How AI is Transforming Battery Management Software for Electric Mobility

INTELLIGENT | CONNECTED | SAFE

Software & Systems

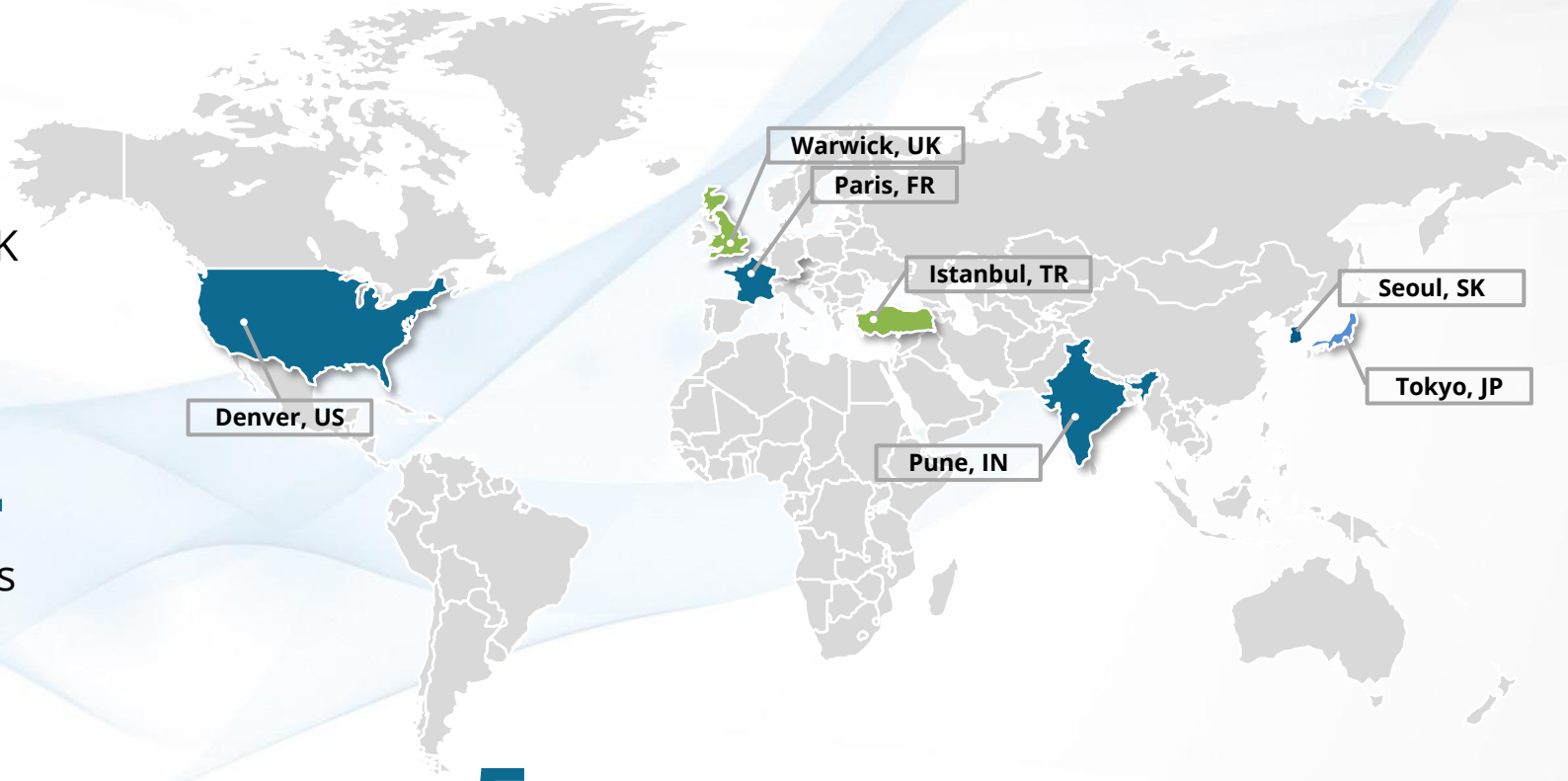
Dr Umut Genç - CEO
Eatron Technologies

We Are Eatron

Unleashing Battery Potential Worldwide with Intelligent Software

2018
Inception

HQ
Warwick / UK



2
Development Centers

60+
Eatronians

$13m+
Revenues Since Start

28
Patents Filed

5
Sales Teams in Major Markets

AI is Changing The World

ChatGPT turns one: The first year of the chatbot that changed the world

OpenAI has been a key p
the launch of ChatGPT ir
the 12 months since.

Tom Acres
Technology reporter @tomiyacres

Thursday 30 November 2023 1

Musk's xAI unveils (rival ChatGPT, Chin

By **Reuters**

February 18, 2025 2:55 PM GMT · Updated 2 days ago

DeepSeek: Tech firm suffers biggest drop in US stock market history as low-cost Chinese AI company bites Silicon Valley

The emergence of DeepSeek's free assistant has placed big doubts over the US market's AI-driven rally of the past two year

James Sillars
Business and economics reporter @

Tuesday 28 January 2025 18:21, UK

DeepSeek's AI Assistant currently tops de

Nvidia earnings: AI chip leader shows no signs of stopping mammoth growth

World's most valuable company delights investors as it reports $35bn of revenue in quarterly results

The Nvidia office in Santa Clara, California. Photograph: Jeff Chiu/AP

Meanwhile in E-Mobility

Home / Finance / Personal Finance / 61% of EV owners find battery charging time as primary concern: survey

