NAATBATT 2025

EXTENDING RANGE

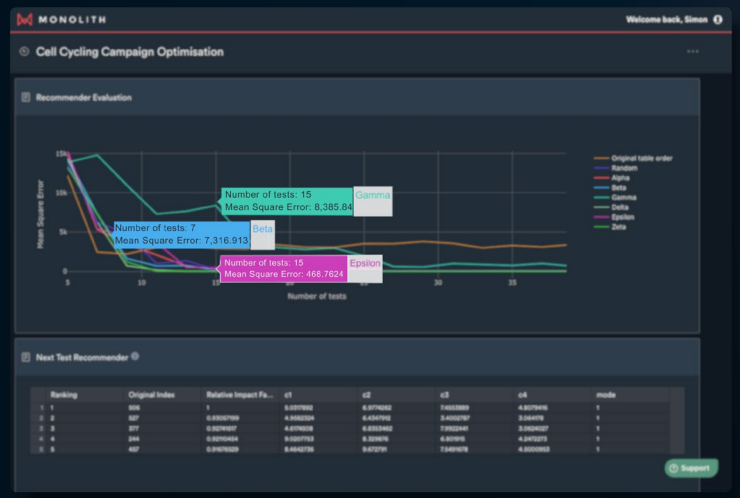
Use AI To Accelerate The Development Of Next-Generation Battery Materials and Cell Components

Dr. Richard Ahlfeld

CEO and Founder

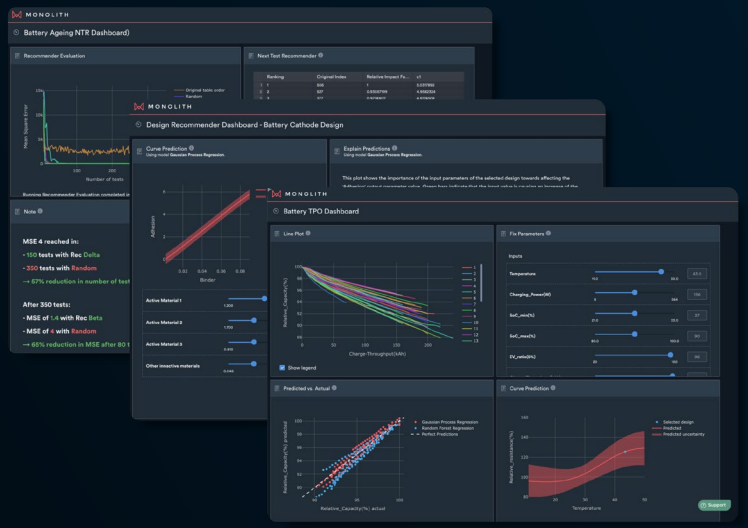
@Monolith AI

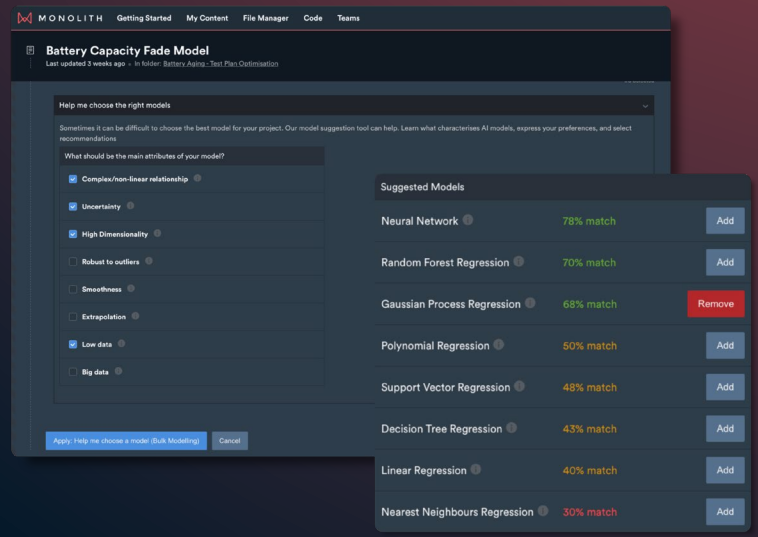
MONOLITH


MONOLITH
Welcome back, Simon
Cell Cycling Campaign Optimisation
Recommender Evaluation
Number of tests: 15
Mean Square Error: 8,385.84
Gamma
Number of tests: 7
Mean Square Error: 7,316.913
Beta
Number of tests: 15
Mean Square Error: 468.7624
Epsilon
Number of tests
Next Test Recommender
Ranking
Original Index
Relative Impact Fa...
c1
c2
c3
c4
mode
Support


MONOLITH
Getting Started
My Content
File Manager
Code
Teams
Welcome back, Simon
Cell Validation Experiment ID014
Auto Refresh
Anomaly Detection Visualiser
Select Mean or Max
max
Click on one of the heatmap squares to change the test and channel in the line plot below.
Aggregate data in heatmap trimmed by 3%
Max
voltage channel 1
voltage channel 2
temperature channel 1
temperature channel 2
current channel 1
current channel 2
DoD
cycler current
SoC
Anomaly Score
Channel: voltage_v_, Test: 6
Actual data
Anomaly score data
Predicted data

