

AI: Less Artificial, More Intelligent

Giving Your Business a Cognitive Advantage

“Companies are Benefiting from AI-Powered Solutions Without Realizing It.”

While only **38%** of companies surveyed say they're currently using AI in the workplace, **88%** of those claiming no use of AI are actually already benefiting from solutions that rely on AI techniques.

2016 Outlook on Artificial Intelligence in the Enterprise Report and *infographic* by **Narrative Science**

Robot toys learning to react to new situations, machines playing Go better than human champions, huge improvements in web-based language translation—we've all heard about AI lately. Not as well-known is the extent to which AI is reaching into and transforming enterprise operations. Today AI is *less artificial*, emerging from computer science laboratories to become a prevalent resource across industries for solving real business problems. It's *more intelligent*, used as a competitive differentiator helping us achieve new levels of performance—customer intimacy at massive scale, high growth with low risk and unprecedented speed in everything.

The New Competitive Distancer

Computing advances and big data are bringing artificial intelligence—for decades, largely an academic pursuit—into the business mainstream. Because AI technologies give us powerful ways to make sense of data at scale, they're becoming an increasingly important source of competitive advantage. Reaping the benefits, however, depends on understanding how to apply machine intelligence to business processes and balance it with human expertise.

Think of AI technologies as ways to perform your current business processes much better than ever before. For instance, most retailers are making an effort to increase the relevance and personalization of their offers to customers and prospects. Many have gone beyond BI-based static customer segments to use predictive analytics such as propensity-to-buy and time-to-event models. You can do even better by using machine learning to discover the mix of archetypal behaviors that makes each of your

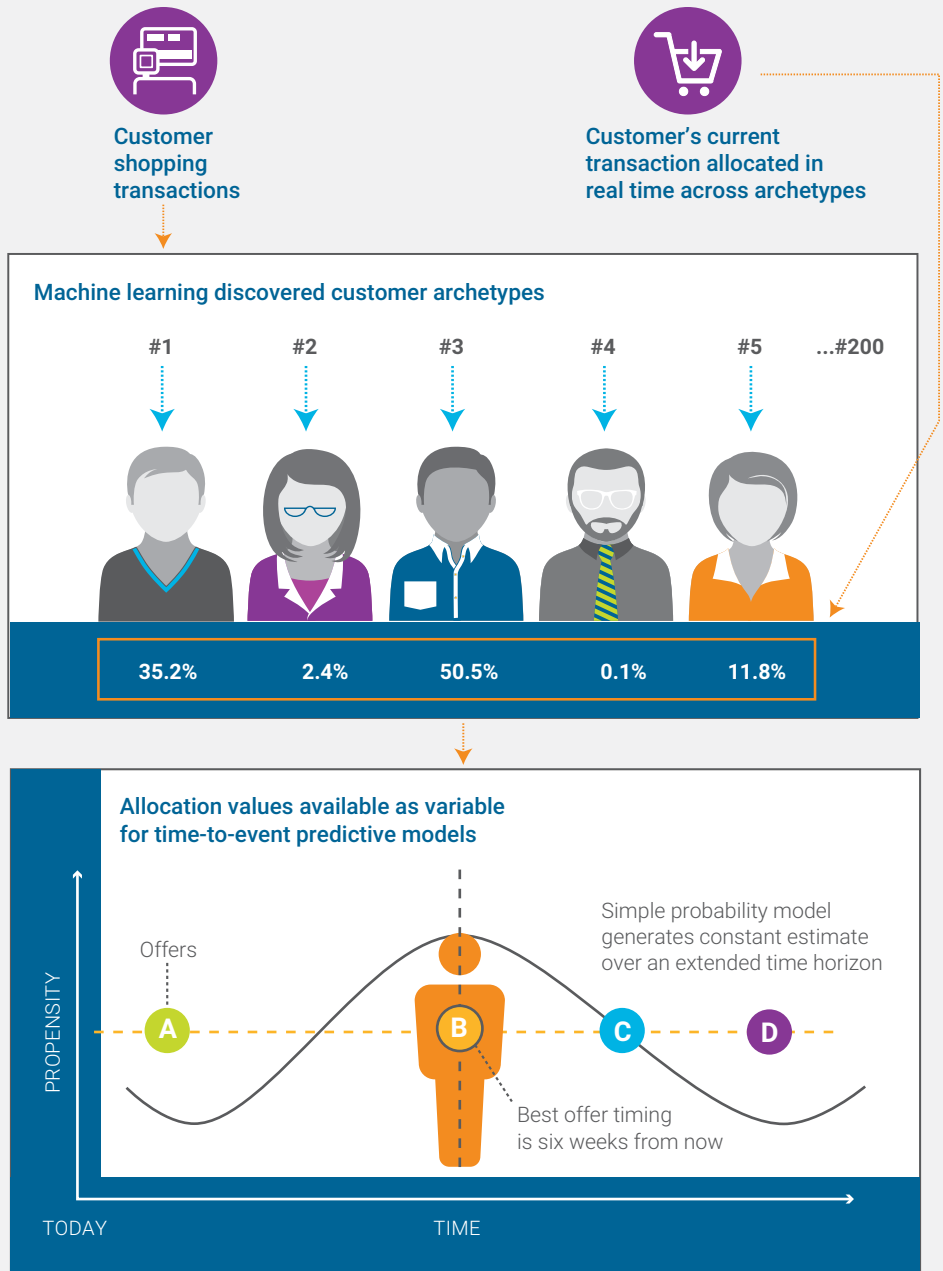
customers unique, measuring changes to the mix in real time, and feeding those insights into your predictions and decision strategies.

