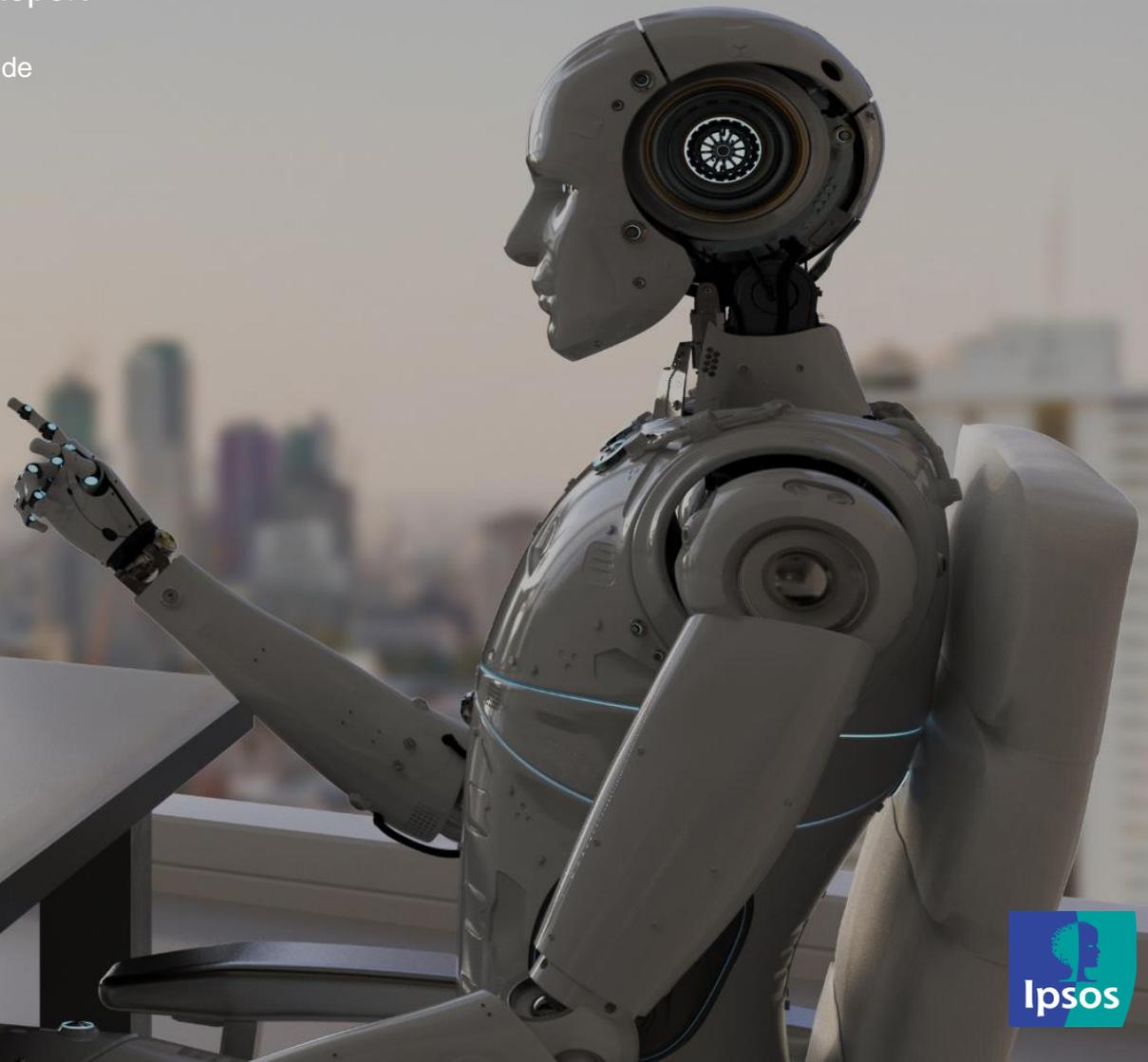


# AI 101

## UNDERSTANDING POPULAR ARTIFICIAL INTELLIGENCE TECHNIQUES AND TOP TIPS FOR PUTTING THEM TO WORK

A Synthesio Report

Author: Allen Bonde



# INTRODUCTION

With more data swirling around us each day, the demand for smart machines to help sort through it, process it, spot trends, and automate how we turn it into business value has never been higher. This is why we have entered the golden era of data science. And why artificial intelligence (AI) - in all its forms - is truly all around us, in our smart speakers and appliances, in our cars, and on our favorite eCommerce sites. AI has become ubiquitous at home, and in our work too. It's time for data and insights teams, digital strategists and product planners, and even marketers and creatives to get on board.<sup>1</sup>

