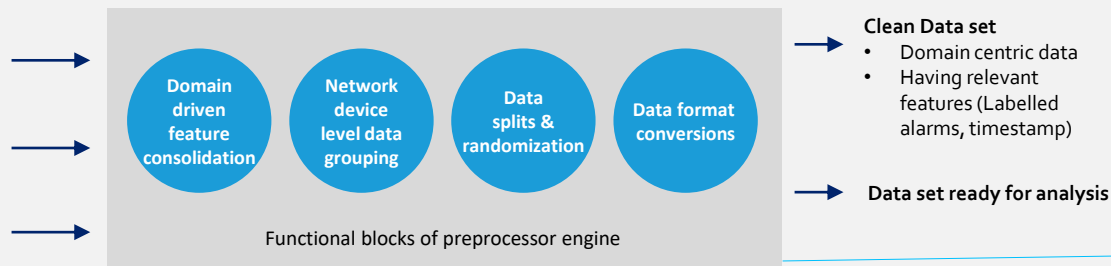
- Multiple alarm type
- Various severity levels
- Different timestamps

Performance metric data

- Frame error correction
- Phase correction
- Chromatic dispersion

Optical device related data

- Manufacturer, Device type
- Identification number

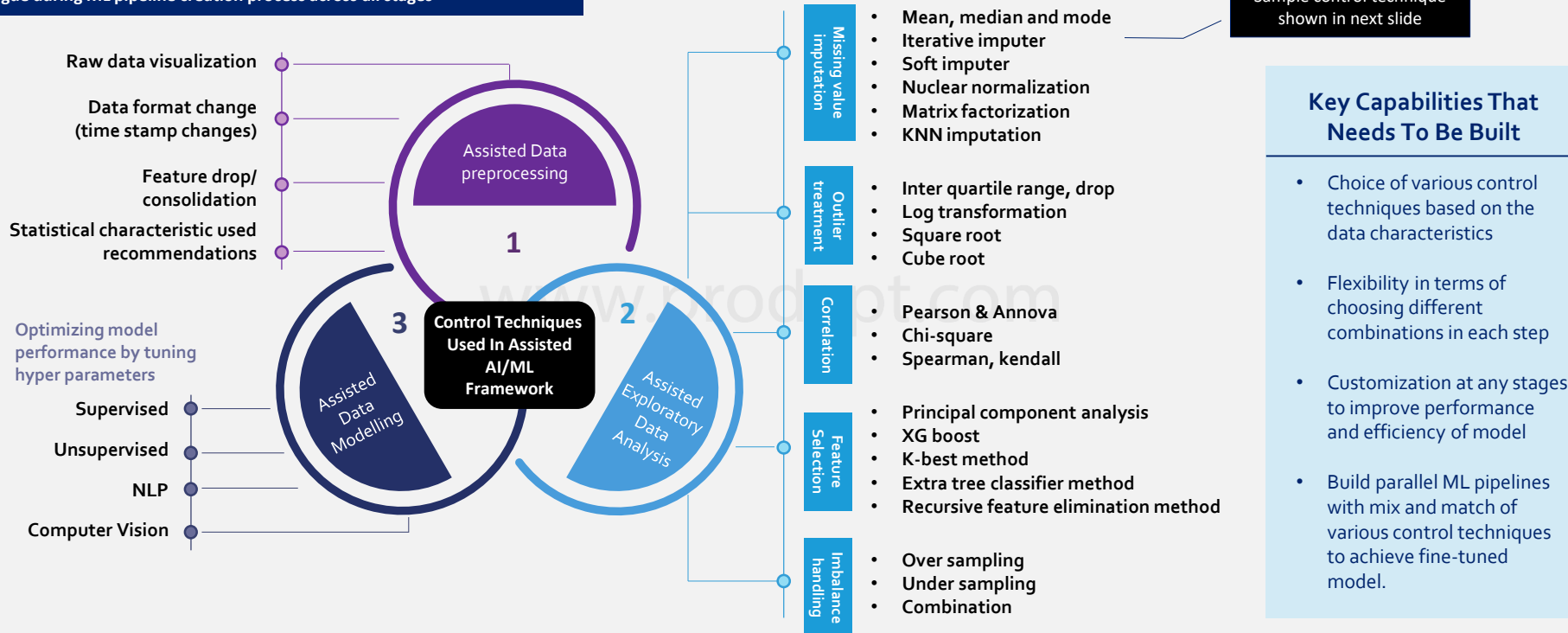


Preprocessing workflow functions are highly automated and flexible in assisted AI/ML framework. However, this needs to be programmed by domain experts in Auto AI/ML framework.