AI technologies find patterns in data and figure out how systems work—sometimes without human intervention. Often they aid data scientists by revealing subtle but important relationships between data variables they'd otherwise miss. Identifying hidden predictors of credit risk or attrition risk, for example, they can enable you to make much smarter onboarding decisions that drive higher revenue, profit and customer lifetime value.

Self-learning AI technologies are especially valuable in new markets where historical data doesn't exist and in dynamic environments where frequent change is making what happened in the past less useful for predicting future behavior. They can improve your understanding of customer behavior around product introductions or quickly show you what's different as you extend existing products into other markets. Monitoring networked devices, manufacturing equipment, customer transactions, university grant spending or corporate travel reimbursement, they learn what's normal on the fly, constantly recalibrating as systems and organizations evolve, and alerting you to activity outside this moving range of normalcy.

Perhaps the biggest competitive advantage of all, AI can help you pick up the pace of performance improvement. Innovative AI techniques identify optimal strategies after just a few test-and-learn cycles, while controlling testing cost. Use them to outpace rivals by getting to the best

AI-enabled deeper understanding of customers improves offer relevance and timing



strategy for achieving your business objectives under current conditions faster. When conditions shift, identify the new optimal while competitors are still thinking about what to do.

You can fold performance enhancers such as these into your business processes today, in many cases through callable services and cloud-based solutions.

It Takes a “Brain”

In just about any industry you look at, top performers excel at making very complex decisions.

One retailer generates the most relevant set of 20 offers—from 380 billion possible offer combinations—for each of its 9 million loyalty program members each week. A wind farm design firm pinpoints the best placement for 20 turbines—from millions of possible pattern permutations in a 200x300 grid—while adhering to regulatory-compliant energy loading constraints.

The complexity involved in driving performance improvement is increasing even for organizations dealing with smaller numbers. Banks of all sizes are competing in changing markets by offering a plethora of new products and account access channels. Telecom companies must meet consumer demand for unique packages of devices, lines and services, as well as, increasingly, for financing.

As these competitors adjust their strategies for success, they spawn even more change in markets. New offers, policies and business models influence customer behavior to move in ways that may not be understood by business experts or reflected in the historical data traditionally used



to predict risk and reward for onboarding processes. Still, companies must make precise decisions, usually in minutes.

We’ve reached a stage in business performance where manual methods of deciding what to do can’t keep up. With the enormous amount of complexity and change businesses face today, there are advantages to technologies that mimic the brain’s ability to make subtle connections between multiple pieces of information and learn to recognize and differentiate entities in dynamic situations. AI algorithms can process massive complexity in an instant to arrive at the clear decisions and recommendations based on latent features of behavior needed for today’s streamlined, simplified business processes.

AI is also the key to managing the exploding number and complexity of data inputs and analytic models being used to drive performance. It’s how you learn patterns occurring between these assets while keeping pace with blurring change.

AI Innovations You Can Use Today

Here follows a quick tour of some of the ways you can use AI to lift competitive performance. We also discuss some cautionary points to keep in mind, for AI that will pay off in line with your expectations.