Why has AI gone mainstream now? It's certainly not a new topic. In fact, McCulloch and Pitts created their early mathematical model of the biological neuron in the 1940s, scientists gathered for the Dartmouth Summer Research Project on AI in 1956, and the release of the preliminary version of the AI programming language, Prolog, occurred in 1971.<sup>2</sup> Through its history, AI has been interdisciplinary, with commercial advances funded by both public and private initiatives, and developments in all corners of the globe.

Artificial intelligence has certainly been through boom-and-bust cycles over the past 70 years. But today's boom is driven by the convergence of a number of factors: an explosion of data from the Web and internet-connected devices, the broad availability of AI platforms, a new generation of engineers and programmers who grew up with tools like RStudio and Python, the emergence of "hybrid" approaches that make AI both more accurate and more scalable, and of course a focus on specific business use cases vs. trying to solve just "big" AI problems.

Over time, one constant has been the search for smart machines that are inspired by the two general types of brain activity: top-down cognitive processes and lower-level or bottom-up perceptual processes. Without getting into psychological science or recent thinking that the delineation between these functions may be much blurrier than previously thought, it's helpful to organize popular AI techniques and applications through the lens of these two branches: "cognitive" and associated reasoning systems, and "perceptual" and associated learning systems.<sup>3</sup>

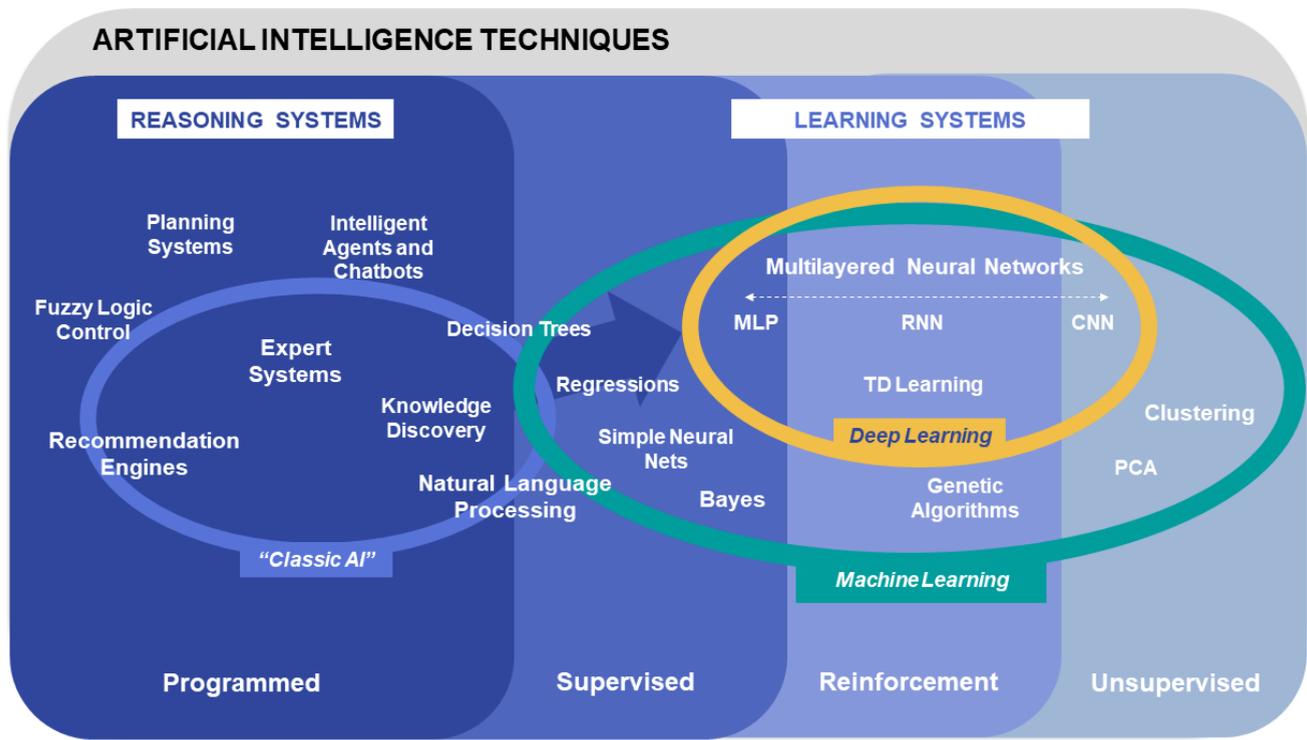
Of course, how you access and consume related algorithms in these 2 branches can vary widely. Many readers will be happy to gain the benefits of AI through an AI-enabled consumer intelligence (AICI) platform from a vendor like Synthesio.<sup>4</sup> Others may be looking at more general-purpose AI/ML solutions from a cloud provider like Amazon, Google, or Microsoft. And a few of you may be inspired to build your own models and start exploring the universe of open source tools, libraries, and communities.