MONOLITH


MONOLITH
Battery Ageing NTR Dashboard)
Recommender Evaluation
Next Test Recommender
Design Recommender Dashboard - Battery Cathode Design
Curve Prediction
Explain Predictions
Battery TPO Dashboard
Line Plot
Fix Parameters
Predicted vs. Actual
Curve Prediction
MSE 4 reached in:
- 150 tests with Rec Delta
- 350 tests with Random
→ 67% reduction in number of tests
After 350 tests:
- MSE of 1.4 with Rec Beta
- MSE of 4 with Random
→ 68% reduction in MSE after 80 t
Active Material 1
Active Material 2
Active Material 3
Other inactive materials
Support

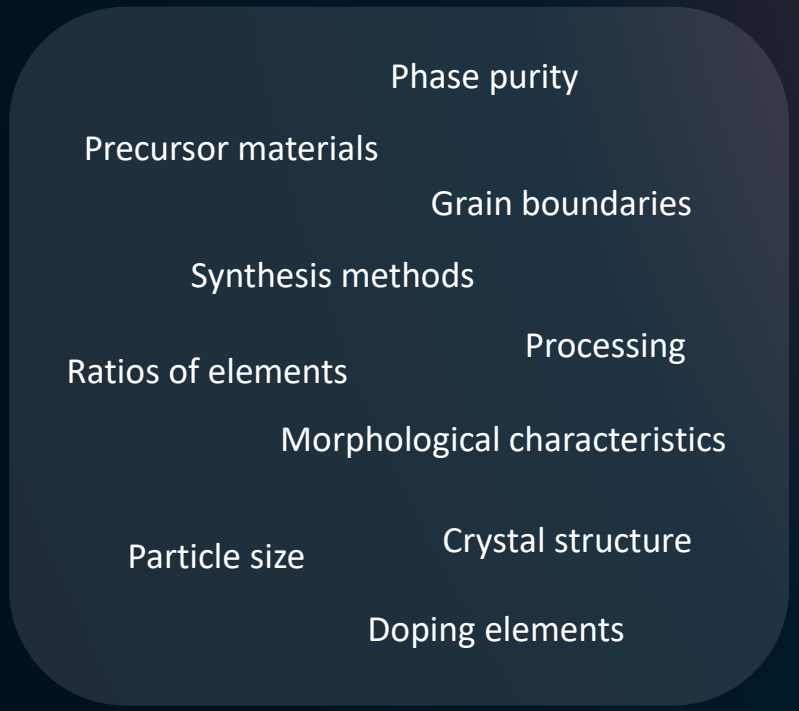

MONOLITH
Getting Started
My Content
File Manager
Code
Teams
Battery Capacity Fade Model
Last updated 3 weeks ago
Help me choose the right models
Sometimes it can be difficult to choose the best model for your project. Our model suggestion tool can help. Learn what characterises AI models, express your preferences, and select recommendations
What should be the main attributes of your model?
Complex/non-linear relationship
Uncertainty
High Dimensionality
Robust to outliers
Smoothness
Extrapolation
Low data
Big data
Apply: Help me choose a model (Bulk Modelling)
Cancel
Suggested Models
Neural Network 78% match Add
Random Forest Regression 70% match Add
Gaussian Process Regression 68% match Remove
Polynomial Regression 50% match Add
Support Vector Regression 48% match Add
Decision Tree Regression 43% match Add
Linear Regression 40% match Add
Nearest Neighbours Regression 30% match Add

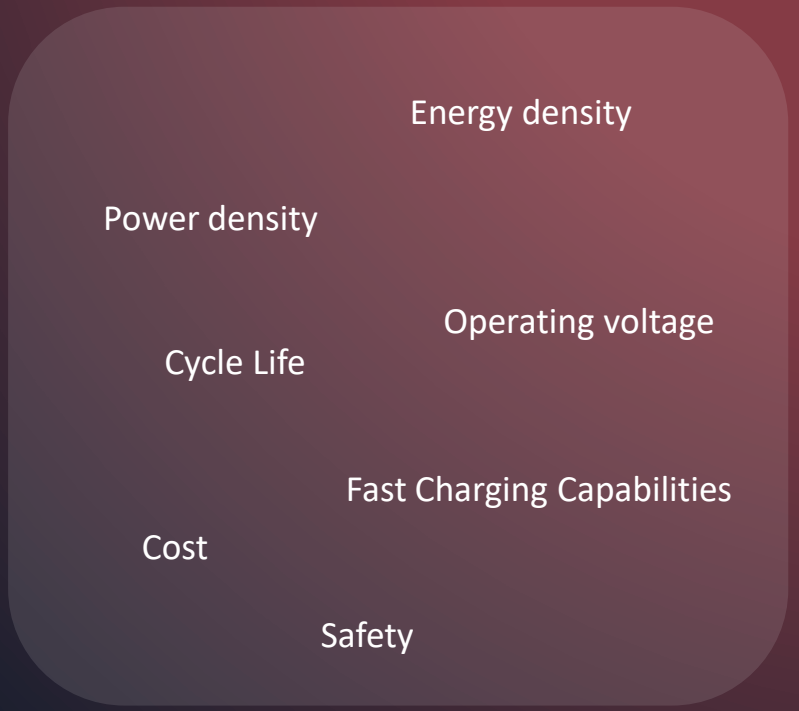
There are a million ways to apply AI…

but let’s focus on just 1:

Development Of Next-Generation Battery Materials and Cell Components

There are too many possible material combinations…



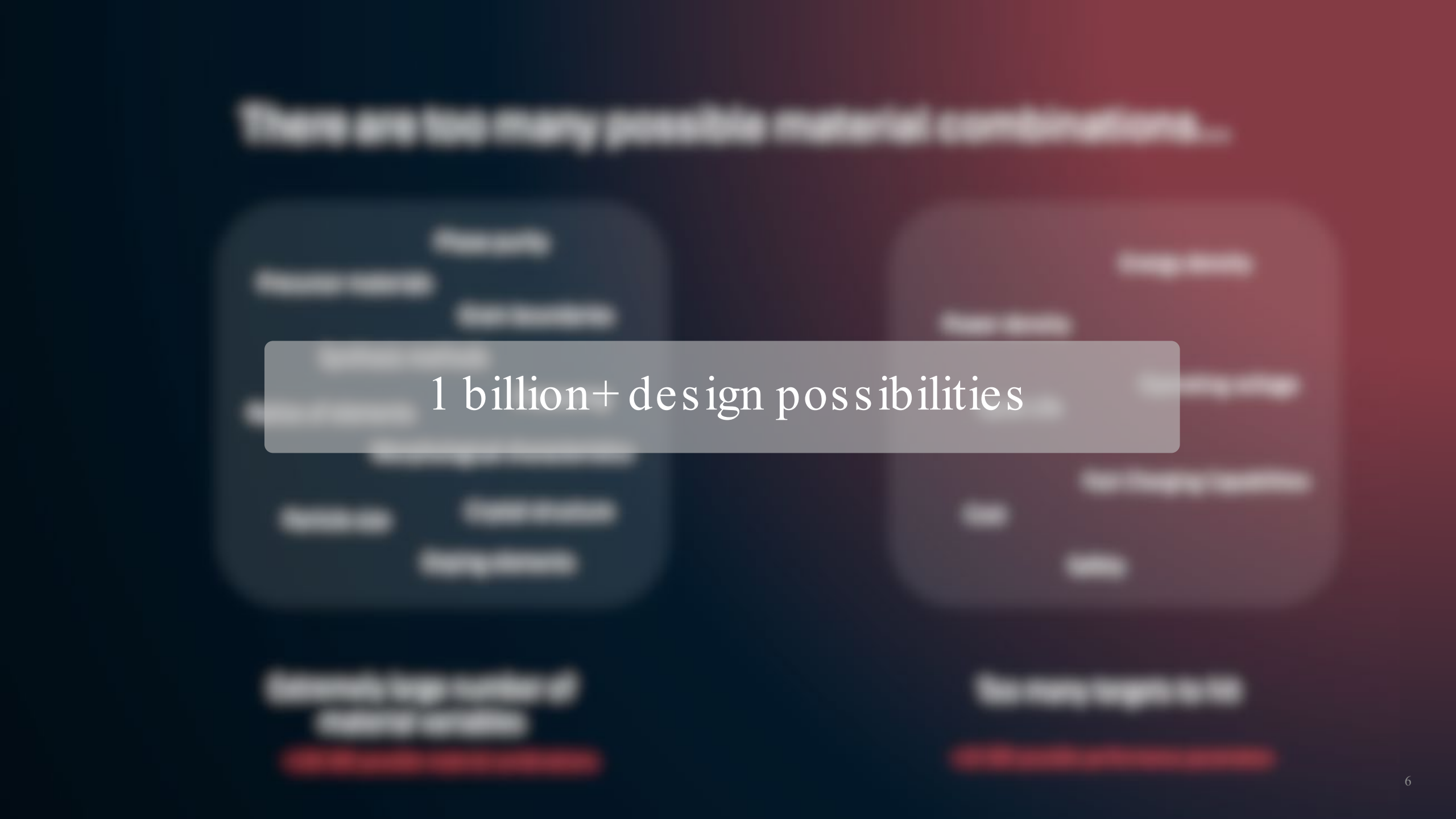


Extremely large number of material variables

>100 000 possible material combinations

Too many targets to hit

>10 000 possible performance parameters


There are too many possible material combinations...
1 billion+ design possibilities

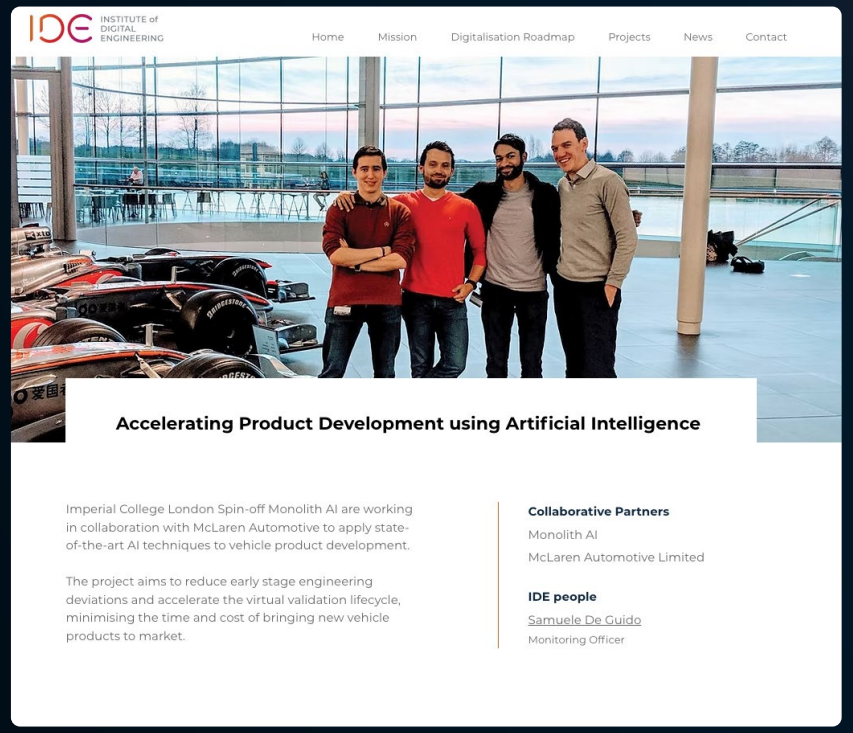
The Race for Better Battery Materials is Complex…