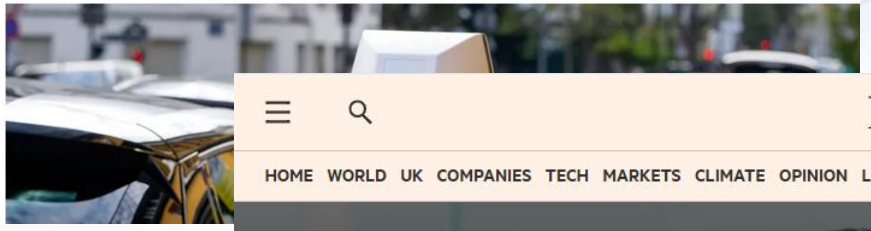
61% of EV owners find battery charging time as primary concern: survey

Environmental benefit / reduced emissions and reduced fuel cost electric vehicle

Revealed: the truth about electric car battery degradation

Switching to an electric car has plenty of benefits, but should you be worried about the lifespan of their batteries?

20 Feb 2025



Stellantis and CATL to Invest Up to €4.1 Billion in Joint Venture for Large-Scale LFP Battery Plant in Spain

Production is planned to start by end of 2026 and could reach up to 50 GWh capacity

13-Dec-2024

FINANCIAL TIMES

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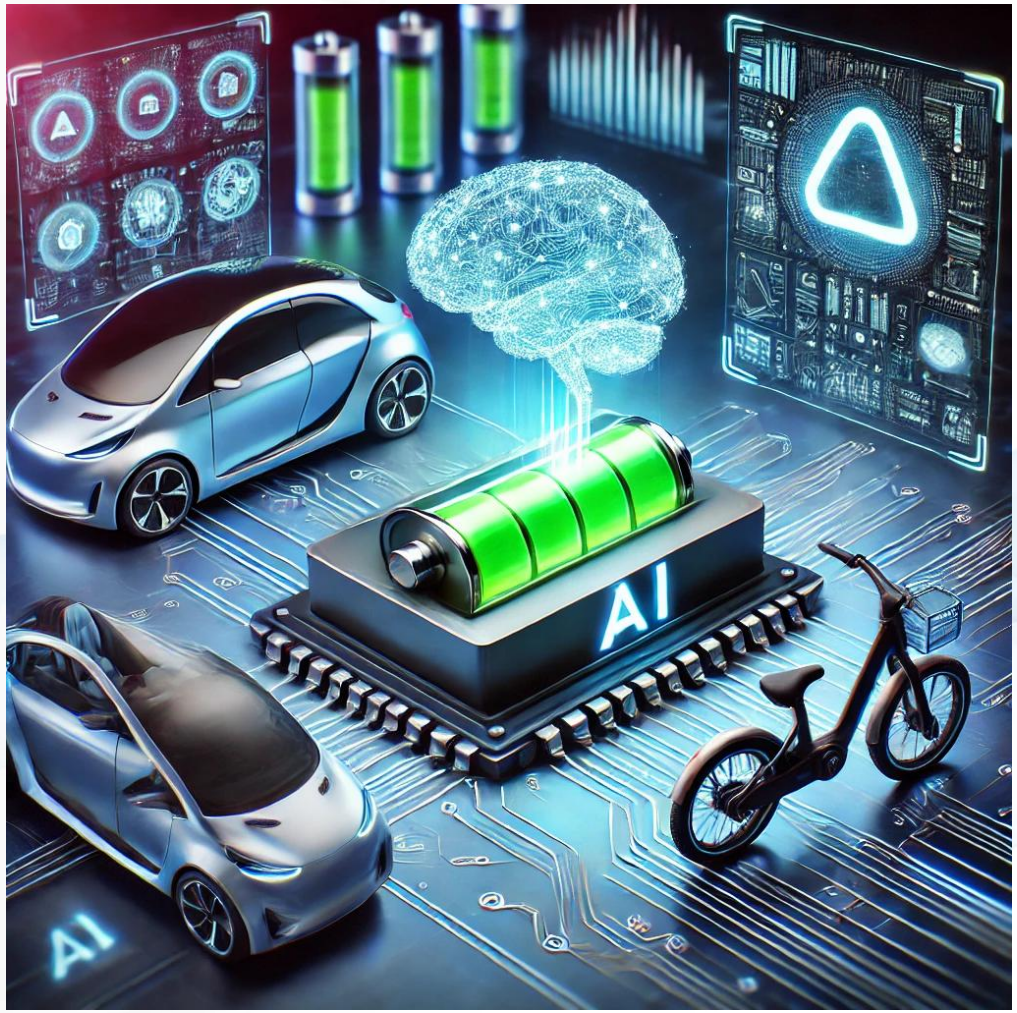
CARS AND TRANSPORTATION | SOUTH KOREA

South Koreans hit the brakes on EVs after battery fires

Julian Ryall in Tokyo
08/19/2024

Several electric vehicle fires in South Korea have dented sales as buyers worry about potential battery hazards. Carmakers are responding by cutting prices and trying to allay consumers' safety concerns.

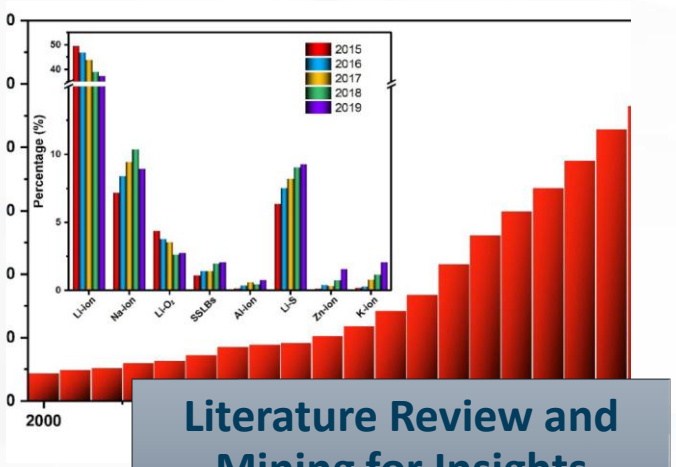
Can AI Help E-Mobility & Batteries?