Whatever your goal with AI, we hope this report helps you on your journey!



# THE MANY FLAVORS OF AI

Figure 1 Taxonomy of Reasoning and Learning Systems



Source: Adapted from "7 Rules for Surviving the AI Hype Machine" Allen Bonde, April 15, 2018

## REASONING SYSTEMS OFFER GUIDANCE, AUTOMATE MANUAL PROCESSES

At a high level, reasoning systems are a type of AI that is programmed or guided, follow a logical process, and map conditions to actions.<sup>5</sup> They may operate autonomously (like a factory robot picking an order) or interactively with humans to gather needs, ask clarifying questions, etc. Born from the cognitive branch of AI, reasoning systems are now part of everything from business software to shopping bots, to natural language processing and helping brands discover how consumers find, consider, and buy new products.

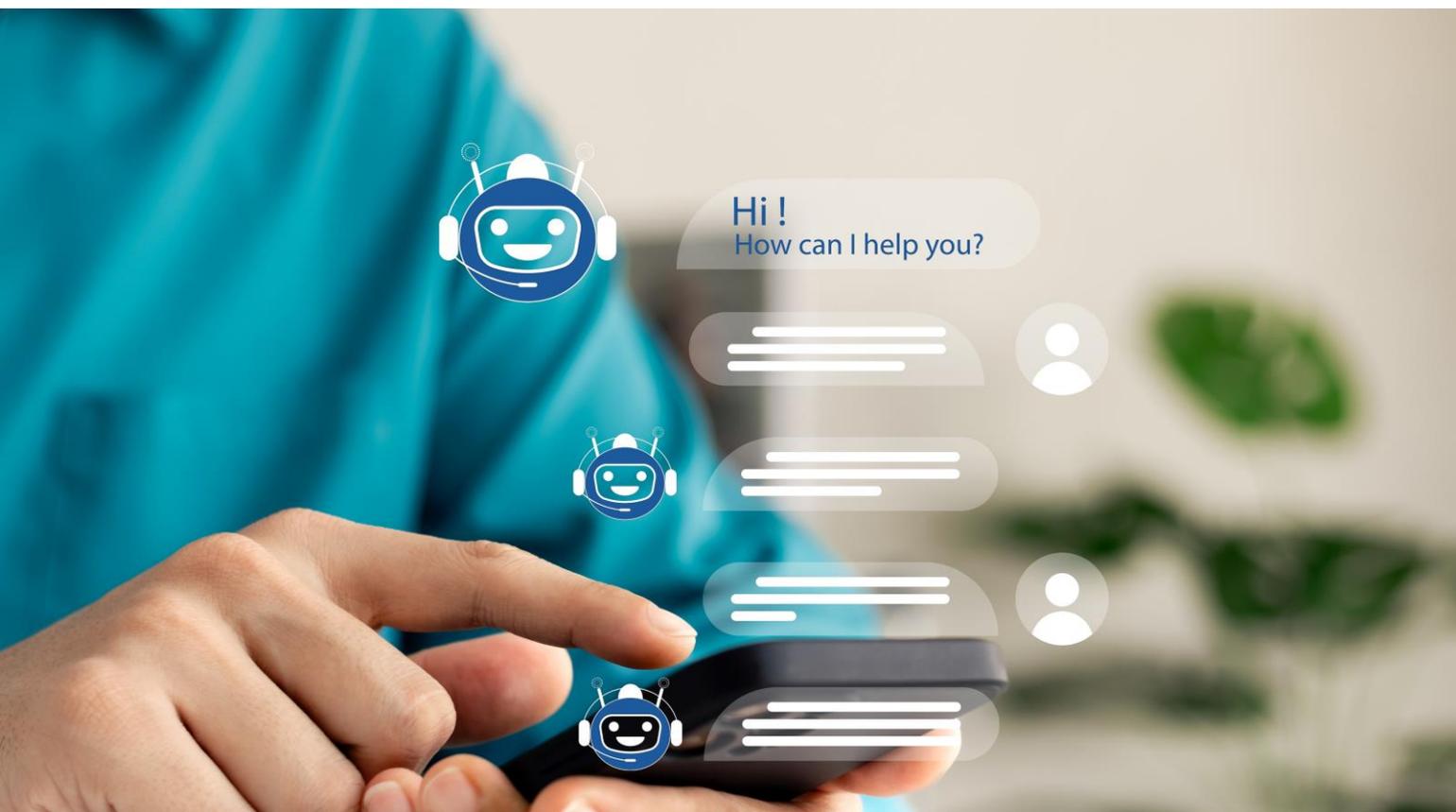
A system that applies this type of AI will follow a set of rules and known approaches and incorporate new inputs with the goal of narrowing down a solution and/or presenting an answer, like which product to buy or how to reach buyers as a brand considers different go-to-market scenarios. The experience can be presented as "human-like" when advantageous, and reasoning systems can explain an outcome, but they can also be time-consuming (or impossible!) to program, "brittle" when encountering out of scope requests...and typically cannot learn.