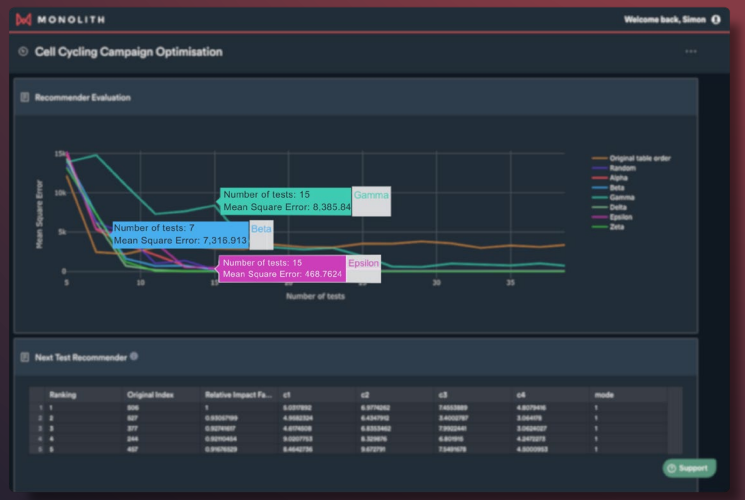
Testing each material formula takes weeks, with thousands of combinations possible

Electrode design has too many interacting variables to optimise manually

Battery lifetime testing takes months or years to complete

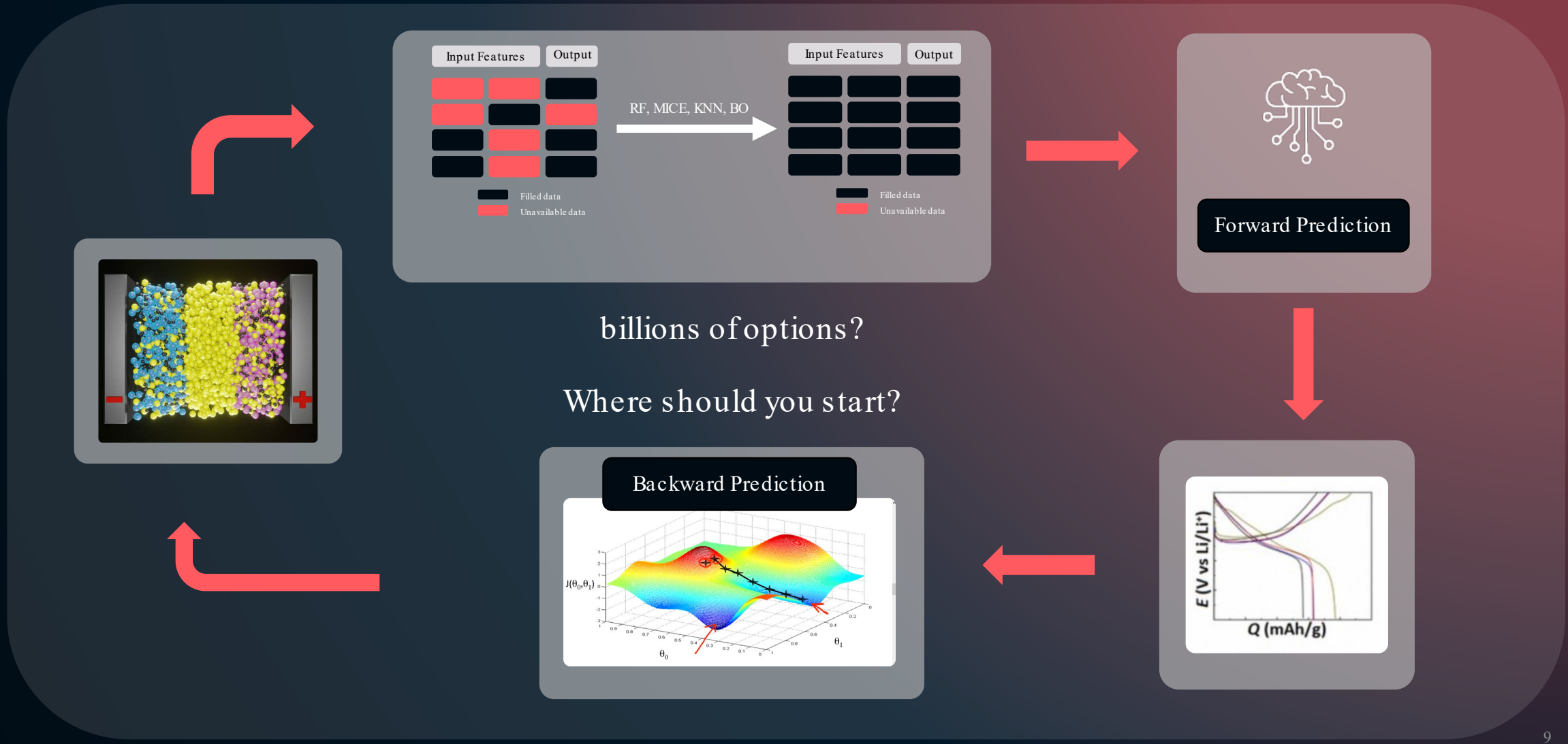
What if you could do less tests, and still learn more?





