

Component

data

Al Model

Tailor-Made Optimization Using Multi-Sigma®

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

When conducting optimization, focusing solely on driving Concept of standard optimization the output variables toward their desired values can lead to unrealistic input-variable settings. **Output** <u>Input</u> Desired value: Values of input Optimization Maximization variables required Ex 1: Medical field output result Minimization to achieve the desired output Target value Need to Minimize the Patient Neural network Al Model probability of reduce age data Multi-objective genetic algorithm by 15 years disease onset **Execute optimization** User-specified Ex 2: Livestock industry Concept of tailor-made optimization Maximize the Need to Livestock Al Model reduce growth rate of data <u>Output</u> Input height livestock Desired value: Values of input Maximization variables required Ex 3: Manufacturing field

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.

Minimization

Target value

User-specified

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

Exceed

specified

input range

Age	Height	Weight	Gender	Medication 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

Maximize

component

strength

To execute optimization, it is first

Training data

Neural network

Multi-objective genetic algorithm Execute according to

tailor-made conditions

necessary to build an Al 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.

Al Model

to achieve the

desired output

Specified by the use

according to the

Optimization

Height Weight Gender Age 66 172

Medication Physical Exercise therapy therapy therapy

Pain reduction 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 Al software designed for research and development, significantly reducing experimental workload and enabling researchers to discover innovative solutions to realworld challenges with minimal experimental datasets.

https://aizoth.com/en/service/multi-sigma/ info@aizoth.com