Assisted Prebuilt Control Techniques Catalogue

Flexible in applying various control techniques to improve model agility & robustness

Domain experts can apply a rich set of various control techniques from prebuilt catalogue during ML pipeline creation process across all stages



Applying various permutation & combinations of different control techniques leveraging assisted AI/ML framework to perform domain centric assisted preprocessing and data analysis

Application of Prebuilt Control Techniques

Sample use case: Network fault prediction for optical domain

Preprocessed dataset comprising various performance metrics data from multiple network devices, with

different class of device (make and model)

different geographic location

different network deployment

different call load

The following section elaborates the difference between auto AI/ML & assisted AI/ML frameworks using missing value imputation for a sample use case

Leveraging assisted AI/ML framework results in retention of feature characteristics

Applying assisted prebuilt control technique catalogue for imputing missing value for a specific feature is shown in the below snapshot.

- Using assisted AI/ML framework, the domain expert can group different class of devices and choose different set of missing value treatment per device class, thereby retaining device specific features.
- However in auto AI/ML framework it is not flexible, and a default method is applied across all class of devices results in dilution of feature characteristics.

Column Name	Update Value
Dummy	0.0

Dropdown menu options: Mean, Median, Mode, KNN, Biocaler, Nuclear Normalization, Soft impute

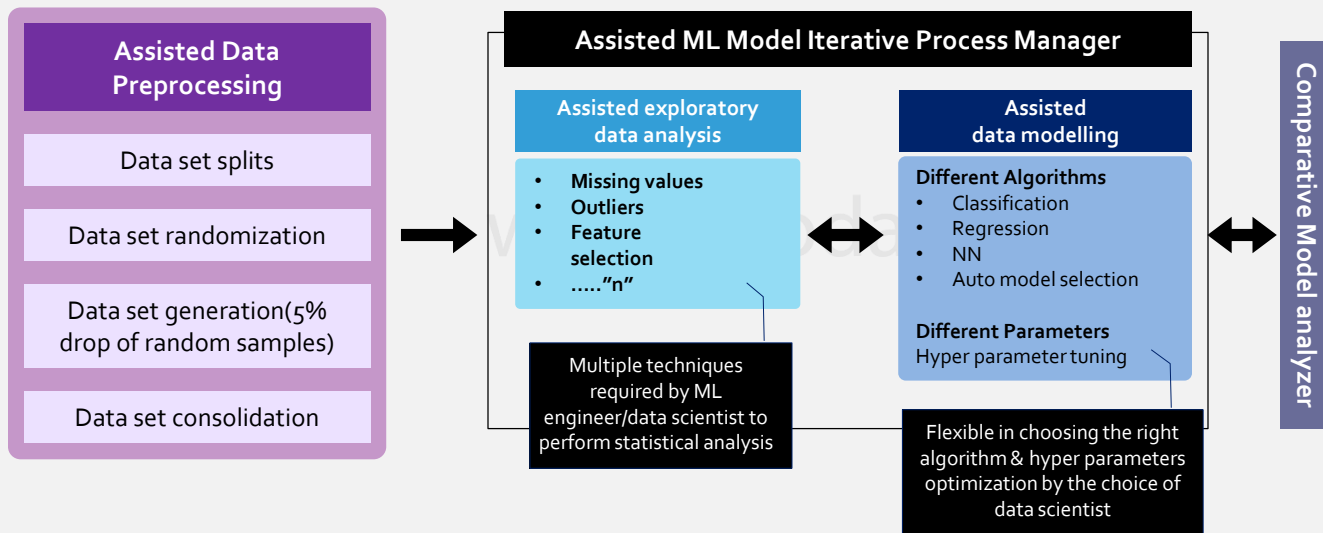
Sample snapshot showing the usage of assisted AI/ML approach in missing value imputation

Assisted ML Model Iterative Process Manager

Enable the domain expert to optimize and fine-tune ML model by performing multiple iterations



During model creation, the iterative process manager helps in creation of multiple ML pipelines in parallel with option to choose relevant techniques. It accelerates the entire ML pipeline creation process.



Iterative process manager enables the domain expert in efficiently performing the below activities

- **Multiple EDA trials:** Assisted exploratory data analysis with domain specific data visualization
- **Multiple modelling trials:** Assisted data model built with various algorithms based on end user's analysis
- **Model optimization:** Further optimizing the model by applying Hyper Parameter Optimization (HPO) techniques

With the help of assisted iterative or experimental approach, the domain expert can do multiple iterations. The resulting models are fed to the comparative model analyzer to choose the best one for deployment and integration.