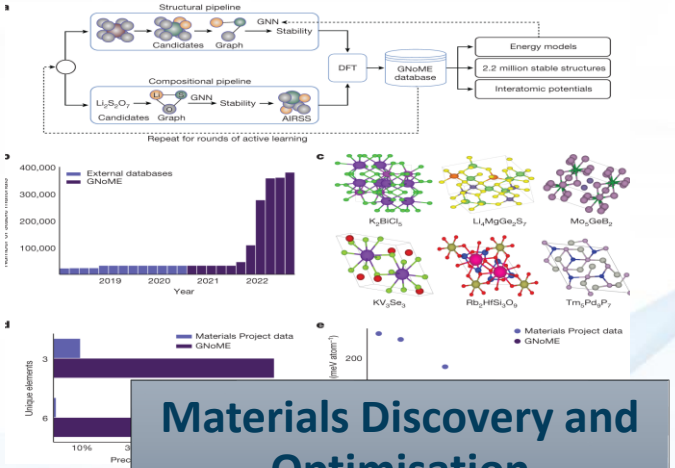
“How AI is Transforming Battery Management Software for Electric Mobility” – by ChatGPT

Not with pretty pictures…

AI is Already Transforming E-Mobility & Batteries

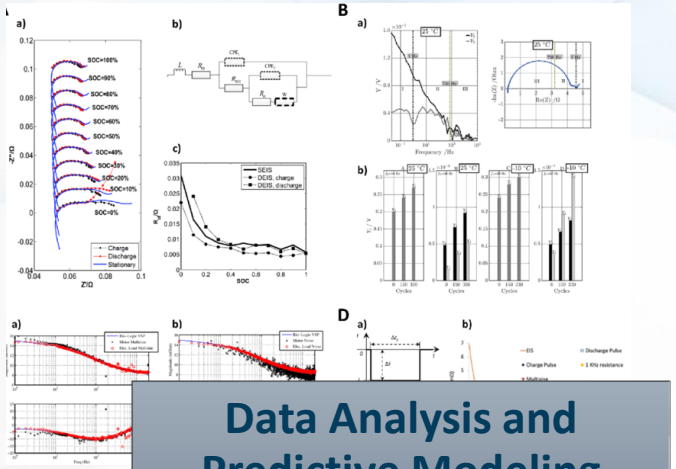


Literature Review and Mining for Insights

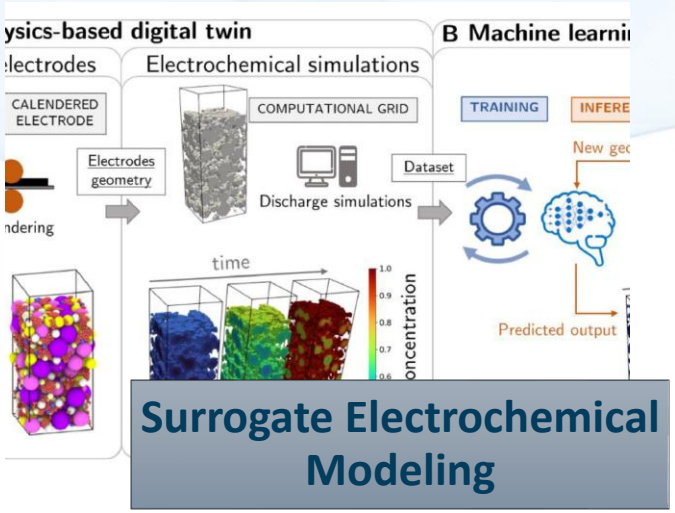


Materials Discovery and Optimisation

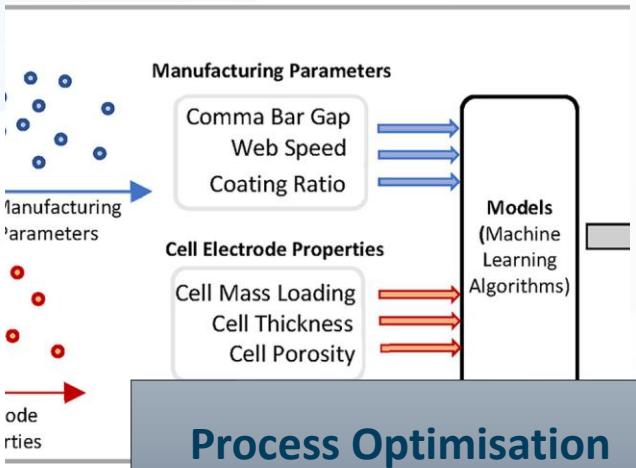
Automated Materials Synthesis



Data Analysis and Predictive Modeling



Surrogate Electrochemical Modeling



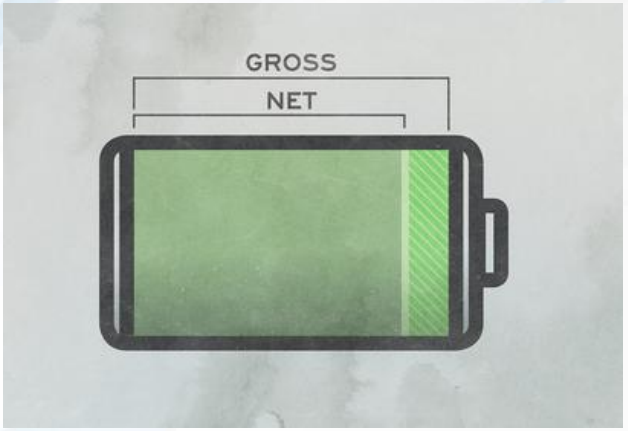
Process Optimisation

What About AI for Battery Management Software?

