AIDesigner tab

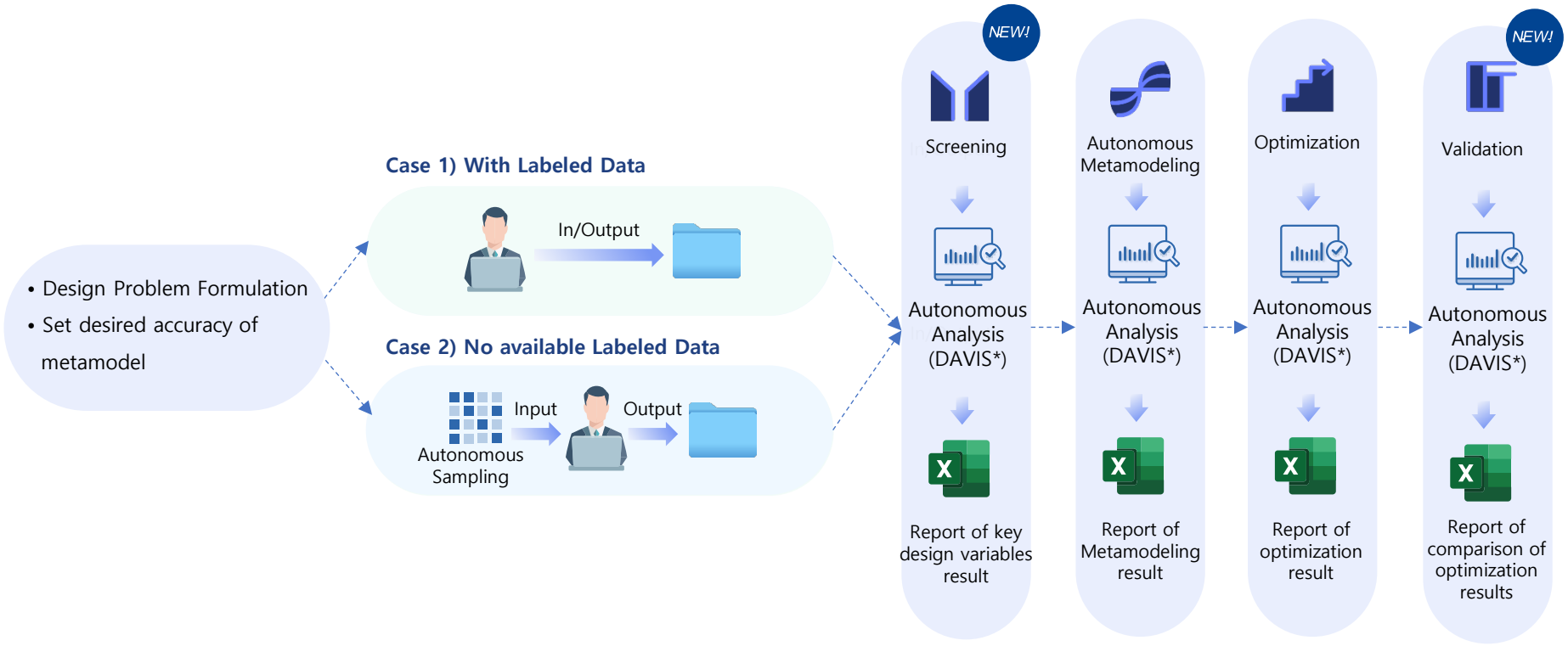
AI-based autonomous optimization
and data analysis software

PIDOTECH

CONTENTS

Contents of AIDesigner tab

AIDesigner tab is an AI-based software for autonomous optimization and data analysis that seamlessly integrates different engines for Sampling, Metamodeling, Integrated optimization, Data analysis, and report generation from labeled data, developed based on know-hows of PIDOTECH. With the use of AI, anyone can perform optimization and generate a report of results without the knowledge of optimal design.



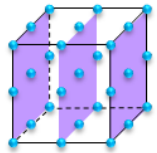
Reduction of report generation time from several days to just a few minutes with DAVIS technology!

*DAVIS – Refer to Page 5 of the Introductory material

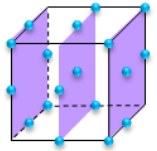
Functions of AIDesigner tab

All procedures can be performed with autonomous selection of appropriate design methodologies, without any user intervention.

Screening NEW!

