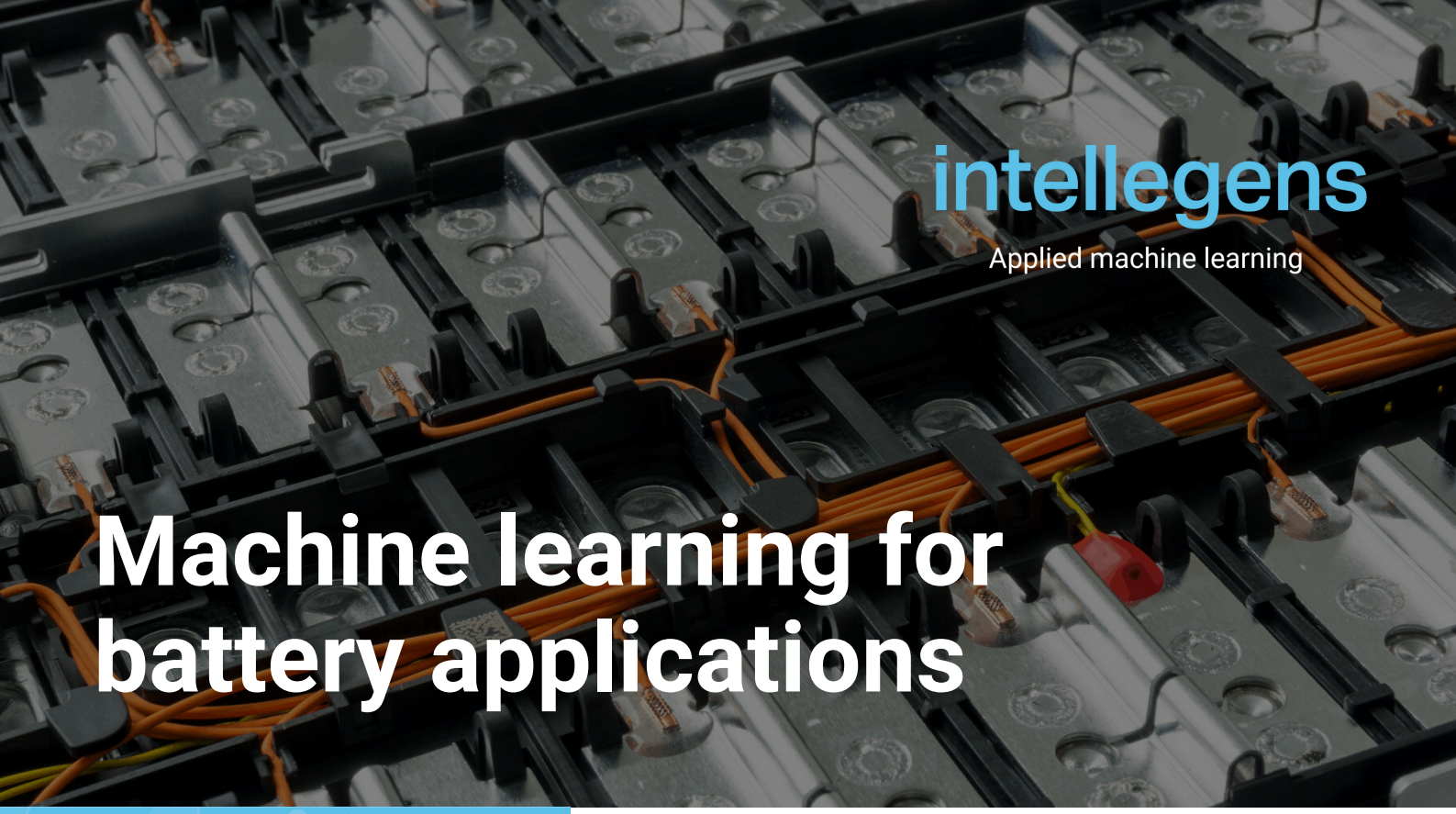

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Applied machine learning

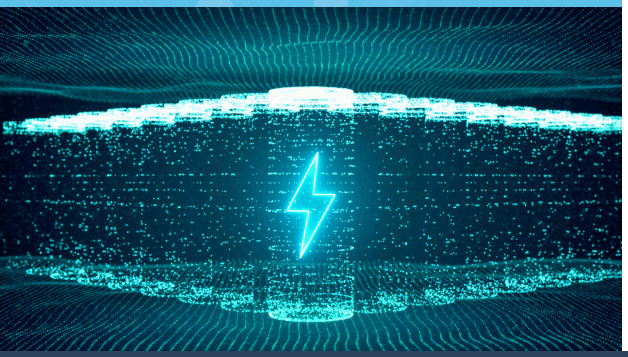
Machine learning for battery applications