Next Test Recommender

Find your optimal design faster

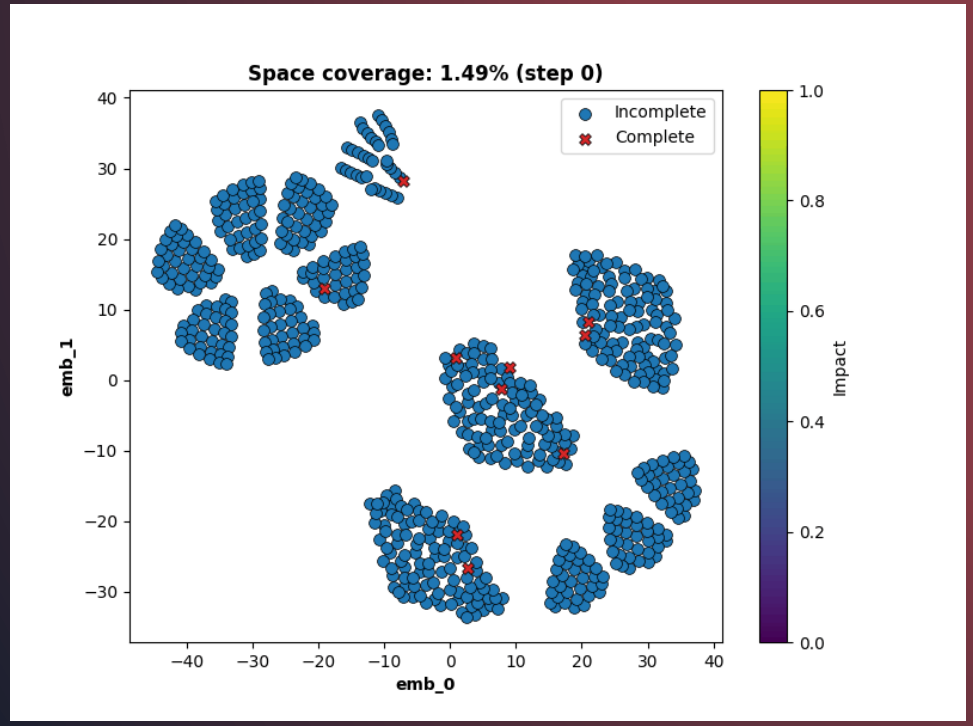


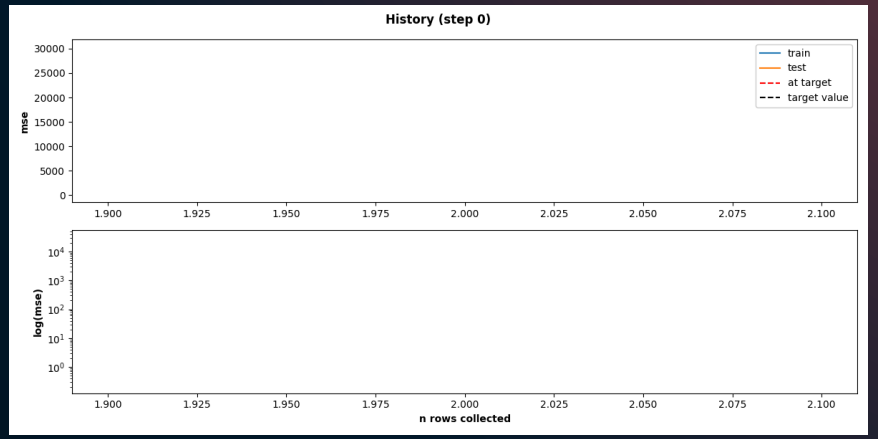
Machine Learning can guide you to best prototype options

