SMART INDIA HACKATHON 2024

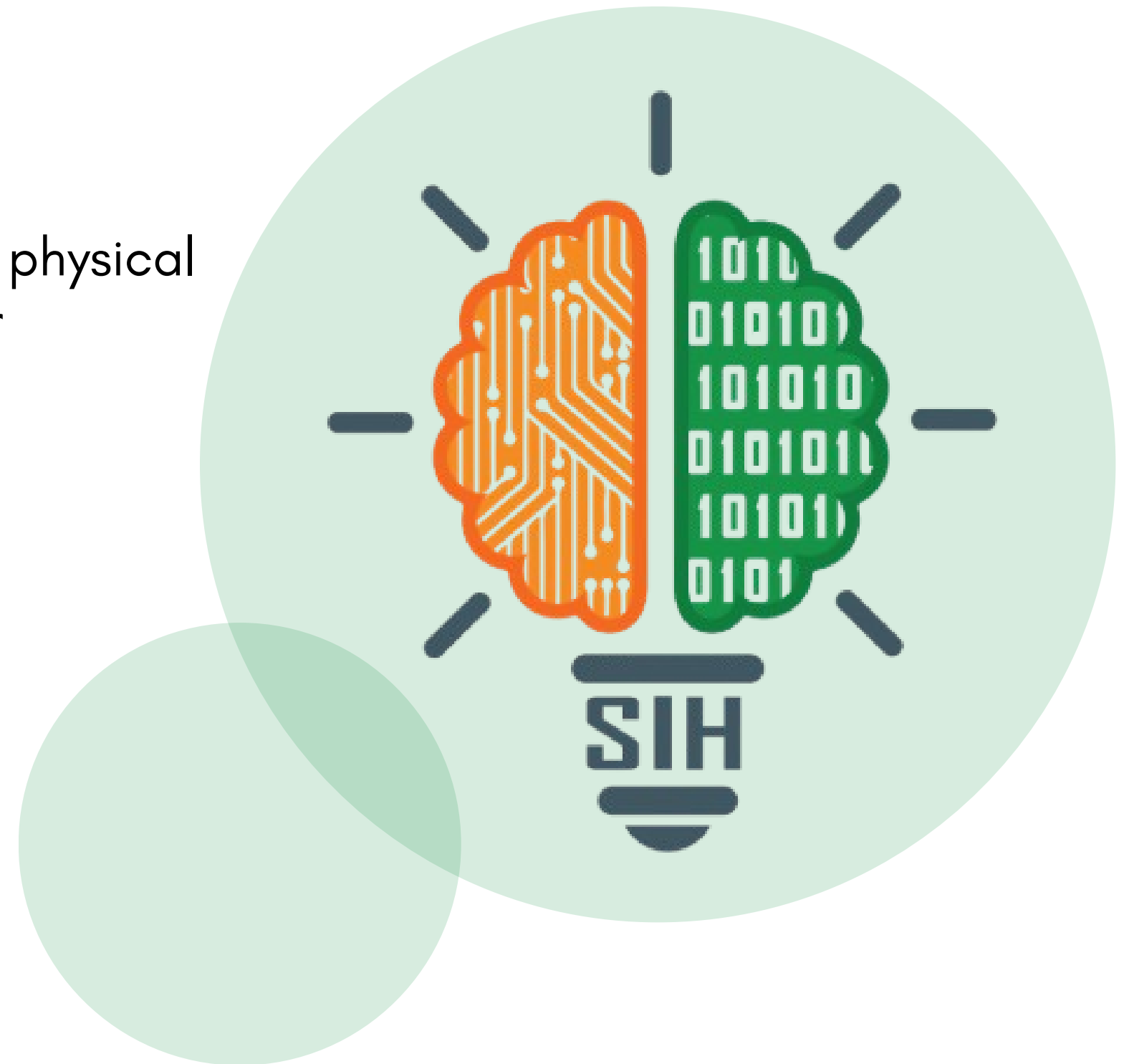**Problem Statement ID** – 1723

Problem Statement Title- Prediction of Aluminium wire rod physical properties through AI, ML or any modern technique for better productivity and quality control.