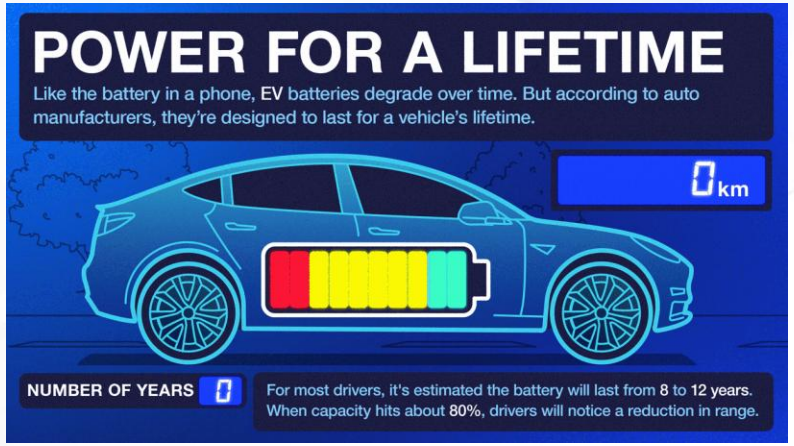
Battery Management Software Key Drivers

Safety

Performance/Cost



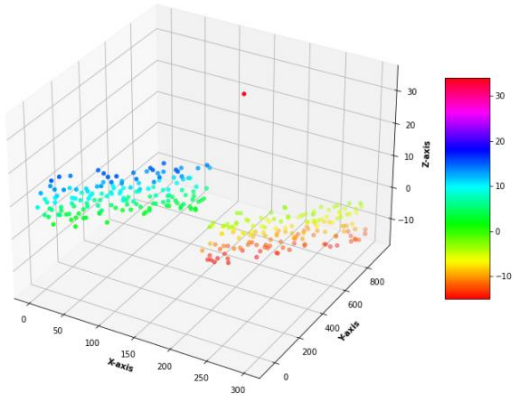
Lifetime



Time to Market

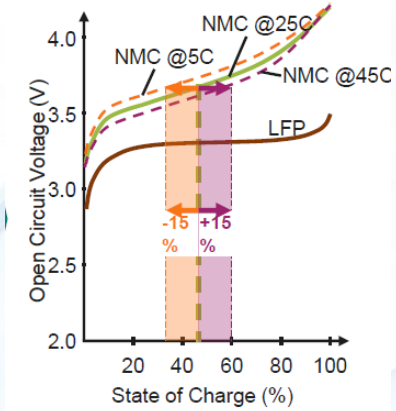
AI-Powered Software is A Game Changer

Safety



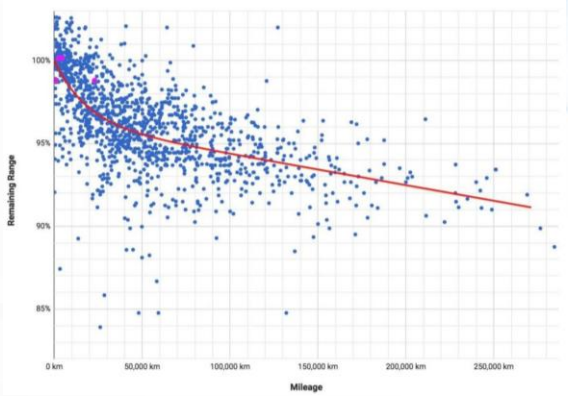
Anomaly Detection with NN

Performance/Cost



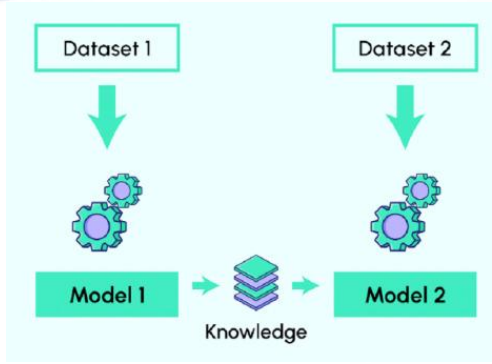
Non-Linear System State Estimation with NN

Lifetime



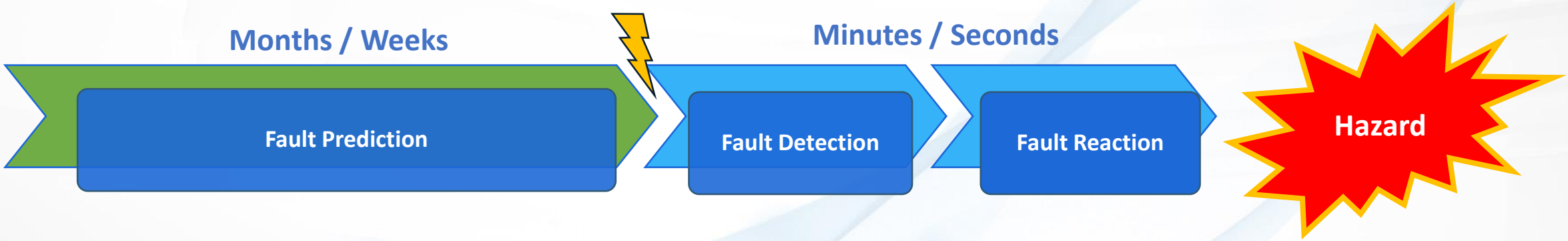
Time Series Forecast in Uncertain Future

