

AI and Machine Learning:

Predicting the Future Through Data Analytics



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Artificial Intelligence. Machine Learning. Predictive Analytics.

You've no doubt heard these terms and may be at least partially familiar with them. They're more than just tech jargon – they are an undisputed part of the future for many, if not most, industries. And that future? It's right around the corner. For some industries, that future is now.

How are AI, machine learning and predictive analysis being used today in manufacturing? What do companies need to know now to keep pace with competitors who might already be riding this train?

In this eBook, we'll look at this new technology through a manufacturing lens. We'll explain what they are, how they're fitting into the industry and wrap it all up in a real-world example of how we at USC Consulting Group (USCCG) have harnessed these high-tech tools to help clients become more efficient and profitable.

The Basics

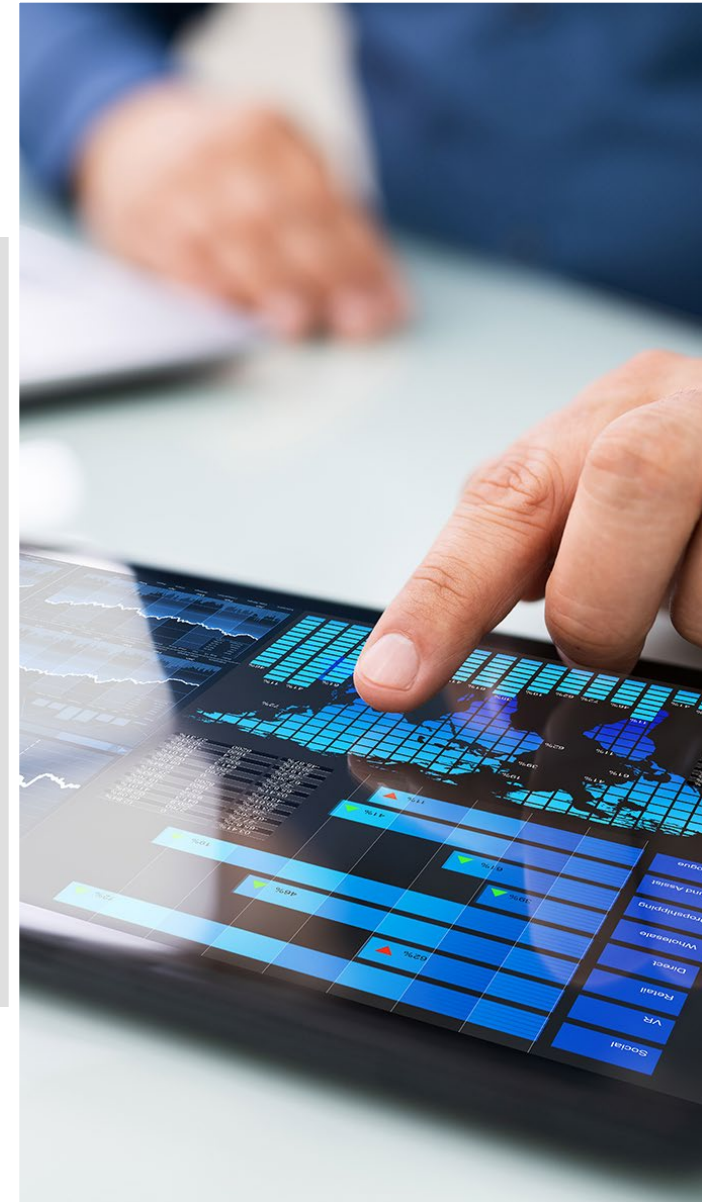
A good place to start in talking about this bot revolution is by defining some of the important terms and concepts.

Artificial intelligence (AI) is a broad net describing computer systems that perform intelligent tasks, like reasoning, learning, problem solving, decision making, and natural language processing, among others. One common example of AI most people know – Apple’s Siri.

Machine learning is a subset of AI. If AI is the goal, machine learning is how we achieve it. Machine learning is all about understanding data and learning from it. It is, technically, a set of algorithms that can learn from data. Instead of having to be programmed, the computer learns on its own based on data.

Predictive analytics is one output of machine learning. It is the ability to forecast future outcomes based on data. It’s like having a crystal ball that’s informed by vast amounts of complex algorithms and data. Everyone is familiar with predictive analysis but may not know it. It’s when Amazon suggests an item for you to buy based on past purchases, or Netflix queues up new shows based on what you’ve already watched.

The predictive analytics piece of this high-tech pie has already changed not just business processes but society as a whole. Consumers are now used to their preferences being known, remembered and anticipated by giants like Amazon, Apple and Netflix. B2C industries that aren’t using it are already behind the curve.



How It Relates To Manufacturing

Siri running your household and Netflix recommending your next binge-worthy television series are convenient, fun and entertaining byproducts of this technology. For industries like manufacturing, it's serious business.

