Machine Learning for Truck Aerodynamic Performance Evaluation and Optimization

RICOS Co. Ltd. 21st Jan. 2025

Agenda

- Updates on generative CAE
- Discussion of project status
- Demonstration of Gen-CAE

Updates on generative CAE

- Overview
 - Generative CAE model is updated to satisfy constraints for all the designs created during optimization
- Result of trial optimization on updated model
 - Trial optimization study is performed with the updated model



Optimization study results

parameter	Trial00	Trial3783
"cab_height_displacement"	0.0	-171
"window_angle_displacement"	0.0	-27
"front_angle_displacement"	0.0	-200
"side_fillet_expanding"	0.0	47
"under_cover_ratio"	1.0	0.549
Predicted Cd	0.4289	0.4258



Best design Trial3783 (red) and base design Trial00 (gray, semi-transparent)

Discussion of project status

- Summary of 1st step(June-Dec)
 - We approached your problem with both Lightning and Generative CAE using your data
 - Both tools operated properly, and produced expected results
- Next Actions
 - We will open the Gen-CAE access to both of you(or your group members) after today's call, and provide a quick manual(as below)
 - You can freely use that until end-of February

- We want to collect your feedback to refine the system for a potential full introduction
- Feedback & improvements
 - During the test period, please evaluate tool usability, output accuracy, and any other aspects important to you
 - Let us know if you have any specific feature requests or improvements
- Next February discussion
 - \circ $\,$ We will collect your feedback and discuss about next step $\,$

Demonstration of Gen-CAE

- Preparation
 - Login to RICOS Production Suite
 - Cloud based tool. Nothing to install to your PC.
 - Please choose the Scania group from "Workspace"
 - When selecting the group, all of the team members will access the same data

RICOS Production Suite	Sc Sc	
RICOS Fluid Conversion Resourcess	RICOS Production Suite	
Train Prediction	Workspace ➡ ▲ a_okayama	20
Data	🚢 mel	(2)
File-set List	🙁 Sc	2
😁 Batch process		
1 File-set bulk upload		

- Go to File-set List and find Generative CAE Template
- You will see "Generative CAE" from "File-set information"

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- Execution
 - Click "Generative CAE" to proceed to modify optimization settings
 - Enter min and max values for each parameter
 - Enter arbitrary "Trial name"
 - Choose Generative CAE "Engine"
 - Click "Run Simulation" to proceed to execute settings
 - Execute settings
 - Computation Time Limit : Up to 86,400 minutes (60 days)

0. Cab Height Displacement	max:	50	min:	-200	mm
1. Window Angle Displacemer	nt max:	200	min:	-50	mm
2. Front Angle Displacement	max:	48	min:	-200	mm
3. Side Fillet Expanding	max:	50	min:	0	mm
4. Under Cover Ratio	max:	1	min:	0	ĺ

	Gen. CAE
ļ	Trial name
	20250120_scania_trial.jso
	E Run Simulation
	Engine
	Generative CAE

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		Compute Resource	iv_24x_ 🗸	24 CPU/480 GB/0 GPU	20250120_scania_tria	il name l.jso
		No. of Nodes	1 ~		5	
		Computation Time Limit	1440	Up to 86400 minutes	Run Simulation	
		License	GenCAE 🗸		Generative CAE	~
		No. of Jobs	1			
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visplacement	min:	Billing				
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. Front Angle	max:	Execute	c	Cancel		
isplacement	min: -20	U	_	_	_	
. Side Fillet	max: 5	0				
xpanding	min:	0				
Under Course Datia	max:	1				
. Under Cover Ratio	min:	0				

- After running optimization, you will see "Summarize Result" for your File-set
 - This feature enables you to visualize the best designs of your optimization study

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	Job List		template.json	JSON	2025/01/20 21:52:27		1.6KB	$_{\pm}$	
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- PostProcess
 - When you click "Summarize Result", you will see the list of optimization jobs

- Choose the optimization job that you want to summarize the result
- Choose GenerativeCAE Summary from "Engine"
- Enter arbitrary "prefix" and "suffix" to identify the postprocess results
- Enter the number of results that you want to visualize
- Click "Batch processing" to start visualization of the result

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Batch	Mode				Batch processing	
	Name	Create time	Туре	ID	20250120_test1_	Prefix
		Descending ~	Generative CAE Optimize Trial 🗢			Suffix
	20250120_scania_trial.json	2025-01-20 21:52:23	Generative CAE Optimize Trial	0cdbd5eb2a944056a6edc91c8f46c4c1		
	Trial1	2024-12-13 17:46:08	Generative CAE Optimize Trial	b7d78fb39e354825b458ab2204c37bcc	Batch processing	
	20241213_scania.json	2024-12-13 14:46:21	Generative CAE Optimize Trial	325545cfee6b47318090bbe58d8a8ed1	selecting 1 out of 6 job)S
	20241205_scania_1212	2024-12-12 16:00:09	Generative CAE Optimize Trial	ac126ad6a8c549ad9936926f97a48ec5	Engine	
	20241205_scania	2024-12-11 23:13:29	Generative CAE Optimize Trial	5640ec5566304431a696225344432152	GenerativeCAE Summar	у 👻
	20241205_scania	2024-12-11 12:37:56	Generative CAE Optimize Trial	580da635a40d4b4da1e878b872810d38	5	orresults

- Once the job is done (you will receive email from the system), you can download the followings:
 - Summary.log
 - Summary of Trial number and Cd value
 - trials.csv
 - Details of trials including result and each parameter
 - result/*.zip
 - Visualized result of the specific trial
 - The number means the order of Cd value (1 means the best)
 - It contains the followings:
 - result/features.txt : cda and cd value
 - result/mesh.vtu : mesh file including pressure and velocity field predicted by RICOS Lightning
 - shape : STL files of the specific trial
 - trials.zip
 - Combined zip file of the results
 - template.json
 - Template file used in the optimization study

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File-set >			File-set > File-set Information						
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	Bulk Upload		summary.log	Application Log File	2025/01/20 23:00:28		54	6 byte	+
			trials.csv	CSV	2025/01/20 23:00:28		81	5 byte	+
			trials.zip		2025/01/20 23:00:28		2	196MB	+
			result/1.zip		2025/01/20 23:00:28			59MB	+
			result/2.zip		2025/01/20 23:00:28			59MB	+
			result/3.zip		2025/01/20 23:00:29			59MB	+
			result/4.zip		2025/01/20 23:00:29			59MB	+
			result/5.zip		2025/01/20 23:00:29			59MB	$\mathbf{+}$

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