Time to Market



Transfer Learning / Unsupervised Learning

AI-Powered Predictive Diagnostics



AI diagnostic functions:

- Spots outliers
- Detects progressive faults early (e.g lithium plating detection)
- Increases design robustness
- Increases availability (preventive maintenance)

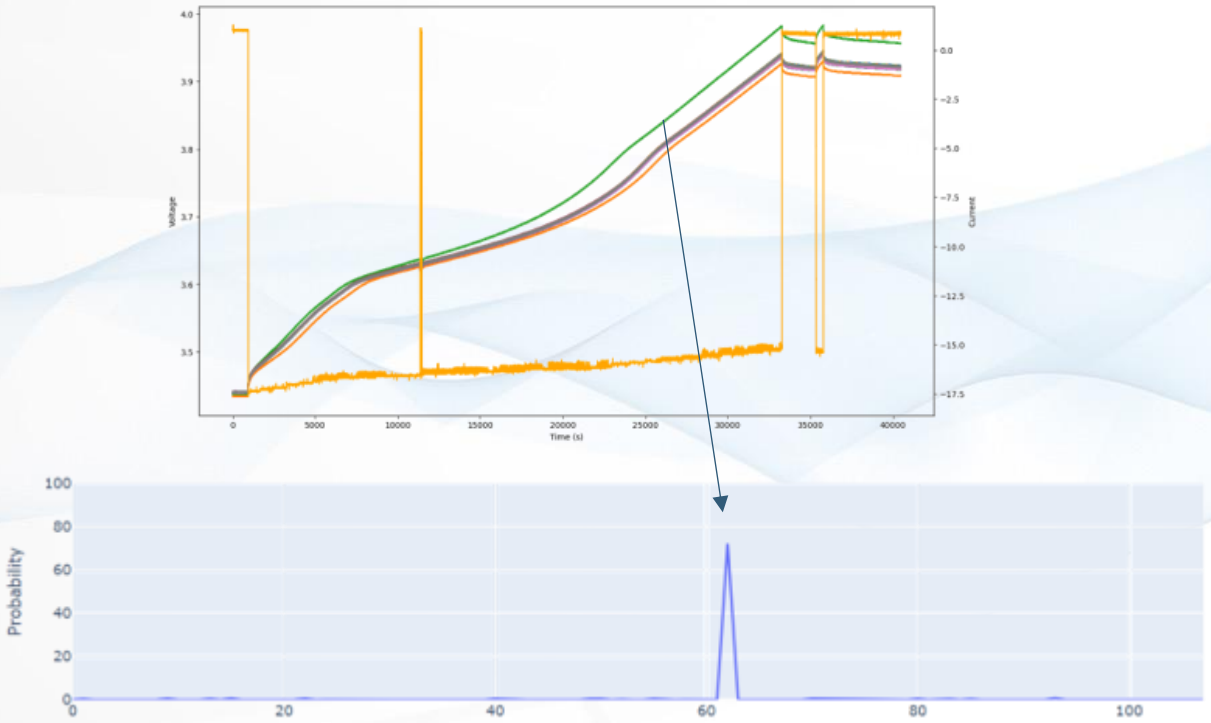
Conventional diagnostic function:

- Last layer of protection before hazard
- Detects faults which require immediate system response (e.g. short-circuit)
- Developed to high integrity following automotive safety standards (ASIL)

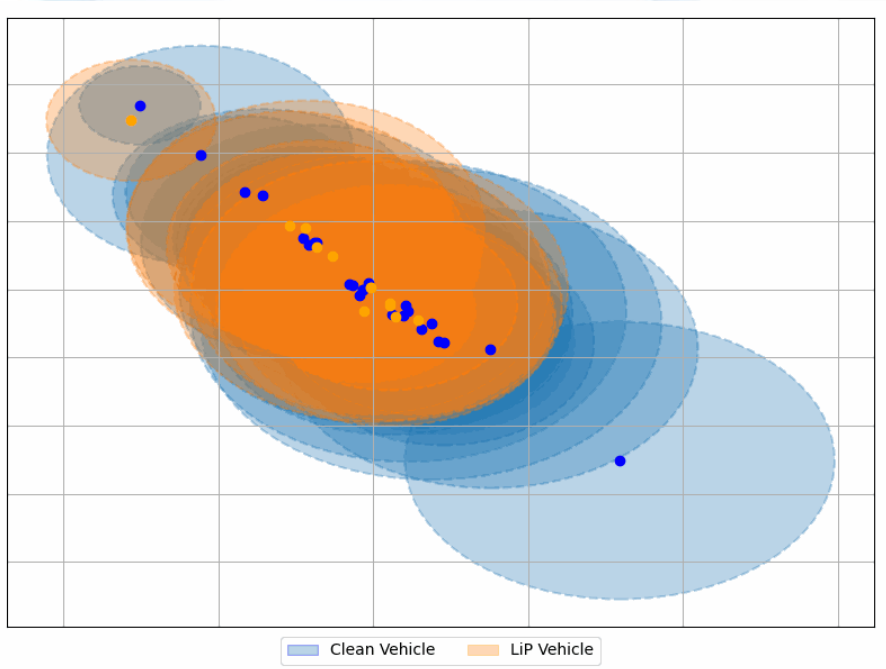
AI enables a layered diagnostic approach increasing safety and robustness

AI-Powered Lithium-Plating Detection

Example detection from OEM I by using pretrained cell-level lithium plating model



