# High-Accuracy Prediction and Multi-Objective Optimization Using Multi-Sigma®

1. AI Model Construction Using Multi-Sigma®

In Multi-Sigma, the no-code AI analysis platform, we can choose between two machine learning approaches, Gaussian process regression or neural networks. This leaflet describes the construction of an AI model using neural networks. Multi-Sigma® supports multi-target models , handling up to 200 input and 100 output variables.
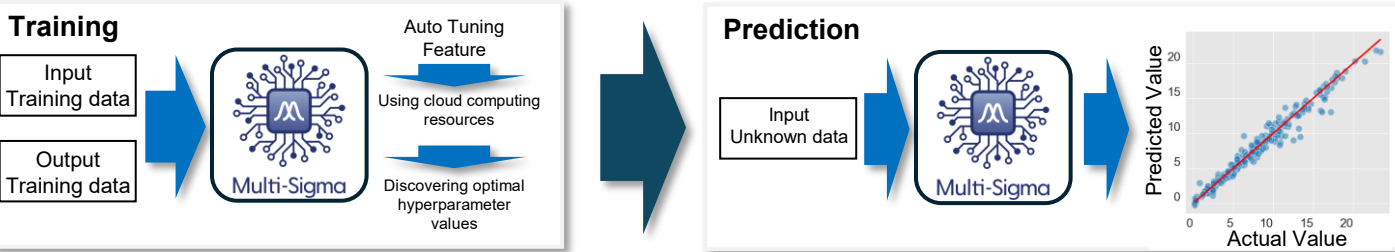
Multi-Sigma offers additional features to impute missing data, scale variables, and address data imbalances during model construction.

In Multi-Sigma®, up to 200 input variables can be handled.

Up to 100 output variables can be handled.
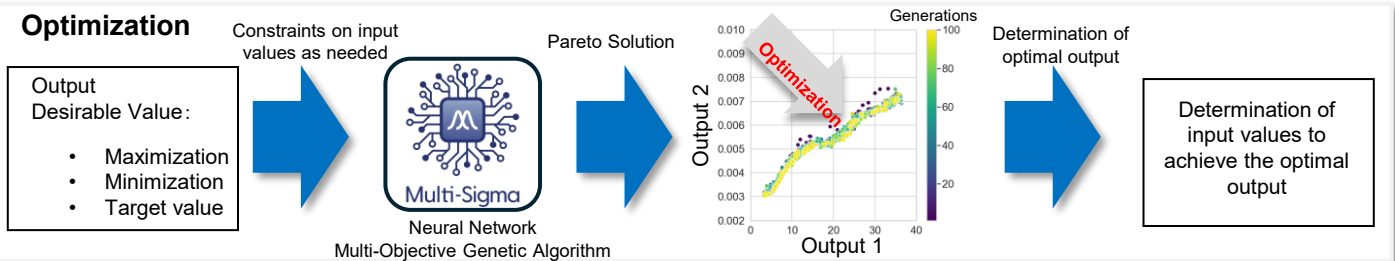

Figure1: Neural Network Model
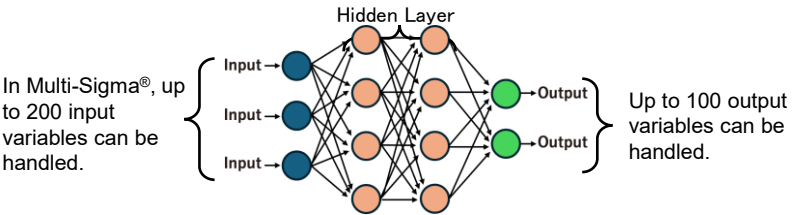
2. High-Accuracy Prediction Using Multi-Sigma®

Training a neural network model involves tuning hyperparameters such as the number of neurons, hidden layers, and activation functions. Because of this flexibility, model architectures and their results can vary significantly based on the skill and experience of data scientists. This diversity reflects the flexibility of neural networks and highlights both the appeal and complexity of machine learning. Due to this complexity, experience of data scientists remains a key factor in building accurate AI models. In contrast, Multi-Sigma® automates all hyperparameter selection using proprietary technology, enabling anyone to build highly accurate AI models.

Training
- Input Training data
- Output Training data

Auto Tuning Feature
Using cloud computing resources
Discovering optimal hyperparameter values

Prediction
- Input Unknown data

3. Multi-Objective Optimization Using Multi-Sigma®

AI prediction aims to estimate outputs from given inputs. Conversely, AI optimization seeks suitable inputs to achieve a desired output, such as performance or specific result. Traditional optimization methods typically focus on single-objective problems, where only one objective variable is considered. These methods aim to maximize or minimize that objective function. For example, one might tune parameters based on a single evaluation metric such as accuracy or processing time. Techniques such as gradient-based methods and grid search have been widely used for this type of optimization. However, in real-world applications, it is often necessary to consider multiple objectives simultaneously. For instance, objectives like high performance at low cost or high accuracy with fast processing often involve trade-offs, and relying on a single optimal solution can make decision-making difficult. To address this challenge, Multi-Sigma® combines neural network models with multi-objective genetic algorithms (MOGA) to enable flexible and efficient optimization across multiple, potentially conflicting objectives.

Optimization

Output Desirable Value：
- Maximization
- Minimization
- Target value

Constraints on input values as needed

Neural Network Multi-Objective Genetic Algorithm

Pareto Solution

Determination of optimal output

Determination of input values to achieve the optimal output

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