Theme- Miscellaneous

PS Category- Software

Team ID- 33891

Team Name- Tech Titans

WireSense - AI Aluminium Control

SMART INDIA HACKATHON 2024

WHAT IS THE PROBLEM?

How can modern techniques like ML/AI help in predicting the physical properties of Aluminium wire rods more effectively?

WATCH THE DEMO

TECH STACK

Keras TensorFlow Google Cloud

SQLite django Flutter

PROPOSED SOLUTION

1. AI/ML-powered prediction software: Develop a software solution using AI and machine learning algorithms to predict the physical properties of aluminum wire based on various input parameters.

2. Real-time monitoring dashboard: Implement a realtime dashboard that provides comprehensive graphs for continuous monitoring of key parameters during production.

3. Intelligent parameter suggestions: Incorporate an intelligent system that automatically suggests optimal parameter adjustments to maintain the desired properties when variations occur.

4. Automated production alerts: Enable automatic alerts to notify the production line of necessary changes or issues in real time, ensuring consistent quality control.

TECHNICAL APPROACH

MODEL DEVELOPMENT

- Gather historical and real-time data from various sources.
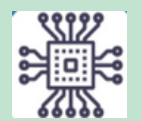- Clean and normalize data, handle missing values.
- Feature engineering and selection.
- Train multiple models using different algorithms.
- Perform cross-validation and hyperparameter tuning.
- Ensemble top-performing models for improved accuracy.
- Develop API for model integration with production systems.
- Create user interface for monitoring and control.

Train AI/ML model with input parameters and desired outputs.

↓

Deploy model in production environment

↓

Connect to dashboard for monitoring

↓

Plot real-time graphs for parameters

↓

Predict properties from input parameters

↓

Plot correlations between input and output parameters

↓

Automatically adjust parameters based on deviations
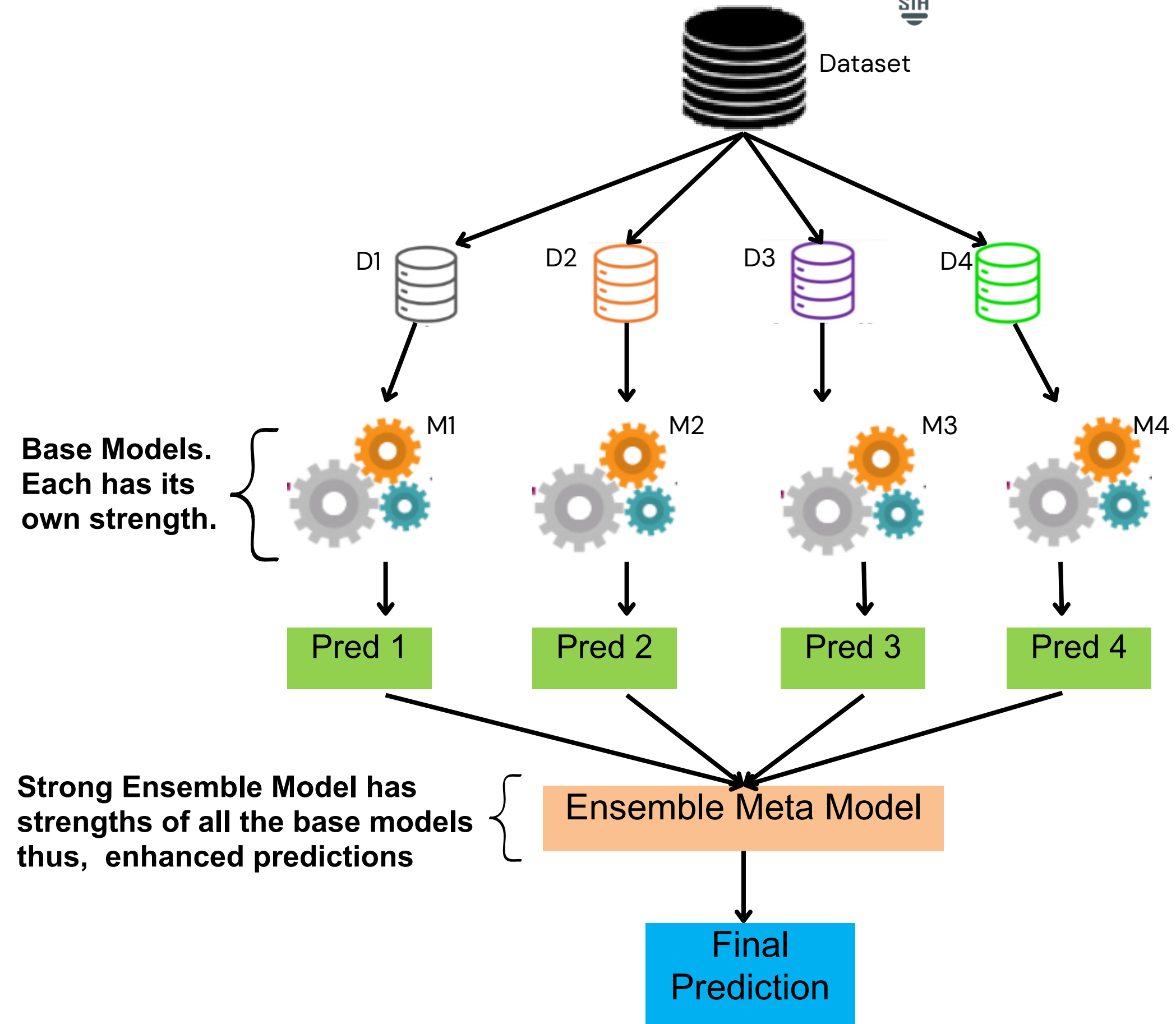
↓

