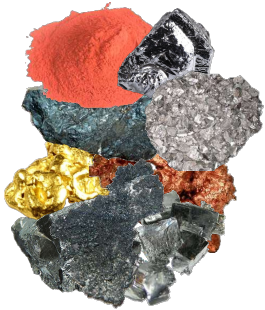# intellegens

The Sparse, Noisy Data Problem In Product Development, Manufacturing, and Beyond

Advanced Engineering 2021
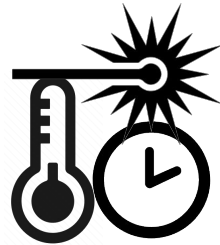
Approach problems with a black box
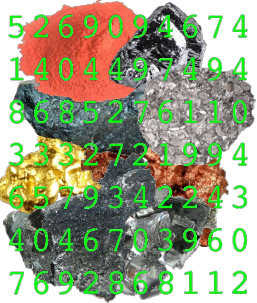
Formulation **Processing** **Black box** **Properties**

Defects
Strength
Cost
Weight
Environmental
Fatigue

Training the machine learning

Formulation + **Processing** ⟹ **Black box** ⟸ **Properties**

Defects
Strength
Cost
Weight
Environmental
Fatigue

Using the machine learning

Formulation   **Processing**   **Black box**   **Properties**
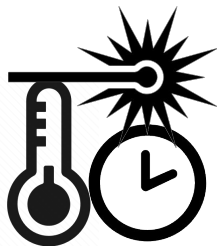
Defects
Strength
Cost
Weight
Environmental
Fatigue

Applied to alloys, composites, plastics, chemicals, batteries, drugs, and ceramics

Data can be sparse

Formulation

Processing

Black box

Properties

Defects
Strength
Cost
Weight
Environmental
Fatigue

Impute sparse data
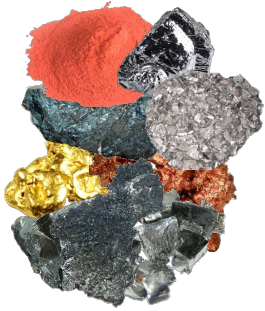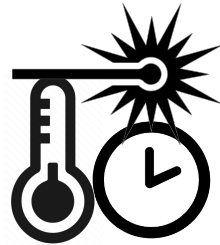

Formulation　　　　**Processing**　　　　**Black box**　　　　**Properties**
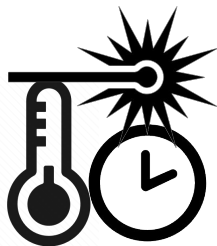
Defects
Strength
Cost
Weight
Environmental
Fatigue

Alchemite™ technology offers a unique combination

Value from sparse, noisy data

Unique self-consistent, iterative algorithm imputes sparse data

Optimise against multiple targets

Solves high-dimensional problems that were intractable

Quantify uncertainty to enable rational decisions

Accurate method (nonparametric probability distributions)

Make a fast start

Auto-generates models, requiring minimal assumptions

Speed and scalability

Light CPU / memory footprint: fast and works for huge datasets

A global view

E.g., ingredients *and* processing parameters in a combined study

Alchemite™ technology offers a unique combination

Handle sparse, noisy, complex data

Value from sparse, noisy data

Unique self-consistent, iterative algorithm imputes sparse data

Optimise against multiple targets

Solves high-dimensional problems that were intractable

Quantify uncertainty to enable rational decisions

Accurate method (nonparametric probability distributions)

Ready-to-use solution

Make a fast start

Auto-generates models, requiring minimal assumptions

Speed and scalability

Light CPU / memory footprint: fast and works for huge datasets
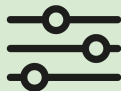
A global view

E.g., ingredients *and* processing parameters in a combined study

High temperature alloy

Design process for AM materials

Validated a new alloy for 20+ composition/process parameters to satisfy 11 physical criteria

90% fewer costly experiments

Reduced costs by $10 million

Accelerated typical discovery and validation time from 20 to 2 years

intellegens.ai/applications/materials/

*Materials & Design **168**, 107644 (2019)*

intellegens.ai

Battery management

Blend experimental and computational data to improve battery management software

Alchemite™ design of experiments used **x10** fewer calculations

Predicting the State of Charge and Health of Batteries using Data-Driven Machine Learning

Nature Machine Intelligence **2**, 161 (2020)

More examples of machine learning for manufacturing

Component design

Validate for heat exchanger and shape memory alloy applications

Ink reformulation

Cut key experimental timescales from months to minutes

Additive manufacturing

Optimize process parameters to deliver AM parts repeatably

Automotive catalysts

Speed-up experimentally-intensive processes

Hardfacing materials

Design surface treatments to reduce wear

Precision medicine

Personalise treatments based on patient data

Sparse data, uncertainty & design of experiments

Alchemite™ uses property-property correlations, uncertainty estimates, design of experiments, and broad access to overcome inevitable sparse data

Track record of designing experimentally verified materials with apparently impossibly small amounts of data, including processes for additive manufacturing
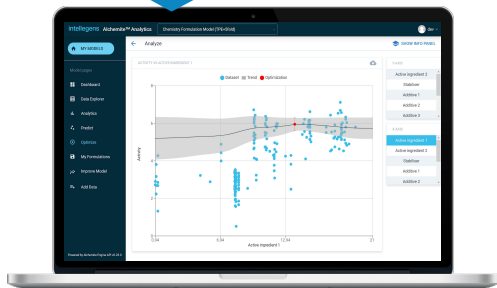
Double winner at the ASME Additive Manufacturing Innovation Awards 2021

Alchemite™ product family

Scientists & engineers
Fast start, easy-to-use, visual

Data scientists
Add to your ML toolkit

Optional connectors
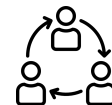
Lab systems

Software & scripts

Sharing & collaboration

Option to deploy models

Alchemite™ Analytics

Deep data insights on your desktop

Guide experiments, predict, design, optimise

Alchemite™ Engine

Integrate into your workflow (API, Python)

Advanced configuration, enterprise deployment

Alchemite™ Success

Access Intellegens deep learning expertise

Advice to your data science team or full project management

Next steps

Contact gareth@intellegens.ai

Website https://intellegens.ai

Papers https://intellegens.ai/article-type/papers/

Demo https://app.intellegens.ai

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