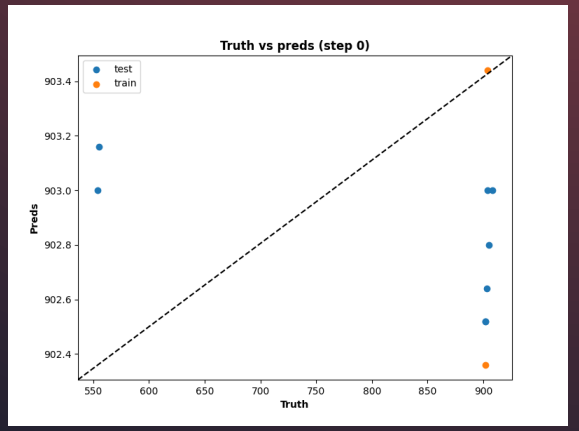
	Test ID	Active Material 1	Active Material 2	Active Material 3	Binder	Other innactive m...	Adhesion	Conductivity	Half Cell Capacity
1	Test 1	1.36	1.87	0.99	0.094	0.048	6.91	35.3	240
2	Test 2	1.66	1.87	0.9	0.008	0.146	0.48	88	251.4
3	Test 3	1.35	1.85	1	0.064	0.161	4.74	119.3	220.9
4	Test 4	1.29	1.86	0.84	0.047	0.131	3.64	101.6	222.9
5	Test 5	1.25	1.82	0.83	0.074	0.179	[illegible]	143.2	202.1
6	Test 6	1.42	[illegible]	0.83	0.056	0.046	[illegible]	32.4	246.2
7	Test 7	1.64	[illegible]	0.87	0.023	0.081	1.4	49.4	254.4
8	Test 8	1.48	1.77	1.04	0.033	0.145	2.23	98	227
9	Test 9	1.42	1.8	1.03	0.068	0.138	4.79	97.2	226.9
10	Test 10	1.66	1.89	0.89	0.024	0.153	1.45	92.2	240.1

	Ranking	Relative [illegible]	Active Material 1	Active Material 2	Active Material 3	[illegible]er	Other innactive m...
1	1	1	1.42	1.8	0.8	0.007	0.068
2	2	0.996601529	1.53	1.79	0.8	0.09	0.181
3	3	0.993033135	1.53	1.77	0.8	0.069	0.181
4	4	0.992013594	1.69	1.85	0.89	0.094	0.181
5	5	0.982667799	1.23	1.78	1.04	0.041	0.181