Collaborative Profiling

To make more relevant offers, you need deeper, more timely understanding of customer behavior. Collaborative

More protection in a dangerous world

It’s not just sales and marketing that benefit from Collaborative Profiling. This AI technology is also being used in fraud detection and anti-money laundering, where large, rapid changes in archetype mix signal suspicious activity, triggering actions or alerting investigators before risk and losses mount. It’s critical in cybersecurity, where machine-discovered archetypes capture common behaviors for networked devices, such as servers, routers, laptops, tablets and phones. Measuring changes in archetype mix helps identify new and morphing threats that can elude conventional signature-based protection.

Profiling extracts these insights from customer purchases and interactions in real time.

This FICO AI technique discovers archetypes—typical patterns of behavior and activity common to large groups of customers—in transactional data. Each customer is a mix of archetypes, which changes over time. The machine learning algorithm instantly recalculates the mix with every engagement, measuring the amount of change, and this information is then available to predictive models and decision strategies. This approach is not only more accurate than judgment-based or BI-based segmentation, it's also more dynamic. Just as radar tracks entities as they move, the archetype mix adjusts naturally as customer behavior evolves. By steering offers and interactions in the direction the customer is going, Collaborative Profiling makes it easier to anticipate your customer's preferences and retain and build valuable relationships.

Because the algorithm measures the difference in the archetype mix for a customer from transaction to transaction, you can pick up major lifestyle changes. Significant changes in the mix may indicate something big is underway—such as marriage, home ownership or retirement. The early heads-up gives you the opportunity to get out ahead of competitors in adjusting offers and interactions to what the customer needs now and what is most relevant to them.



You can even predict the likelihood of behavior that hasn't happened yet. Though a behavior has never been observed for a particular customer, it may nevertheless be probable based on their archetype mix. Such latent probabilities are opportunities to target offers and incentives that encourage consumers to try new products and services.

Smarter scorecards

If you're trying to grow your business by onboarding more customers, partners or suppliers faster, do you know how many of these new relationships are going to contribute to your profitability? Today many companies are looking beyond a short-term boost in revenue and market share to cultivating long-term value from the start.

For instance, a major online marketplace is using an analytic scorecard to predict

the risk of new seller applicants acting fraudulently or breaching service level agreements—behaviors that lead to costs, losses and reputational damage that negatively impact the retailer's profits. Many wireless providers are using analytic scorecards at onboarding to predict risk of attrition—high rates of voluntary churn are one of the industry's biggest problems—and taking the score into consideration in automated decisions about what combinations of products, services and financing to offer an individual.

AI technologies can be used to increase the precision of scorecards without losing their advantages of model transparency for business decisions. Scorecards output numerical values that rank-order the probability of a certain outcome, such as a new customer becoming delinquent on their bill. These scores make it easy to set thresholds,



Squeezing more value from your data

By using machine learning to find latent customer characteristics with predictive power, you increase the value you're getting from your data. As TEMs stop identifying strong multi-characteristic predictors, you know you've gotten as much as you can from the current data. It may be time to look elsewhere, such as at orthogonal data sources.



above and below which different automated actions are triggered. And scorecards make it easy to explain decisions to regulators, executives and customers, since they can be presented in a way that shows a clear relationship between input characteristics to the model and output score.

FICO is using a machine learning technique called Tree Ensemble Model (TEM) to improve scorecard performance by discovering latent predictive features (hidden relationships between input characteristics and behavioral probabilities) in data. A TEM is an algorithm that generates many statistical “decision trees,” then combines their predictions into a composite prediction. This technique is adept at finding complex interactions between characteristics. It’s especially valuable for guiding model updates to keep performance high in the face of new data and patterns between variables that the scorecards haven’t seen before.

A word of caution: Machine learning’s ability to discover latent predictors is something that must be used carefully. Imagine an algorithm discovering a relationship between yellow cars and the credit risk level of their owners. Even if the data says this is true, no responsible business person would want to see people denied credit or charged higher interest rates because of the color of their car. It’s a silly example, but it points to the importance of human supervision

over machine learning and how it’s used, especially for businesses subject to regulatory oversight, such as financial services and, increasingly, telecom.

Another problem with machine learning is lack of transparency. These sophisticated algorithms can be a “black box” to stakeholders and regulators trying to understand how a decision is being made. A FICO innovation addresses this issue by transmuting machine learning insights into a segmented scorecard, which analyzes the complex data relationships discovered by the algorithm while still presenting scoring factors in business terms. Alternatively, the output can be new characteristics, which can be incorporated into other models.

Change-aware model governance

The rapid pace of market change has businesses deploying more models of more types to analyze more data than ever before. The value of the resulting analytic insights—and the exposure to financial, regulatory and reputational risk—depends on the quality and consistency of the data and efficacy of the models.