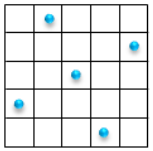


Full Factorial Design



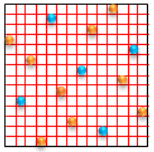
Partial Factorial Design

Ex) OA, NearOA, PBD,...



Dace Sampling

Ex) OLHD, CVT,...

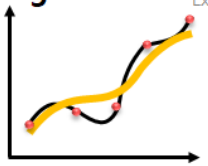


Augmenting Design

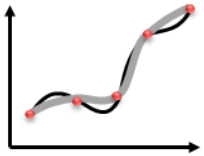
Ex) ALHD,...

Metamodeling

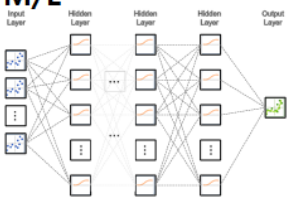
Regression Ex) PR, RBFr,...



Interpolation Ex) Kriging, RBFi,...



M/L Ex) MLP, EDT,...



Optimization

Local

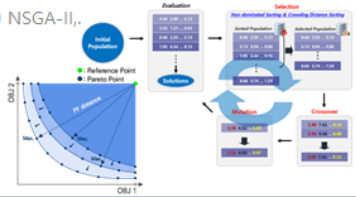
Ex) Function-based / Gradient-based Method

Global (Metaheuristic)

Ex)
HMA,
CMA-ES,
PADO,
EA,...

MOGA

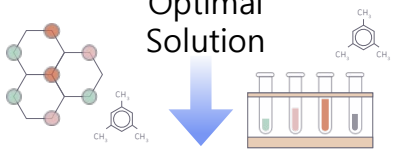
Ex) NSGA-II,.

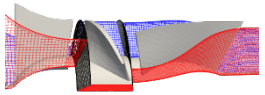


Validation NEW!

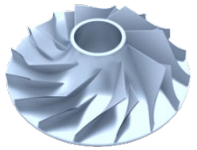
AIDesigner tab

Optimal Solution





Simulation Model



Real Model

Comparison and analysis of optimal solution and actual validation results

1 Autonomous Screening

2 Autonomous Metamodeling

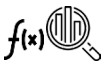
3 Autonomous Optimization

4 Autonomous Validation

DAVIS (Data Analysis, Visualization and Interactive Storytelling)

DAVIS, developed by PIDOTECH, is a data-storytelling technology for design optimization, which provides reports of results and design guidelines in a data-storytelling format that users can intuitively understand.

1) Data Collection Autonomously collects required data for analysis by using ML Models.



2) Data Analysis Extracts useful information to explain results such as optimal design, contribution analysis, trade-off analysis, and sensitivity analysis.

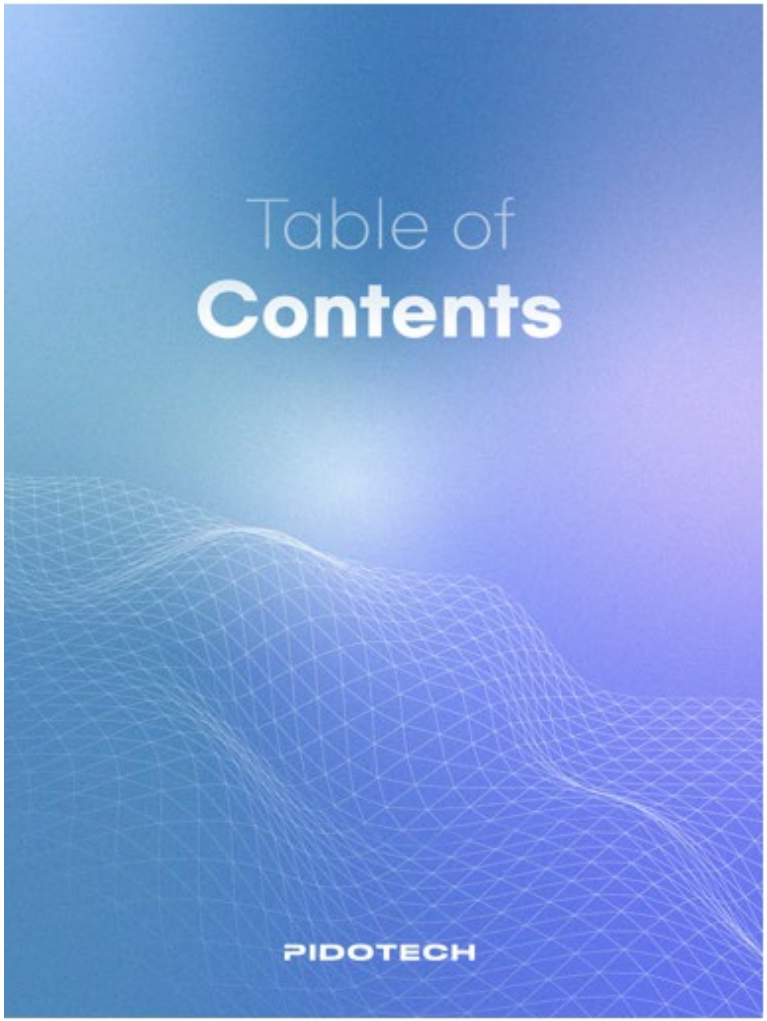
3) Narrative Generation Generates narratives that explain and summarize analyzed results to assist users in understanding.