There are more efficient ways to explore engineering design space



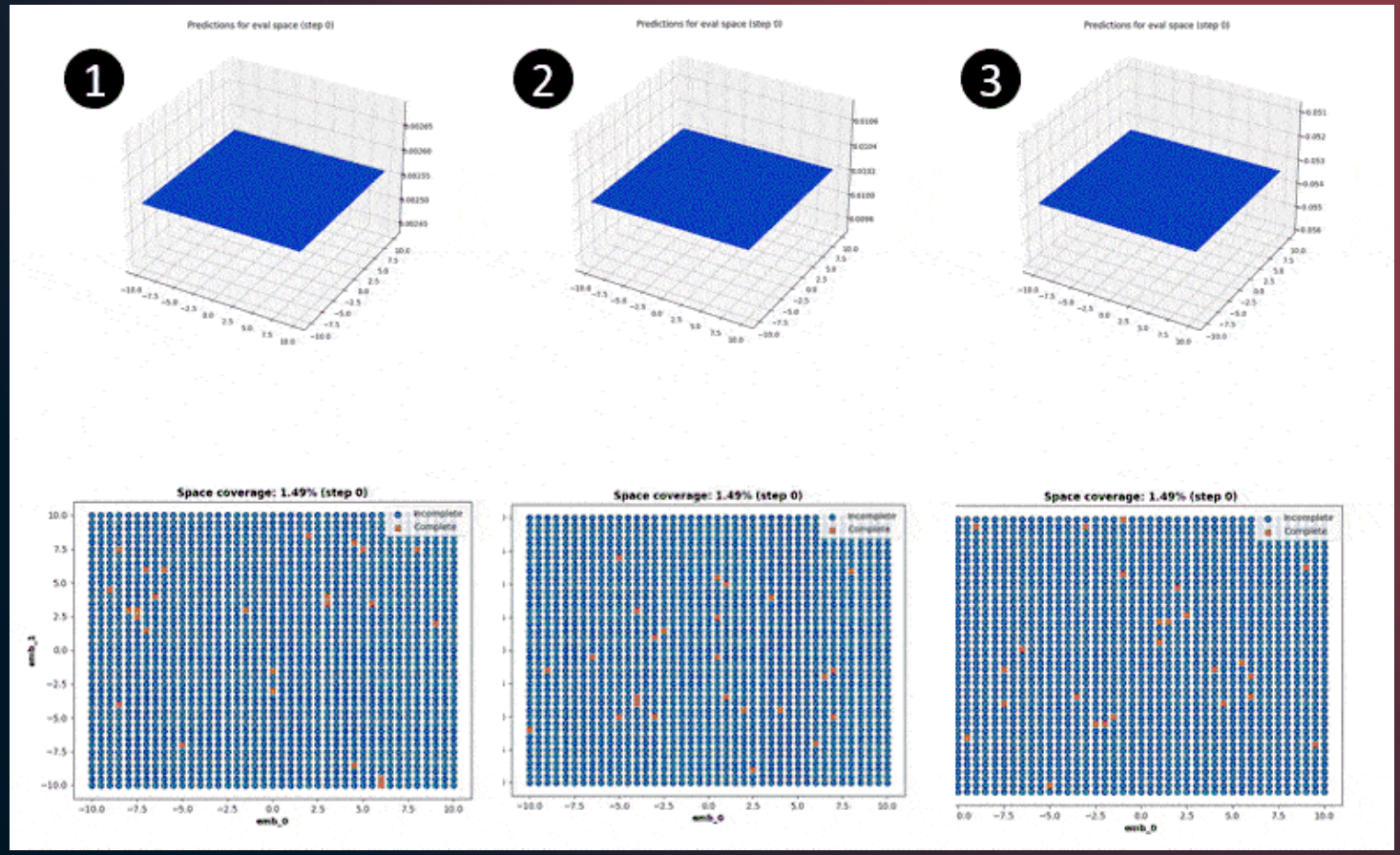




Explore design space faster

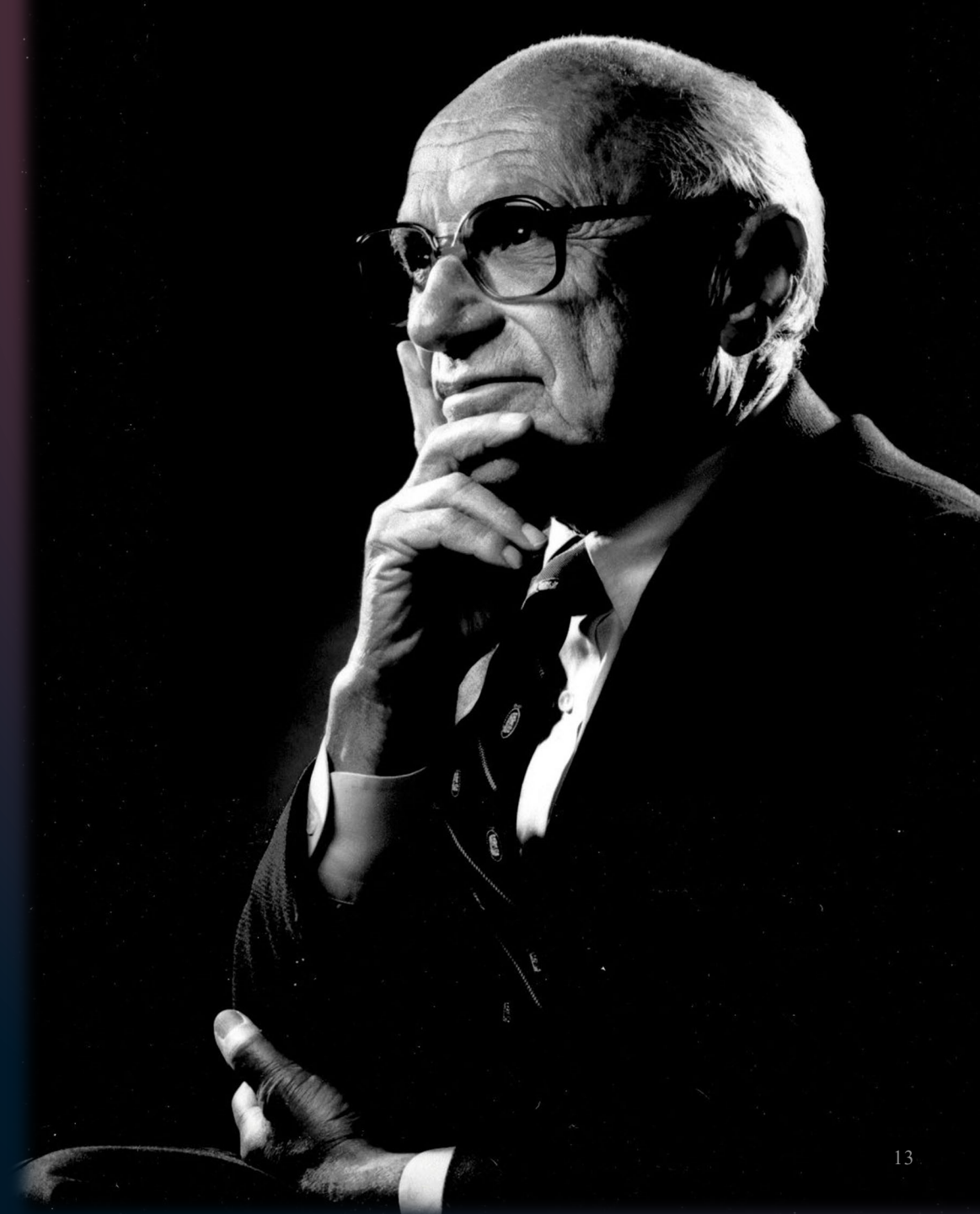
+

find features you might have missed



"There's no such thing as a free lunch."