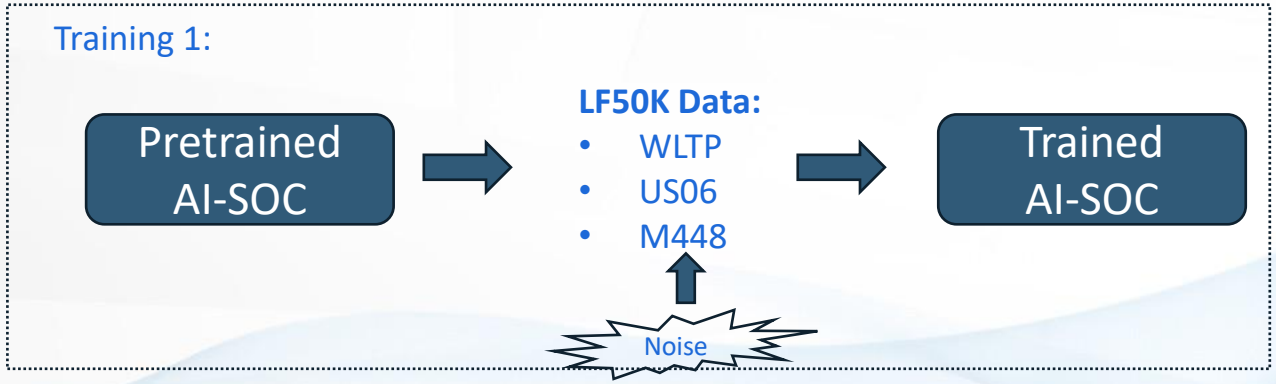
Example training behaviour with OEM II, clustering lithium plating (LiP) vehicles leading to thermal events

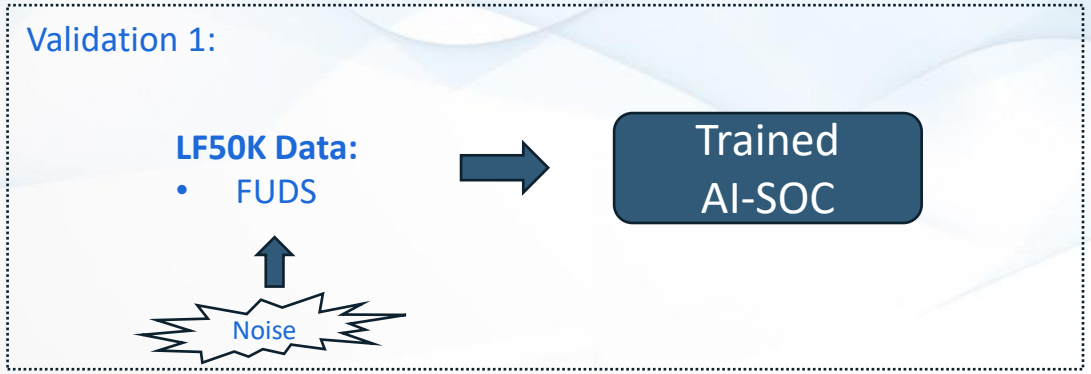


Standard **cell voltage**, **pack current** and **temperature** readings are all we need to start!

AI-Powered State Estimation

AI-SOC Estimation Example with LFP Chemistry





Performance in different Dynamic Drive Cycles

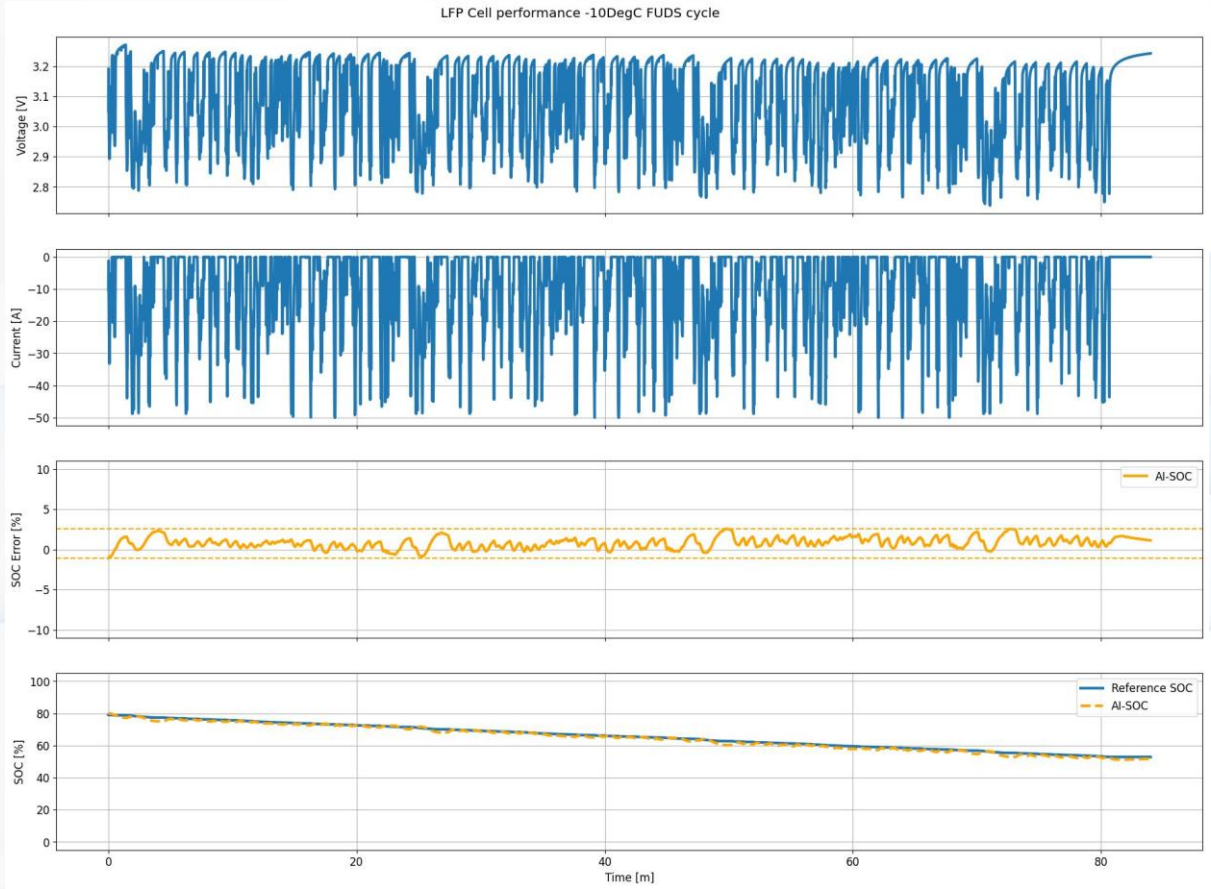
Unseen Drive Cycle	MAE	RMSE	3σ	MAX
US06	0.26 %	0.39 %	1.12 %	2.62 %
FUDS	0.36 %	0.46 %	1.20 %	1.70 %
M448	0.37 %	0.49 %	1.33 %	2.37 %
WLTP	0.39 %	0.52 %	1.44 %	2.29 %