4) Visualization Generates various visual materials to assist engineers in understanding key outcomes.

5) Excel Deployment Generates Excel report that includes interactive features along with explanations and visual materials

Reference Report Table of Contents Feature

The table of contents for the Reference Report on Screening, Autonomous Metamodeling, and Optimization is organized, allowing navigation to the desired sheet.



Screening Result

1

1_Sensitivity Matrix

2_Design degrees of freedom

3_Key design variables

4_Effect of key design variables

5_Analysis of performance indices

1 Click to navigate to the desired content

Report of Screening Result

Screening Result

1 2 design variables out of 5 design variables were selected by removing only design variables that had little impact on the optimization

2

No. of design variables
5

No. of objectives
1

No. of constraints
2

No. of data
63

1) Summarize it

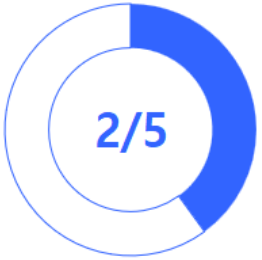
3

- It is an optimization problem that improves 1 objectives while satisfying 2 constraints with 5 design variables.
  63 data can predict the relationship between the design variable and the response in a quadratic form.
- 2 design variables out of 5 design variables were selected by removing only design variables that had little impact on the optimization (Priority 1~2) - refer 2)
- About the ranging of design variables to find a better optimal solution, it is recommended to adjust the range of 1 design variables - refer 2)
- The sensitivity table below provides information such as sensitivity , trend, and direction of improvement between design variable(column) and objective/constraint(row). - refer 3)

2) Screening information and proposal for important design variable ranging

- 2 design variables out of 5 design variables were selected by removing only design variables that had little impact on the optimization (Priority 1~2)
  The table below is sorted according to the order of priority of the design variables, so if you want to add in addition to the 2 design variables, you can add it according to the order of priority.
- About the ranging of design variables to find a better optimal solution, it is recommended to adjust the range of 1 design variables

No. of selected design variables /No. of all design variables



Priority	Name	AS IS LB	AS IS UB	TO BE LB	TO BE UB	Range(graph) Gray: AS IS Blue: TO BE
1	A1	3.00	10.00	3.00	10.00	
2	A2	3.00	10.00	2.70	10.00	
3	Angle	42.50	47.50	42.50	47.50	
4	Length	90.00	110.00	90.00	110.00	
5	Force	1,900.00	2,100.00	1,900.00	2,100.00	

1 Check the final result

2 Check the number of design variables, objective function, data and constraints

3 Check the summary of the screening result

Report of Screening Result

4

3) Trend and sensitivity of responses to design variables

- The sensitivity table below provides information such as sensitivity , trend, and direction of improvement between design variable(column) and objective/constraint(row).
  The darker the color of the cell, the higher the sensitivity, and the line chart inside the cell shows the trend of
- In the current sensitivity table, for example,
  the most sensitive design variable to the objective Volume is A1, which means that the smaller A1 to improve Volume, the better.