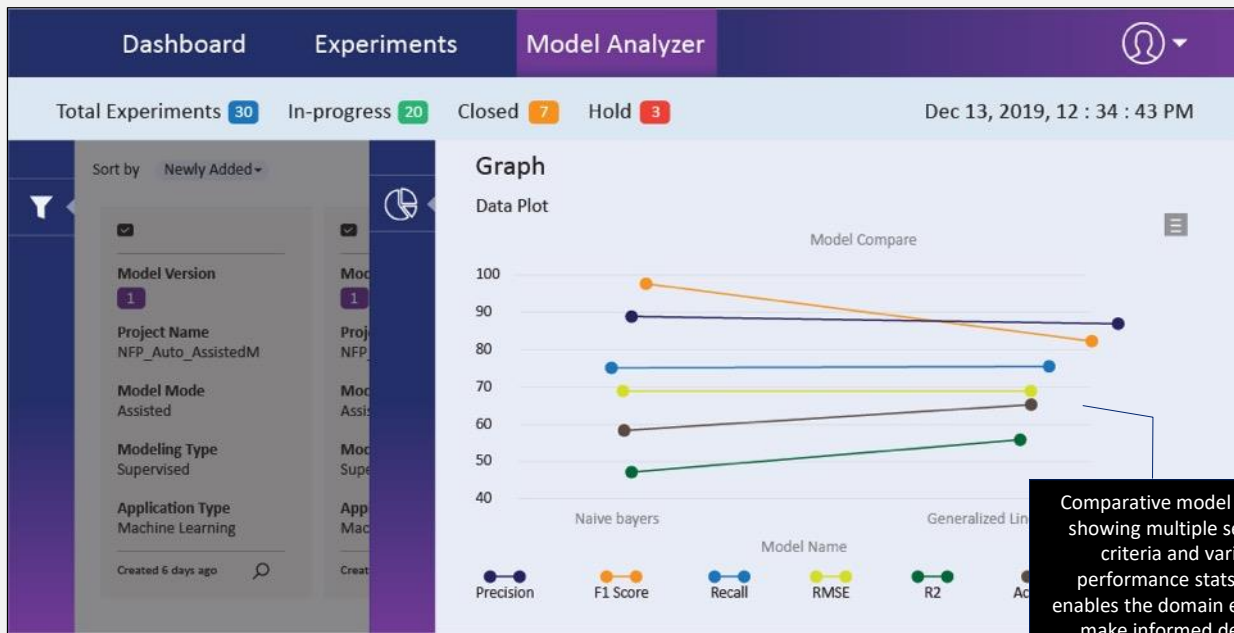
Assisted Comparative Model Analyzer

Enhancing decision making capabilities using analysis tool to choose the best optimal model



Sample Snapshot Of Comparative Model Analyzer

Complete set of models from iterative process manager are loaded into assisted comparative model analyzer tool to perform statistical and deep dive analysis.



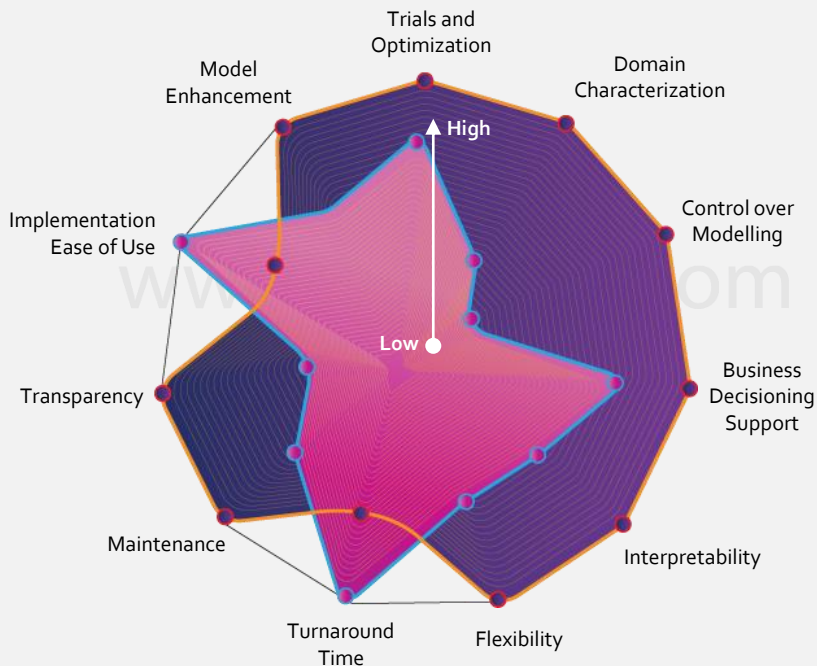
Key Capabilities That Needs To Be Built

- An intuitive visualization dashboard to show different model performance stats such as accuracy, precision, recall & F1 score.
- Ability to compare auto generated models against various assisted models to choose the best one.
- Capability to create an ensemble model which can be leveraged to address various complex challenges.
- The optimized model must be selected after validating the performance characteristics of various trial-results.

In Conclusion...

Existing auto machine learning (Auto AIML) frameworks are currently popular among DSPs.

However, in order to achieve transparent, scalable, robust and maintainable machine learning model, **assisted AIML framework-based solution** is highly recommended. The following shows the comparison between Assisted vs Auto AIML frameworks.



Assisted AI/ML

Auto AI/ML

Benefits that could be leveraged over Auto AIML

- Customer driven analysis
- Two-fold improved domain centric approach
- More flexibility in terms of model fine tuning
- Enables building optimized & robust model
- 5X improved transparency

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THANK YOU!