So, what are some techniques that are especially relevant to consumer market research or other client-facing functions? Think of your last online shopping experience. Odds are you encountered a virtual assistant powered by AI, saw tailored recommendations, and received personalized offers (or extra-personal service) after making a purchase, raving about it on your social channels, filling out a post-purchase survey, etc.

Here are three types of applications that apply the reasoning branch of AI:

- **Intelligent agents and chatbots.** As Forrester's Kate Leggett has written, as digital engagement increases, AI and automation become foundational to customer service.<sup>6</sup> Reasoning techniques power chatbots and automated answers. They enable richer self-service interactions and are key to driving full-service adoption of digital channels like chat, video, and co-browsing (and even self-service surveys). Leading edge business platforms are using this type of functionality to work side-by-side with users, offering suggestions and even taking over repetitive tasks.
- **Decision and recommendation engines** can offer guidance to consumers or researchers looking to complete a task or answer a question. In this case, AI helps to automate how the user makes a decision or determines outcomes, like suggesting the right product. A related approach is how Synthesio's AI-powered search auto-suggests and recognizes specific search terms of interest when users are exploring social data, and within a dashboard improves the ability to search and browse specific entities like products, places, people, etc.<sup>7</sup>
- **Natural language (and image!) processing** as a discipline has evolved from custom models built and maintained by linguistic gurus, to AI-enabled techniques that streamline how diverse teams can understand conversations, see trends, and analyze not just text but also images and other formats. Both reasoning and learning approaches are helping insights and marketing pros supercharge their social insights with advanced NLP: reducing noise from spam and bots on social sites, to automatically surfacing spikes in engagement or sentiment. In this foundational example, AI helps machines understand human language, and humans find insights (more quickly) in the ever-growing volume of online data.<sup>8</sup>

Behind the scenes of all these examples are usually some combination of decision rules and workflows, along with other data science models for pre-processing of inputs. Structured approaches have the benefit of repeatability - and explainability. And when combined with learning algorithms used to build decision trees, like the ID3 algorithm, reasoning systems can be an efficient way to do top-down classification, especially where there is a significant amount of qualitative data.<sup>9</sup> But increasingly, machine learning (ML) is augmenting and even replacing key parts of reasoning systems, especially in data-intensive applications.



## LEARNING SYSTEMS SPOT PATTERNS, HELP TEAMS MAKE PREDICTIONS

Machine learning comes from the perceptual branch of AI and is where a lot of the money and focus is today.<sup>10</sup> Learning systems apply algorithms that are trained vs. programmed and can be supervised or unsupervised (or a blend). They generally are focused on two types of tasks: predicting something that has happened before like our recent Trend Radar work that discovered correlations between diet trends and related product sales from years of historical data, or spotting an anomaly that hasn't happened before, like a new Gen Z fashion trend.<sup>11</sup> ML-powered systems may have a wide range of techniques under the covers, from those that branched off of reasoning systems, to advanced models mimicking biological functions in humans or even insects.<sup>12</sup>