▶	Improve as design variable increase
◀	Improve as design variable decrease
◀ —— ▶	Improve as design variables go up and down
▷◁	Improve as design variables reach middle

Design variable

Priority ▶	1	2			
	A1	A2	Force	Angle	Length

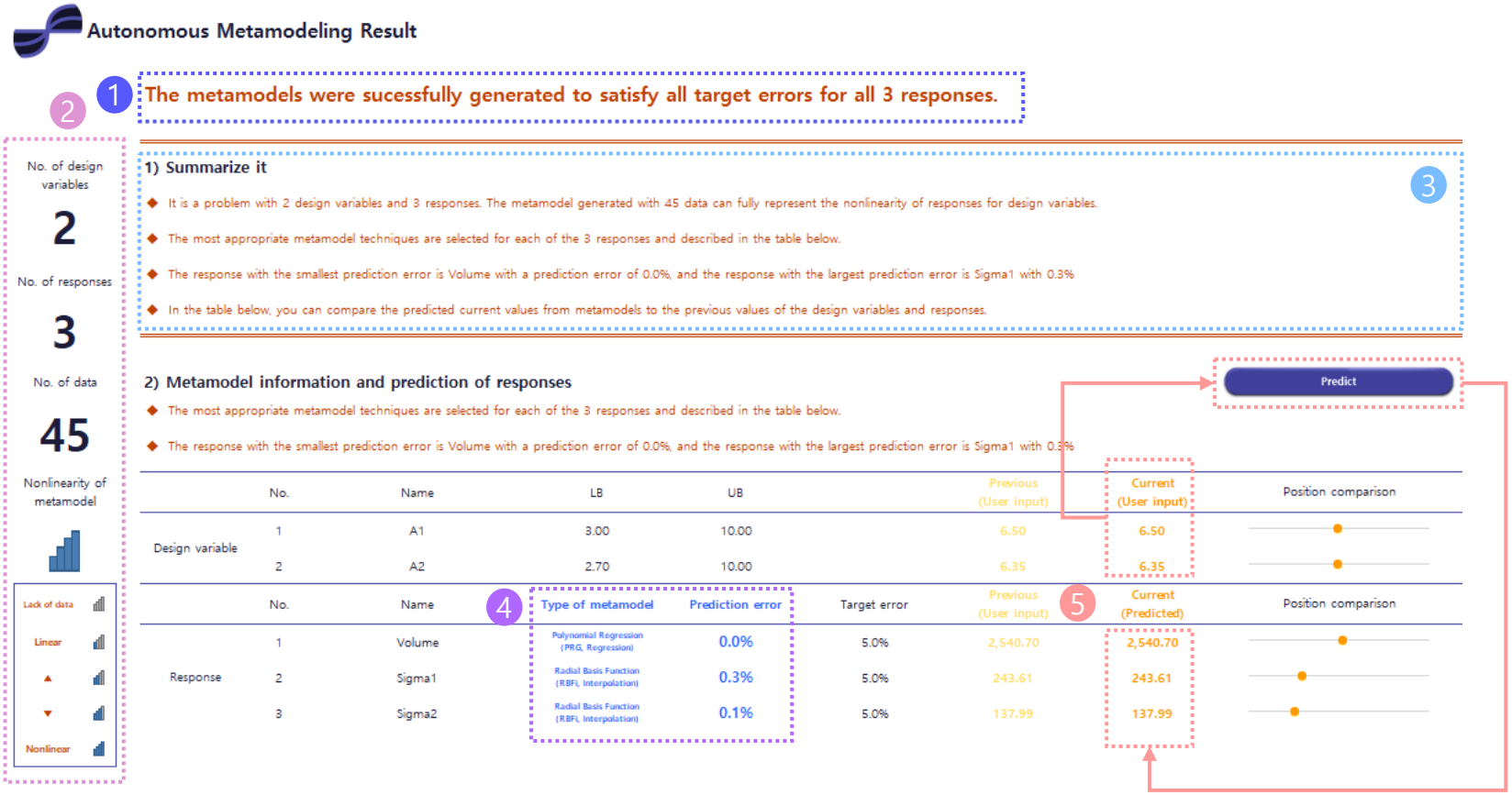
	Name	Type	Target					
Objective	Volume	Minimize	None	67% ◀	21% ◀	1%	0%	16% ◀
	Name	**LB**	**UB**					
Constraint	Sigma1	None	200	75% ▶	14% ▶	7%	2%	2%
	Sigma2	None	200	35% ▶	47% ▶	6%	8%	4%

4 Verification of the trend and sensitivity of performance metrics about design variables

Report of Autonomous Metamodeling Result

With DAVIS technology, writing report that can take several days can be completed within minutes.

The exported Excel-format report can be used by anyone without the need for a license, enhancing the efficiency.