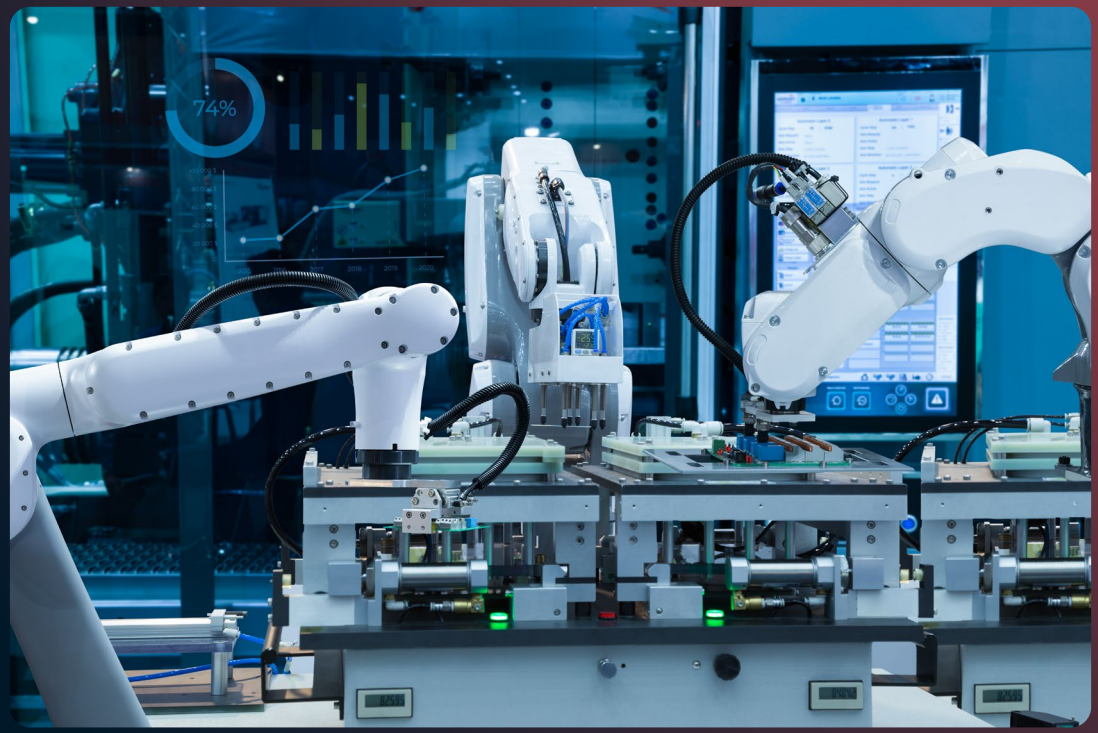
– Milton Friedman



"You never get something for nothing in science."

The Future:

Robotic labs controlled by learning algorithms



We are already seeing engineers build their own high-throughput labs…

CASE STUDY: CELL DESIGN

Reduce cathode development time by 50% with AI

A major OEM developing high-performance batteries with higher power density, faster charging, and high-temperature resistance is counting on AI to get to market faster. By partnering with Monolith, they can accelerate every aspect of cell design and development with machine learning – such as finding the best cathode recipe, reducing characterisation efforts, and identifying and overcoming design issues faster. Their aggressive target is to reduce cathode development time by 50% with AI.

Using design optimisation tools in M… hundreds of thousands of cathode d… only the most promising options. Co… to streamline the cell characterisatio… can streamline the entire developme… techniques to anode and electrolyte… the engineering team to move faster, … and find answers to issues more quic…

Next Test Recommender applies hundreds of … data to find the most efficient test plan or des…

We have a very aggressive plan to introduce high-

Sep 20, 2024 04:06 AM BUSINESS

CATL is Using AI to Discover Next-Generation Battery Materials

By An Limin and Denise Jia

Gift this article

CATL holds 37.6% of the global power battery market in the first seven months of 2024, according to SNE Research.

Contemporary Amperex Technology Co. Ltd. (CATL), the world's largest battery producer, is focusing its research and development team on the use of artificial intelligence to discover the next generation of battery materials.

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Thank you

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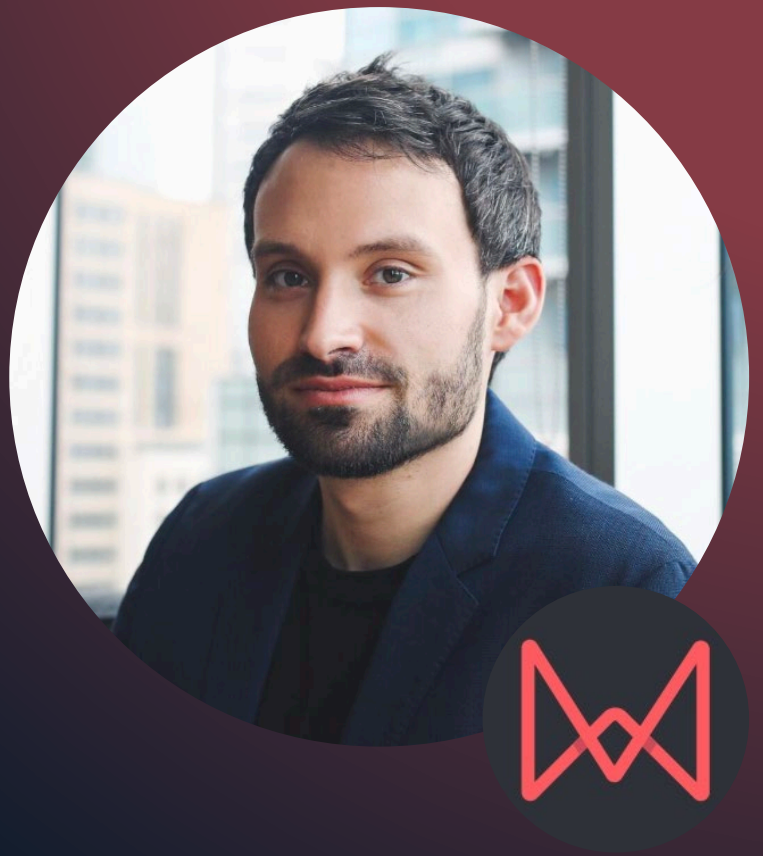
@ Monolith AI

richard@monolithai.com



Monolith AI, London WC2H 9JQ, United Kingdom

www.monolithai.com