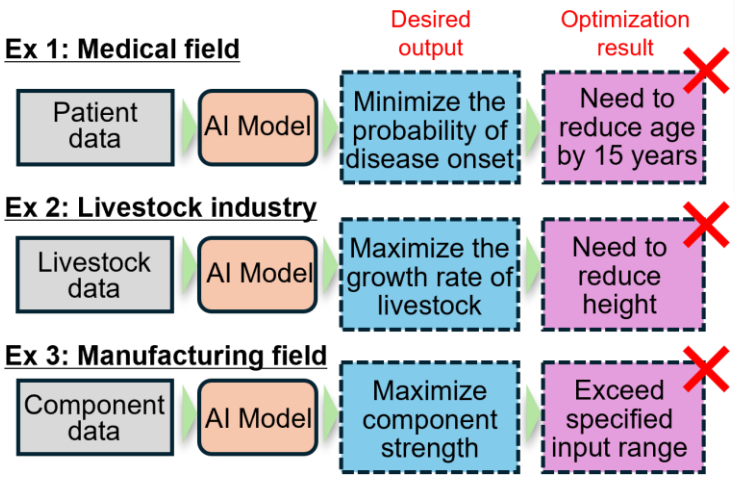
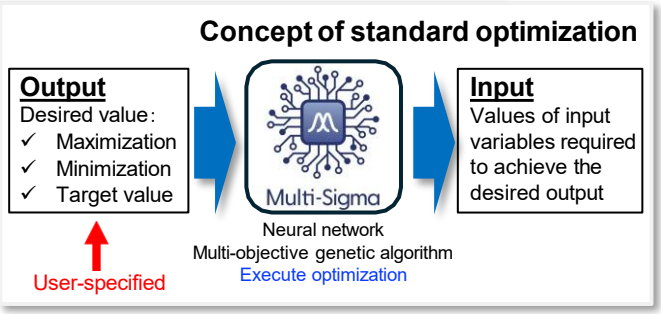
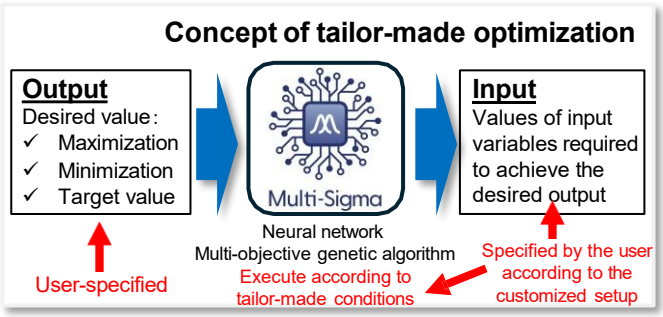
Tailor-Made Optimization Using Multi-Sigma®

1. Fundamental principles of tailor-made optimization with Multi-Sigma®

When conducting optimization, focusing solely on driving the output variables toward their desired values can lead to unrealistic input-variable settings.







To address this issue, Multi-Sigma® provides a tailor-made optimization feature. This feature allows users to impose constraints on the possible ranges of input values during optimization, enabling them to specify input parameters that fall within certain values or defined limits.

2. Case study of tailor-made optimization using Multi-Sigma® (Medical data)

Age	Height	Weight	Gender	Medication therapy	Physical therapy	Exercise therapy	Pain reduction
66	172	80	0	2	7	0	1.9
76	168	88	0	7	6	10	4.2
84	167	54	1	7	6	10	4.5
79	168	86	1	7	3	0	2.3
84	150	56	0	8	4	4	0.1
65	180	75	0	5	1	6	0.7
85	157	57	0	7	0	9	3.5
66	152	84	0	10	6	4	4.3
88	180	83	0	6	3	1	3.4

Input | Output

Training data → AI Model → Optimization

To execute optimization, it is first necessary to build an AI model. In Multi-Sigma®, users can choose between a neural network and aussian process regression when constructing the AI model. Using the model built in this way, optimization is carried out to maximize the degree of pain reduction through therapy. However, since input variables such as age, height, weight, and gender need to be specified for each patient, the tailor-made optimization feature is used.

Age	Height	Weight	Gender	Medication therapy	Physical therapy	Exercise therapy	Pain reduction
66	172	80	0	2	7	0	Maximize

Fixed input variables:
Set to the values specific to the target patient.

Adjustable input variables:
Search for optimal values

By fixing patient-specific input variables such as age, it becomes possible to propose a tailor-made treatment plan optimized for the individual patient.

Note 1) The data used in this analysis is an artificial dataset.
Note 2) For gender, 0 indicates male and 1 indicates female.
Note 3) Pharmacotherapy represents the drug intensity (0 to 10).
Note 4) Physical therapy represents the frequency of therapy sessions (times per week).
Note 5) Exercise therapy represents the intensity of the exercise program (0 to 10).

AIZOTH inc. provides a range of AI services, including Multi-Sigma®, AI consulting, experimental condition optimization support, and contract research and development.
Multi-Sigma® is a cloud-based AI software designed for research and development, significantly reducing experimental workload and enabling researchers to discover innovative solutions to real-world challenges with minimal experimental datasets.

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