1 Check the final result

2 Check design variables, performance metrics, number of data, and nonlinearity of metamodels

3 Check the summary of the Metamodeling result

4 Check the information of metamodels

5 Enter the design variable values and click Predict to immediately view the predicted performance metric values

Report of Design Optimization Result (1)

Design Optimization Result

1 The optimization with a 1.8% improvement in the objective was successfully finished, satisfying all constraints.

2

No. of design variables
2
No. of objectives
1
No. of constraints
2

1) Summarize it

3

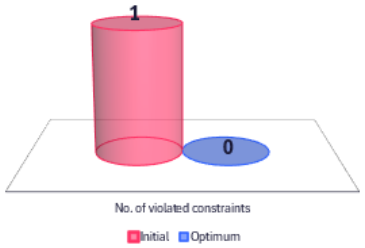
- It is a single-objective optimization problem that improves an objective while satisfying 2 constraint(s) with 2 design variables.
- 1 constraint(s) was/were initially violated, the optimization was successfully finished satisfying all constraints.
- The objective Volume was improved by 1.8%.
- The objective Volume was improved the most by the contribution of the design variable A2

2) Satisfaction of constraints

4

- 1 constraint(s) was/were initially violated, the optimization was successfully finished satisfying all constraints.

Change in the number of violated constraint(s)



ALL
satisfied

3) Improvement of objectives

5

- The objective Volume was improved by 1.8%.

Improvement rate of individual objectives(%)

1.8%
Improved (Average)

1 Check the final result

2 Check the number of design variables, objective function, and constraints

3 Check the summary of the optimization result

4 Check whether the constraints are satisfied

5 Check the degree of improvements in the objective function

Report of Design Optimization Result (2)

4) Detailed results

◆ The objective Volume was improved the most by the contribution of the design variable A2

	No.	Name	Changes after optimization	LB	Initial	Optimum	UB	Red: Initial Blue: Optimum	Additional improvement guide
Design variable	1	A1	Increased	3.00	7.00	7.83	10.00		
	2	A2	Decreased	2.70	7.00	4.17	10.00		
	No.	Name	Changes after optimization	Weight	Initial	Optimum	Type	Target	Red: Initial Blue: Optimum	Additional improvement guide
Objective	1	Volume	Improved	1.00	2,679.90	2,631.53	Minimize	NONE		It is in conflict with Sigma1, Sigma2.
	No.	Name	Changes after optimization	LB	Initial	Optimum	UB	Red: Initial Blue: Optimum Green: Feasible region	Additional improvement guide
Constraint	1	Sigma1	Satisfied within tolerance (Approaching UB)	NONE	202.03	200.60	200.00		
	2	Sigma2	Satisfied	NONE	118.36	145.65	200.00		

1 Check the result of design variables, objective function, and constraints

2 A guideline is provided in case the optimal solution can potentially be improved further.

Report of Validation Result

Design Optimization Validation Result

1 As a result of comparing the actual value with the predicted, an average error of 0.00% (0.00 ~ 0.01%) occurred.

2

No. of design variables **2**

No. of objectives **1**

No. of constraints **2**

1) Summarize it

3

- It is a single-objective optimization problem that improves an objective while satisfying 2 constraint(s) with 2 design variables.
- As a result of comparing the actual value with the predicted, an average error of 0.00% (0.00 ~ 0.01%) occurred.
- The optimization with a metamodel results in 1.8% improvement in the objectives, satisfying all constraints.
- The validation analysis with a real model results in 1.8% improvement in the objectives, satisfying all constraints.

2) Comparison (Predicted vs. Actual)

4

- The validation analysis with a real model results in 1.8% improvement in the objectives, satisfying all constraints.

	No.	Name	LB	Initial	Optimum	UB
Design variable	1	A1	3.00	7.00	7.83	10.00
	2	A2	2.70	7.00	4.17	10.00

	No.	Name	Weight	Initial		Optimum		Type	Target
				Predicted /Actual	Error(%)	Predicted /Actual	Error(%)		
Objective	1	Volume	1.00	2,679.90 / 2,679.90	0.00%	2,631.53 / 2,631.53	0.00%	Minimize	NONE

	No.	Name	LB	Initial		Optimum		UB
				Predicted /Actual	Error(%)	Predicted /Actual	Error(%)	
Constraint	1	Sigma1	NONE	202.03 / 202.03	0.00%	200.60 / 200.57	0.01%	200.00
	2	Sigma2	NONE	118.36 / 118.35	0.01%	145.65 / 145.66	0.01%	200.00

1 Check the final result

2 Check the number of design variables, objective function, and constraints

3 Check the summary of the final result

4 Compare the results of the optimal design

Additional Functions of Report

Offers three color modes, allowing users to extract content from reports and design guides for use in research papers or technical documents. Additionally, it facilitates collaboration with international engineers by providing report options in both Korean and English.