Much like Netflix's use of predictive analytics created a seismic shift in consumer expectations, this technology also has the potential to transform operating procedures and processes for many industries.

AI, machine learning and specifically predictive analytics are extremely powerful when dealing with processes in which multiple predictors are influencing outcomes. It has the ability to tell us which path to take in order to achieve a desired outcome, even when process patterns and trends are changing.

Predictive analytics helps companies:

- Better understand what's occurring in any given process
- Keep informed of changing patterns and trends in the process
- Refine and optimize the process



The benefits of using AI in predictive analytics are many, including:

- **Greater precision and accuracy.** Yes, humans do the programming. But AI can analyze mountains of data and identify complex patterns people might miss.
- **Speed.** AI can analyze vast amounts of data in a snap. This helps companies make decisions faster.
- **Increased efficiency.** All of this accuracy and speed leads to greater efficiency, output and ultimately, profits.

Now that we've covered the basics, let's look at the use of AI, machine learning and predictive analytics in practice in the real world.



CASE STUDY:

How USCCG uses predictive analysis to improve yield

Recently, a large metals processor needed our help to improve yield. That happens to be one of our specialties at USCCG, so we were eager to help out. But, when we got into the meat of the challenge, we discovered a wide variety of variables was interfering with the process.

The client's goal — more than **99.99%** of their product needed to conform to customers' desired product specifications with **a Cpk of greater than 1.33**.

It wasn't easy. We discovered there were 18 predictors influencing product quality, potentially standing in the way of our getting to that goal.

Predictive analytics in action

At USCCG, we like to say predictive analytics is where traditional statistics meets machine learning.

Remember those 18 predictors? We used a Classification and Regression Tree (CART) to help us determine which combinations of those 18 predictors would help us achieve the client's desired outcome. It took the guesswork out of the process, analyzing the data for us.

The results of the analysis quickly showed the right combination of predictors that would help us achieve our goal. Great! Except... then, it got more interesting.

AI is only as good as the data provided and — here's the key in this case — the stability of the process. We were experiencing a high degree of variability. The variation at these targets was unacceptable and clearly contributing to the undesirable product conformance.

“We needed to figure out why we had such high variability,”

says Dr. Frank Esposto, USC's Senior Director of Quality, who headed up this project.

And that meant good old fashioned, human problem solving, courtesy of Dr. Esposto's expertise in Lean Six Sigma.

Here's how we handled it:

Uncovering the causes of the variability involved analyzing the processes from the cradle to the grave, identifying the highest-impact operations and drilling down into the tasks and steps within those operations.

We uncovered a critical process issue: A hydrocarbon cleaning fluid used to clean the material prior to entering the furnace was interfering with air flow within the furnace.

A constant airflow is believed to be vital in maintaining stable product characteristics during manufacturing. But... we weren't going to make any permanent design changes on a "belief." So, the engineering team created a prototype to prove its theory.

We analyzed that prototype test with a variety of statistical tools and it showed an 80% decrease in variability. Bingo!

With further refinements, the team is on the path to hit their **goal that more than 99.99% of product conforms to a Cpk >1.33.**

Humans are the key to effective results

What did we learn about AI, machine learning and predictive analytics? These are powerful tools, but only as good as the data humans initially supply them.



Predictive analytics uses machine learning to predict possible outcomes, and the application of predictive analytics – where classical statistics meets machine learning – used for our client had not only uncovered vital predictors influencing the desired outcomes, it also helped uncover issues with our process design that needed to be addressed in order to reduce variability.

And that's the rub about AI. If it's going to render accurate results, it needs minimal variation. But, as we all know, life is not a data set. Variation is happening all around us, all the time, even in projects where we need great precision.

That's why the bots are never going to replace humans. They need us as much as we need them. At USCCG, we have more than 50 years of experience making process improvements, finding hidden opportunities for efficiency, creating leaner systems and helping companies thrive. For the next 50, AI will be one tool we use to help achieve that.



The Future of AI and Machine Learning in Manufacturing

This comprehensive look at AI and Machine Learning underscores the transformative potential in shaping the future of data analytics, particularly within the manufacturing sector. However, the success of such technological advancements is heavily predicated on the quality of the underlying data.

Clean and enriched data serve as the cornerstone of accurate, reliable AI and ML analytics. USC Consulting Group partners with [AICA](#) to strengthen our offering by ensuring that the predictive analytics and process improvements are based on data that is both pristine and robust.

USCCG can confidently assure clients of a data foundation that will enable more accurate forecasting, improved decision-making, and ultimately, a more profitable and efficient operation. USC and AICA is setting a new standard in the consulting industry for what can be achieved when high-quality data meets cutting-edge AI and ML technologies.

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