In general, a system that applies machine learning will “learn” from some combination of training data, prior knowledge, and trial and error reinforcement, with the goal of predicting, classifying, or clustering new data.<sup>13</sup> Systems that apply variations of statistical methods can be grouped into a class of Bayesian techniques, and are adequately covered elsewhere.<sup>14</sup> At the other end of the spectrum, **deep learning** methods like multi-layered perceptrons or convolutional neural networks (CNNs) can be extremely powerful in high-complexity fields like machine vision and bioinformatics, and in fact are applied in Synthesio's image and logo recognition capability.<sup>15</sup>

So, how should we think about the different types of machine learning? It's easiest to start by examining the type of training inputs that are available or provided and how the system uses this information to predict a known outcome (or spot something new) for its “human helper”:

- **Supervised learning** is one flavor of learning system where the algorithm is trained on a data set with explicit inputs and desired outputs, and then tested with new data, and retrained, and so on until an acceptable level of performance is achieved for classification or related problems. Example techniques include Random Forest and back-propagation neural networks.
- **Reinforcement learning** also uses training data, but applies simpler feedback based on a high-level goal or outcome, such as winning a game or not dropping an object. Reinforcement learning has been essential in fields like robotics and decision management (and even custom NLP models) where there are many inputs and “paths” to solving a problem but rather simple “pass-fail” type outputs. This technique has also been applied to time series analysis, most notably the TD Learning models developed by Rich Sutton.<sup>16</sup>
- **Unsupervised learning** is a more free-form type of learning system where outputs are (initially) unknown but the desire is to look for patterns in a set of data that may indicate trends or even help to spot and validate unknown unknowns.<sup>17</sup> Examples include the clustering approaches like HDBSCAN that are applied in Synthesio's Topic Modeling discovery engine.<sup>18</sup>



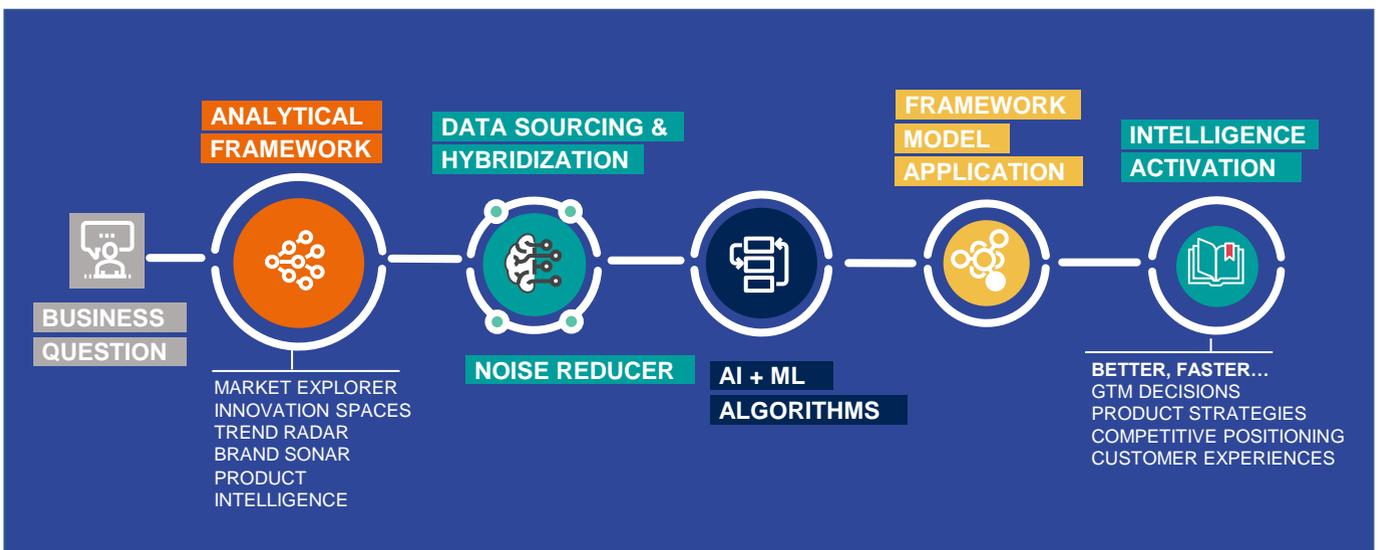
## HOW DATA SCIENCE TEAMS BRING IT ALL TOGETHER