AI can help you improve both. A FICO neural network autoencoder monitors input data and predictive model components (features and profiles) to tell you how much current data is moving away from what the model was originally trained for and when input data is underrepresented

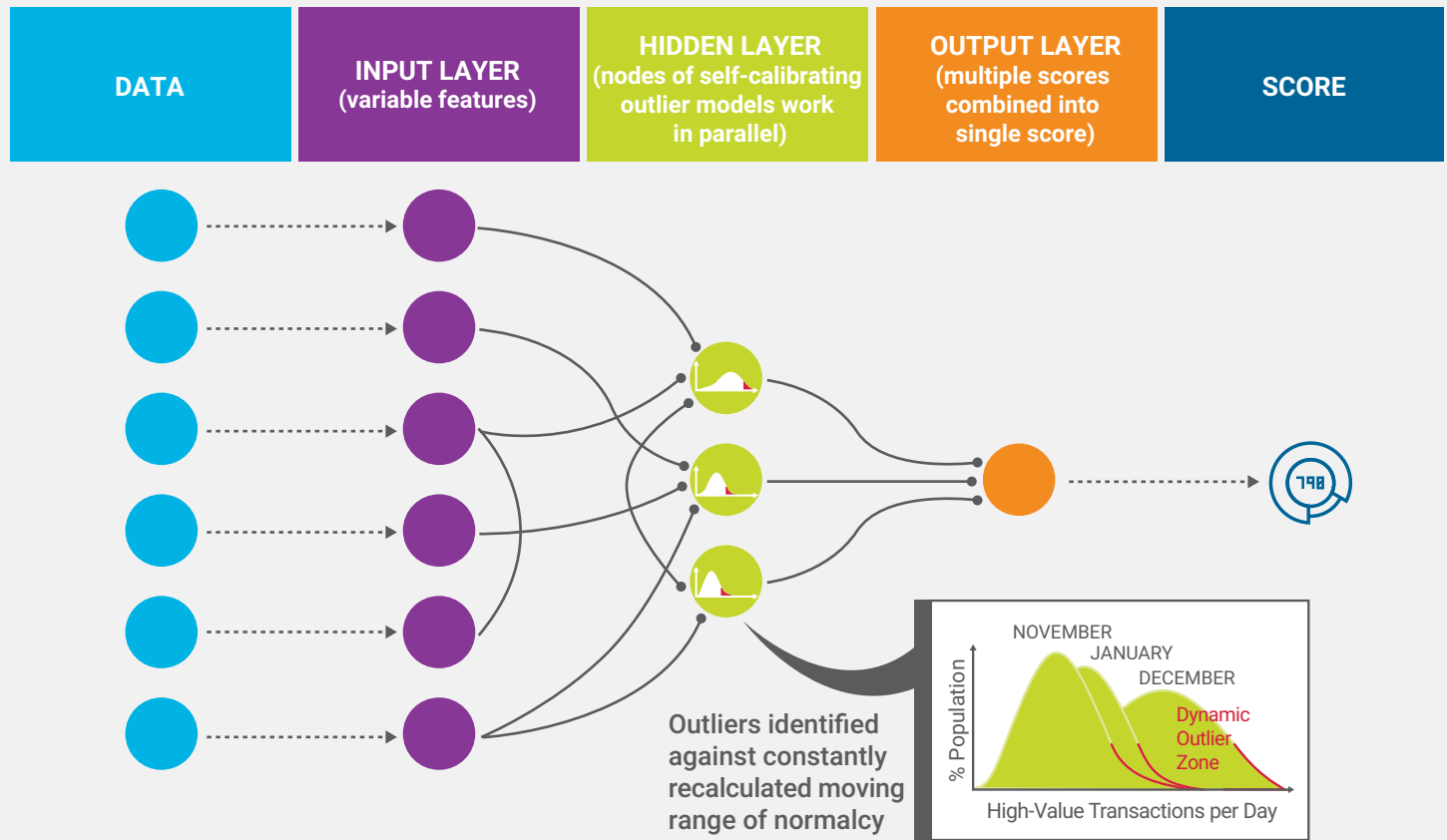
in the model. It’s a powerful tool for better model governance because it can reveal specific parts of your market where there’s more change happening and where you may therefore want to place less trust in model outputs. In fraud management it can pinpoint new schemes and behavior patterns. Overall, it gives you an early heads-up to take a look at specific areas of performance and make efficient, focused plans for model updates.

