MACHINE LEARNING AND AI ENABLE DECISIONS JUST FIVE MINUTES INTO THE MELTING CYCLE TO HELP SAVE MONEY AND RESOURCES

Steel is the world's most popular construction material because of its unique combination of durability, workability, and cost. Methods for manufacturing steel have evolved significantly since industrial production began in the late 19th century. Today, steel production makes use of recycled materials. A top U.S. steel manufacturer, "Metals, Inc.," (name withheld) purchases scrap metal and melts it into steel billets either to sell or to cast into other finished goods for sale.

MORE ENERGY PER 90 MINUTES THAN A HOUSEHOLD USES IN A MONTH

Like most manufacturing businesses, Metals, Inc., was looking to optimize the efficiency of their most expensive processes. Metals, Inc. owns and operates three electric arc furnaces for steel-melting, which are very costly to run as they heat up to thousands of degrees for each batch.

The cost for melting each batch includes:

> $40,000-$50,000 of scrap metal used in each melting batch

> 60% of the energy spent for each metal shop is on running the furnaces

> $17.8 million on energy to run the three furnaces each year

> Each minute a wasted batch run costs roughly $200

> Furnace uses 80 megawatts of energy every 90 seconds - more than an average household uses in a month

QUICK FACTS

> Solution: RapidInsight

> Industry: Manufacturing & Industrials

> Technology: Microsoft Azure

Despite the high stakes, the quality measurements for each batch are not available until the last few minutes in the 90-minute melting process. This lack of visibility means it's difficult for operators to know when corrective action can be taken, and ultimately leads to wasted furnace time.
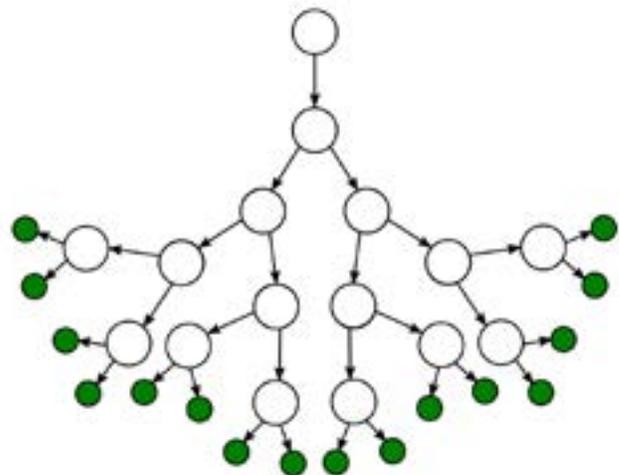
CCG'S SOLUTION

CCG proposed an artificial intelligence solution that would go beyond human analysis to more accurately refine and predict the success of melting batches. Decreasing low quality or scrapped batches would allow the company to save money and increase overall production to drive revenue.

Metals Inc. already had IoT sensors capturing real-time information like temperature, airflow, heat transfer through the ventilation ducts, and electricity consumption. Using this historic IoT data together with the measured quality of previous batches, CCG trained a random forest machine learning model to recognize the patterns in the sensor data that indicate whether the current batch will come out good or bad. The random forest model works by creating over 1,000 decision trees and aggregating the results across those trees for a final prediction.

The model was exposed through a REST API for Metals, Inc.'s developers to make the predictions visible to the furnace operators in real time throughout the melting process. As more steel goes through the process and more data is collected, the model can also continue to learn and improve the accuracy of its predictions.

CCG also discovered some unexpected relationships in the data. Though things like temperature, chemical mix in the burners, or valve positions were expected to be the greatest predictors, most useful data in predictions was found to be the ratios of heat loss across ventilation ducts. With this knowledge, Metals, Inc. can plan for expansion of their IoT program to capture more reactive data points useful for enhancing this model or approaching other problems like predictive maintenance.

POSITIVE RESULTS

The machine learning approach managed to produce predictions within Metals, Inc.'s accuracy tolerance just 5 minutes into each melting cycle. On a 90-minute melting process, this allows the furnace operators to determine whether each batch can be salvaged by taking corrective action, or whether to scrap it and move on to the next batch and keep efficiency high. As the melting cycle continues, predictions are updated and get more accurate over time.

Ability to determine the likelihood of a successful batch **92%** **faster**	**Informed decision making** instead of gut-based decisions.	**Decreased annual energy bill** and reallocated funds
Improved percentage of successful **batches,** **boosting sales**	Proven **statistical modeling** will become **increasingly valuable over time**	**Uncovered hidden data patterns**