MAE: Mean Absolute Error
RMSE: Root Mean Squared Error
3σ: 3-Sigma Value of Absolute Error
MAX: Maximum Absolute Error

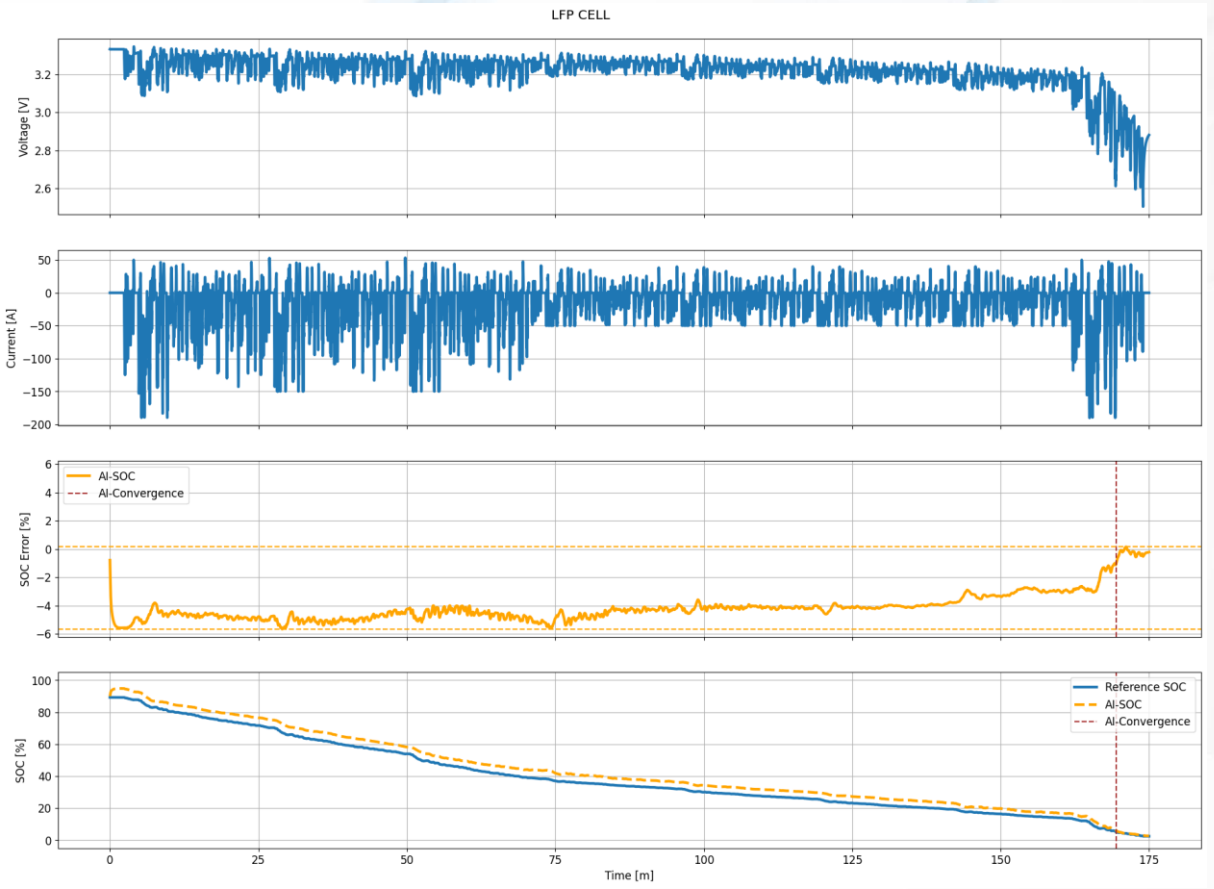
AI-Powered State Estimation

AI-SOC Estimation Example with LFP Chemistry

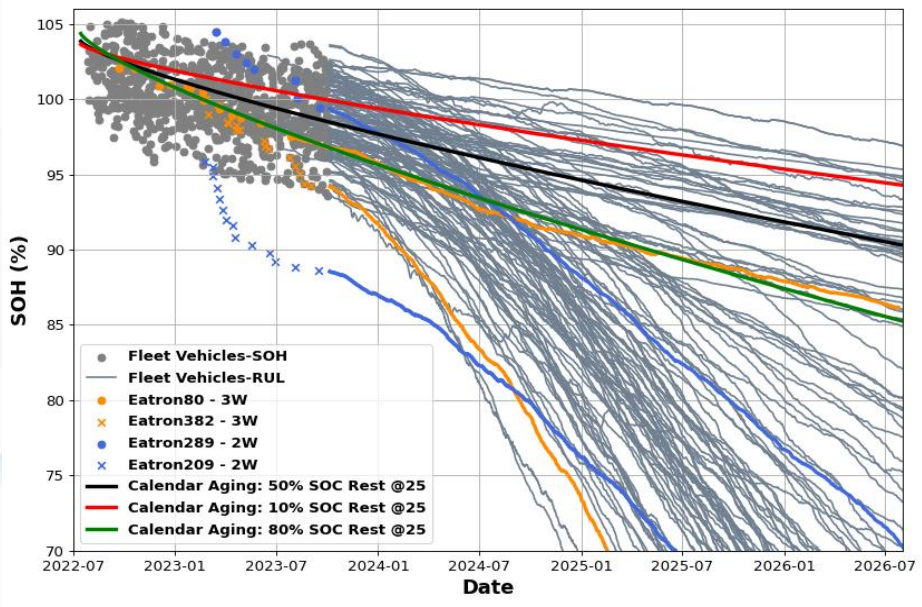
Performance in –10 degC



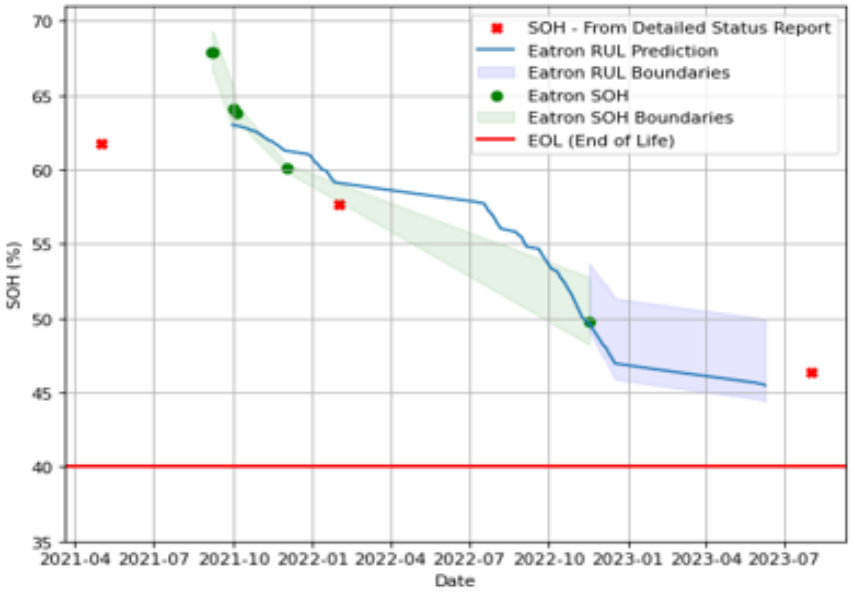
Fast recovery in the flat OCV zone without full charge or rest requirement.



AI-Powered Battery Lifetime Estimation



Deployment 20k packs – 1st Life



Deployment 100 packs – 2nd Life

Projects & Field Deployments

- 3 R&D projects funded by Innovate UK, since 2021
- 2 pilots with leading cell suppliers (NMC, LFP)
- Deployed on 20k packs for traction batteries
- Deployed on 100 packs operating in 2nd life for stationary usage

Edge AI for Battery Management Systems

Edge AI Enables Significant Performance Improvement and Cost Savings

Feature	Standard	AI	Benefit
SoC estimation error	3-5%	< 1%	> $$$ cost saving per pack
Pack failure prediction rate	< 30%	> 90%	> 90 % less in battery fires
Battery life prediction accuracy	N/A	< 3%	> 20% more battery life
Cell characterisation effort	months	weeks	Quicker time to market

EV Engineering News

Eatron and Syntiant introduce new battery management chip

Posted June 20, 2024 by Nicole Willing & filed under Newswire, The Tech.