Models that self-adjust to change

AI technologies can increase the ROI from your models by extending their shelf life and improving performance between updates. You can also use AI to rapidly generate reliable data-driven predictions in environments where you have little or none of the historical data needed for the supervised training methods traditionally used in building predictive models.

For models that have been built with supervised methods—such as the neural networks widely deployed in fraud detection—an adaptive layer can be “bolted” on to increase sensitivity to changing behavior patterns. This adaptive layer continuously learns about morphing and emerging behavior patterns in analyst feedback data (for instance, was a transaction that scored high for fraud really fraudulent?). It self-adjusts the weights of connections between predictive features and can

Learning what's normal behavior and what isn't on the fly



also swap out some features for others based on their relevancy to what's currently happening in the production environment. The adaptive model's output is then blended with the base model's output for a single score.

Another FICO AI innovation, the Multi-Layered Self-Calibrating Model (MLSCM), doesn't need training on historical data because it learns about normal and abnormal behavior on the fly from the incoming stream of production data. The architecture of an MLSCM is neural network-like in that it has a "hidden layer" where weighted connections between input features are made, adjusted and tested.

In this case, however, the nodes in the hidden layer are self-calibrating outlier models. As the data streams in, they continuously compute the distributions

of each feature for a peer group (such as similar mobile connections, similar factory line equipment, or customers who are similar because they may share the same archetype distributions), calculating a normal range and quantifying the distance of any outliers from that range. Working in parallel, each of the outlier model nodes connects features in different ways—essentially getting different views on the data and exploring latent feature creation. Their multiple output scores are fused into a single score.

Because this process is ongoing, feature value distributions and the designation of what constitutes an outlier range are always changing. The technology is therefore very useful and widely applicable in many dynamic environments. In cybersecurity applications, for instance, MLSCMs

quickly detect suspicious behavior in command-and-control network relationships, such as between a "bot" on a malware-infected computer and the "bot master" on a server somewhere giving it commands.

The same technology is being used by a leading university to improve compliance of grant-supported research programs with internal and federal policies. They're able to go beyond simply detecting spending that breaks specific rules. They also notice waste and abuse that are outside the behavioral norms of peer groups. In the same way, organizations could use AI to track evolving norms in travel reimbursement—catching abusers of travel spending policies, but also seeing where organizational policies may need to be updated to align with the current realities of traveling staff.

Strategy learning factories

Given the constant uptick in competitive intensity and speed of change, a paramount factor in your success is how fast you can figure out the best strategy to take under current conditions and operationalize it—i.e., before conditions change.

AI is a powerful ally here as well.

A new FICO machine learning technique is capable of self-learning the mathematically optimal strategy after just a few iterations of an automated test-and-learn cycle.

This algorithm accelerates the process by increasing the amount of learning in each cycle. It uses a boundary-hugging test design that substitutes different offers on a random basis for some customers who are near the boundaries of their segments (for instance, have propensity scores similar to customers in the adjacent segment). That's the

closest you can get to the ideal, but practically impossible, experiment of making and not making an offer to the same customer at the same moment. The result is data rich in causal evidence about customer behavior, essential for faster learning.

You can control testing risk and cost by telling the algorithm how much deviation to allow from your current champion strategy. Using simulation tools, you can find your company's "sweet spot," balancing learning speed and investment for high ROI.

This innovation could make mathematical optimization of decision strategies (often called prescriptive analytics) practical for many more organizations. Optimization—currently used by hundreds of organizations worldwide, including banks for credit line management, oil refineries for production scheduling, and the

US National Football League for game scheduling—is a powerful way of identifying the best choices out of a mind-boggling number of possibilities.

An obstacle to wider adoption of this technology is that you need not only an excellent optimization engine, but a well-designed network of action-effect models predicting the probable outcomes of actions you could take. Depending on the problem you're trying to solve, this network may comprise hundreds or even thousands of models. Building it takes a lot of time and expertise from data scientists, in short supply.

The FICO technique automates the generation of action-effect models and identification of optimal strategies, democratizing access to a tool that is becoming more and more critical to competitive success.

It's Time to Get Real About AI.

Today, AI technologies are less artificial, no longer foreign to the business world and its interests. Making them more intelligent requires proper knowledge of how and when to apply them to business processes.

As we go forward, the current buzz around AI may subside, but you'll see the results every day, in the widening gap between competitors who use it intelligently and those who don't.

Want to put AI to work for you? We can help.

Call or e-mail us now.

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