Optimise battery formulations and manufacturing parameters

Save time and cost with fewer experiments

Get battery pack design right first time, reducing the number of prototypes

Understand and predict key battery metrics: SOH, SOC, RUL



Powering the electric vehicle revolution. Enabling renewable energy sources. Cutting charge times for personal devices. These are urgent drivers to develop new battery technologies, and to do so faster. But battery R&D is complex and slow, with many competing factors to balance, and a heavy reliance on time-consuming, costly experiments to fill gaps in data and test prototypes.

Machine learning (ML) can guide and focus this work. But there are challenges in applying ML. Most ML methods do not work well with real-world, sparse, noisy experimental and process data. And these methods are typically hard to implement and apply.

Alchemite™ is unique deep learning software that can build models from sparse, noisy data. Its intuitive user interface makes machine learning easy to apply in industrial R&D. Successful applications include: development of new battery materials and formulations; design of cells and battery packs; and optimising battery management systems. Benefits include improved charging capacities and energy density, lower development times and costs, and more efficient operation of batteries in service.

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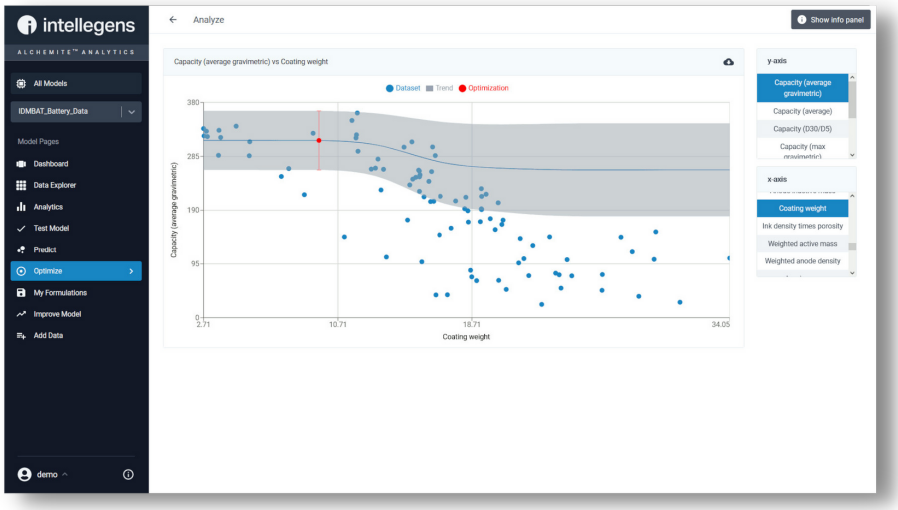

The Alchemite™ Analytics platform provides scientists and engineers with quick, easy access to advanced deep learning methods, applying powerful graphical analytics via a web browser user interface.

Example projects

Battery materials and manufacturing – with industry and academic partners, Alchemite™ was applied to optimise the formulation and manufacturing of electrodes for lithium-ion batteries. This usually requires a large matrix of trial-and-error experiments. Predictions of electrode performance were used to focus experimental work and cut development time. The proposed electrodes were manufactured and showed excellent lifecycle and capacity, as predicted. *Cell Reports PhysicalScience* **2**, 100638 (2021).

Battery management – another project used Alchemite™ to study electric vehicle battery states, delivering accurate predictions for State of Charge (SOC), State of Health (SOH), and Remaining Useful Life (RUL). Such prediction offers the potential for manufacturers to embed these methods into battery management systems, enabling more efficient operation. *Nature Machine Intelligence* **2**, 161-170 (2020).

Applying Alchemite™ for batteries

Alchemite™ Analytics provides easy web browser-based access to the Alchemite™ deep learning method, while the Alchemite™ Engine API enables data scientists to integrate the algorithm with their in-house workflows and tools.

With these solutions you can:

- Design testing programs to achieve objectives with the fewest experiments or prototypes
- Propose new battery materials or chemistries
- Select and optimise process parameters to improve battery manufacturing
- Trade off size, weight, power, charge speed, lifetime, etc. in designing cells and battery packs
- Inform control systems for battery management, including state of charge and safety monitoring.

Visit **intellegens.com/batteries** for a recorded webinar with battery experts **Deregallera**.

Next steps

Contact us to book a demo tailored for your application. Visit our website to download white papers and subscribe to our newsletter. Or follow us on social media.

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