Send signals to production for adjustments

FEASIBILITY AND VIABILITY

- **Proven Scalability of AI Libraries:** These libraries are well-supported, easy to integrate, and scalable, making them ideal for building advanced AI solutions.

- **Flutter for Cross-Platform Development:** Flutter's cross-platform capability and performance make it a cost-effective solution for real-time web, mobile, and desktop applications.

- **Simplified Machine Learning Integration:** With modern ML tools, building and fine-tuning such models is straightforward, and they can be effectively integrated into various processes.

- **Readily Implementable Real-Time Alert System:** Libraries like Twilio and Firebase make implementing customizable alert systems for real-time notifications via the software application.

CHALLENGES

- Limited availability and poor quality of data related to production parameters.
- Resistance to change in traditional manufacturing processes.
- Ensuring model accuracy

STRATEGIES

- Implement strong data governance and quality assurance processes.
- Provide thorough training and change management support.
- Develop a phased implementation approach with continuous validation.
- Collaborate with cybersecurity experts to ensure system integrity.

TECH TITANS

IMPACT, BENEFITS and REFERENCES

SMART INDIA
HACKATHON
2024

SIH

IMPACTS

- Enhanced **product quality** and **consistency.**
- Improved production efficiency leads to **reduced waste**.
- **Strengthened** process control and **decision-making** capabilities.
- Attainment of **competitive advantage** in the aluminum manufacturing industry.

BENEFITS

- **Economic:** Reduced production costs, enhanced yield, and creation of higher-value products.
- **Environmental:** Decreased energy consumption and material waste.
- **Social:** Upskilling of the workforce, and improved job satisfaction through advanced technologies.

REFERENCES

- Prediction of the Mechanical Properties of Aluminum Alloy Using Bayesian Learning for Neural Networks | SpringerLink

- Machine Learning Prediction of Aluminum Alloy Stress–Strain Curves at Variable Temperatures with Failure Analysis | Journal of Failure Analysis and Prevention (springer.com)

- Prediction of Mechanical Properties of Aluminium Alloy Strip Using the Extreme Learning Machine Model Optimized by the Gray Wolf Algorithm

- Prediction of Mechanical Properties of Wrought Aluminium Alloys Using Feature Engineering Assisted Machine Learning Approach

- Mechanical properties prediction of high strength aluminium alloy components formed under the PHF process