Customers

Automobile

Electrical/Electronic

Steel

Construction

Shipbuilding/Plant

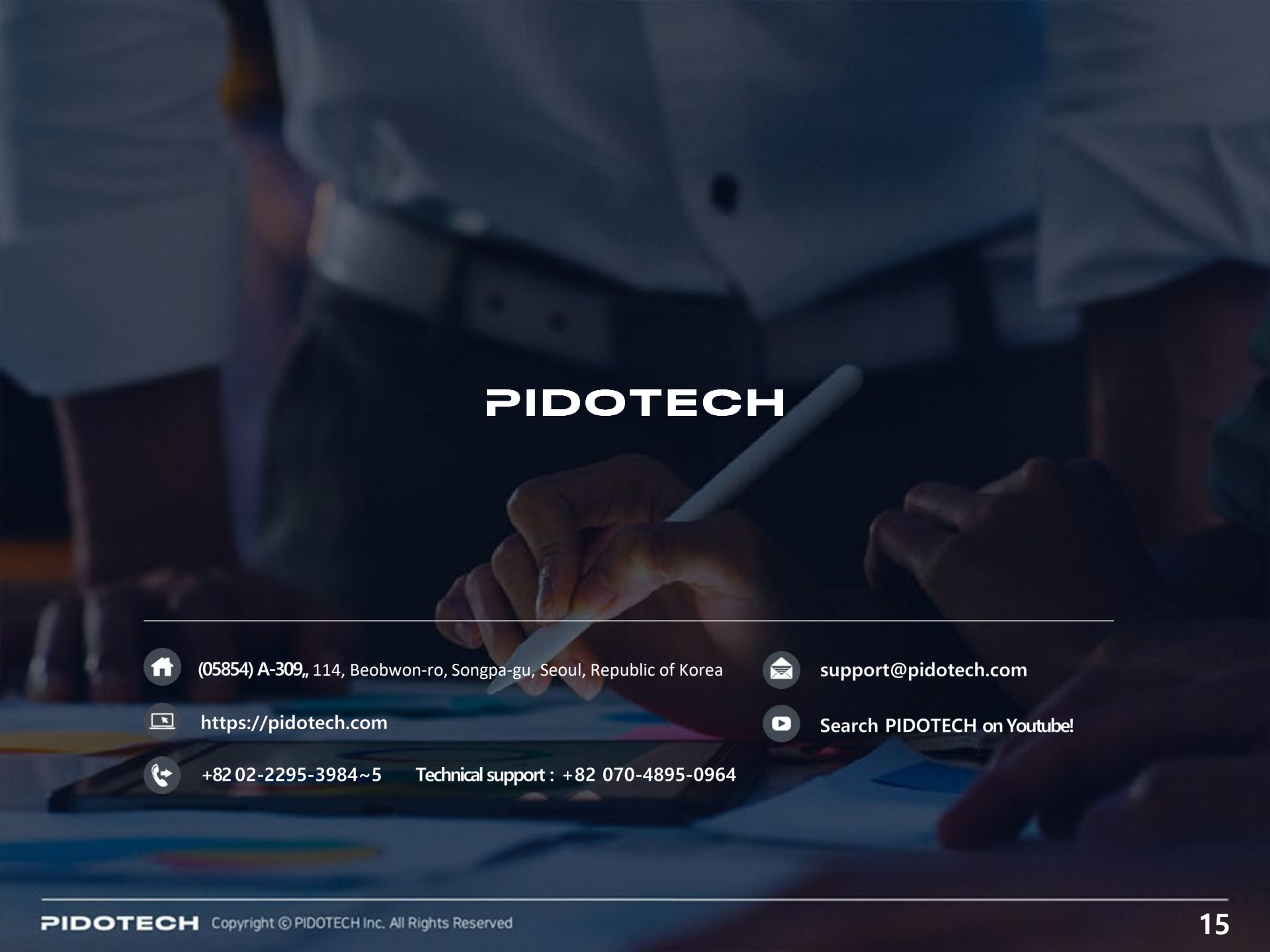
Material

National defense / Aviati

Machinery/Production

IT/SW

University



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