Most learning systems cannot explain their outcome without a human helper adding context or sharing details on how the system was trained, what performance it achieved, etc. As Synthesio's CTO Felix Goalec noted:

*"You'll never be able to deterministically explain the output of an ML model, because of the sheer number of factors. To improve explainability, we're pushing the methodology to better build our training and test data set, understand the underlying biases and either correct them or present them upfront."*

For these reasons we continue to see the benefits of a hybrid approach where humans and machines work together, even when advanced AI or ML does the heavy lifting behind the scenes.<sup>19</sup>

Figure 2 Hybrid AICI combines human and machine intelligence



Source: Synthesio



"With the exponential growth of data, brands are starting to grasp that they need to tap into consumer-generated data sources. To better understand consumers and their behavior (across millions of posts), brands need machine learning, AI, big data, automatic language processing, image processing, sentiment and emotion analysis, and more. Recently, brands have started to understand consumers' spontaneous expressions on social networks. The development of multi-language processing techniques that use bottom-up approaches

allow insights pros and marketers to get complete, unbiased pictures of what consumers are saying about their brands, competitors, and markets. This is valuable both upstream and downstream from traditional research methods and provides valuable insights that more brands are starting to turn into action."<sup>20</sup>

- Benoit Hubert, Chief Data Science Officer, Ipsos

# TOP TIPS FOR YOUR AI-POWERED PROJECT

If AI is on your wish list, you are in luck. There are proven AICI platforms, AI-powered tools for text analysis and data discovery, lots of open source if you are a techie, and communities willing to help out (like our MVPs at Synthesio).<sup>21</sup> Yet no matter your starting point, AI is a journey. While many teams are looking for the big win, they benefit from starting small and looking for ways to apply AI to processes and data sources that bring out their value - for the broadest set of users.

Here are 7 top tips for putting AI to work:

1. **Sell value...not the technology.** Sure, it's fun to explore the techniques above, but remember that most users don't care about the tech - unless they are techies.
2. **Watch the scope.** Automating common, repetitive tasks offers a lot of initial value. So does processing and visualizing new data sets, and spotting patterns that could be an anomaly or even a trend.
3. **Apply Agile.** Especially with machine learning. The process of training is iterative! Also know that there are many flavors of learning systems as outlined, each suitable for the different levels of training data that you have - or don't have.
4. **Get your data in order.** The best insights come from blending big data (like social) and small data (like surveys) to get the complete picture.<sup>22</sup> Adding in search data can also give you unique insights on the path to purchase as well.
5. **Make sure there are human helpers at the ready.** Is your AI the coach or the player? Who is looking after bias and accuracy of results? Who can help you pick the right tool or platform? Who will set up initial models?
6. **See how/where you can embed insights.** If you are using a platform like Synthesio, this is about how different users will consume insights (via API, via reports, via an app, etc.).
7. **Target high-value use cases.** For insights teams, it's often about efficiency and accessing new unsolicited insights. For brands, it's often about time to market. And don't forget about innovation and customer experience (CX) as well!

## CONCLUSION

To scale your AI efforts, you are going to need platforms. Modern insights platforms like AICI offer core data services, reporting apps and tools, and add-ons to explore, blend, and activate new insights, plus a community of practice. Some are increasingly focused on specific business functions or industries, or are looking to push/pull data to/from other systems of record via APIs.

When rolling out a new AI program you are likely going to need consultants as well. Very few organizations have the full range of digital and data science chops in-house. These most advanced firms or "Insights Insourcers" are the first movers, and firms to study and learn from for those who aren't yet data wizards.<sup>23</sup>

Finally, you are certainly going to see more innovation and new use cases when it comes to AI. Although AI in various forms has been around for 70 years, many are still getting started. It's not too late to master AI 101 and get ready to put smart machines to work!

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## About Synthesio

Synthesio, an Ipsos company, is a global leader in AI-enabled Consumer Intelligence. Our hybrid offering provides companies, brands, and agencies with the most complete, accurate, and predictive picture of their markets and buyers. Our AICI platform, powered by the most advanced natural language understanding and AI algorithms, supports the broadest set of online and offline data sources and fully leverages Ipsos' award-winning analytical frameworks. Synthesio was founded in 2006 and has offices in New York, Paris, London, Singapore, and Brussels.

Want a deeper look at the social insights we uncovered while researching for this report? Ready to see a social listening pioneer and global leader in AI-enabled consumer intelligence in action? Request a demo with our team today to learn how you can turn online conversations into critical business insights.

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