UK-based battery management software developer Eatron Technologies has introduced a new battery management system-on-chip with US-based edge artificial intelligence (AI) semiconductor company Syntiant for light mobility, industrial and consumer electronics applications.

WHITEPAPER

Exploring next-generation AI battery management systems with Infineon and Eatron technologies

Cenk Goren (Eatron Technologies)
Senior Project Manager
Dr. Ugur Yavas (Eatron Technologies)
Head of Artificial Intelligence
Yining Yang (Infineon Technologies)
Director of Innovation and Technology (Automotive)

www.infineon.com

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INFINEON AND EATRON EXTEND COLLABORATION FOR AI-POWERED BATTERY MANAGEMENT SOLUTIONS TO INDUSTRIAL AND CONSUMER APPLICATIONS

FEBRUARY 25, 2025 | IN NEWS | BY EATRON

PRESS RELEASE – MARKET NEWS

Munich, Germany, 25 January 2025 - Infineon Technologies AG (FSE: IFX / OTCQX: IFNNY), a global semiconductor leader in power systems and IoT, and Eatron, a leading provider of AI-powered battery optimization software, extend their existing partnership for battery management solutions (BMS) in automotive to a comprehensive BMS portfolio including various industrial and consumer applications. Enabled by Infineon's PSOC™ microcontrollers, this collaboration brings together the benefits of AI-

Thank you!

/eatron-technologies