As the digital data that surrounds us grows exponentially, it will power advanced forms of artificial intelligence that, over time, will augment human capabilities to make us smarter, more productive and more effective in our personal and professional lives.
EXECUTIVE SUMMARY

Applied AI is setting the stage for organizations across industries to enhance humanity, solve business challenges and create new opportunities. They can do this by applying artificial intelligence (AI) to business, social and personal situations at meaningful points of action with deep advice and contextual insights.

Consider these examples:

- **Enhancing humanity:** When it comes to treating stroke victims, speed is everything. A small startup named Viz is using AI to quickly read the scans of newly admitted hospital patients and, based on training from past examples, identify future stroke victims. As founder Chris Mansi notes, quick treatment can mean the difference between returning to normal life and suffering a lifetime of medical care.¹

- **Solving business problems:** The experiences of thousands of farmers, based on historical approaches and ultimate yields, can be combined and analyzed with data on soil, weather, petroleum and fertilizer costs, and market pricing. Applied AI on smartphone apps can provide farmers with insights for optimizing crop outcomes, bringing experience and recommendations to those who would not otherwise have them.

- **Expanding our talent:** Teachers can customize lesson plans with applied AI by advancing the course development process and scaling their own experiences, which ultimately enables them to be more involved with their students.²

Imagine these examples multiplied across touchpoints in commerce and society, and how applied AI can assist. Companies applying AI for transformation will lead the way, enhance their customer relationships, and advance their corporate and social missions.

This white paper defines and assesses the role of applied AI in business and society, lays out an approach for determining new opportunities, and offers proven ways of getting started.
APPLIED AI IN ACTION

How can businesses seize applied AI? What type of leadership will they need to get there from here? We start with a glance a few years out, in 2020.

7:00 AM, Winter 2020, Marriott Hotel, Downtown New York

You wake up to a voice from “Felix,” your robo assistant, which alerts you to a work emergency resulting from a sudden breakdown of a critical machine on your organization’s assembly shop floor. As you ask for more information, you learn that the factory sensors have detected the problem and activated a backup.

Felix then suggests scheduling a team discussion in the next hour, considering the criticality of the situation and loss of redundancy. You nod, and Felix asks, “Is that a yes?” which initiates an integrated action sequence:

• Felix reviews your organization’s history of interactions with team members and partners; recommends who should be included in the discussion, including manufacturing, supplier compliance and the sales team; assigns a priority (with your agreement) that supersedes the schedules currently in place; and reschedules the rest of the team.

• In presenting the meeting invitation, Felix emphasizes the economic impact of the possible shutdown should the backup systems also fail, and the probability of such an occurrence. Felix has learned from experience that this added detail will make it more likely for team members to comply with a meeting request.

• Felix listens to the meeting’s conversation by applying natural language processing (NLP) algorithms and effectively transcribes the conversation for all involved (even the “insider” jargon, which it has learned to recognize). This comes after first alerting the meeting audience that the call may be transcribed due to contractual commitments and the legal implications of the outcome.

9:00 AM, Elsewhere in New York

After the incident review meeting, you head out to choose a driverless car from the kiosk in the lobby. While in New York, you plan to engage in both personal and business activities, and Felix knows this. This initiates the following sequence:

• As you instruct the car to your business destination (confirming the pre-populated address Felix identified from your calendar), your sales report arrives, with annotations from your team and a series of related news articles that may be relevant to the sales impact of a snowstorm in Boston, which closed the airport for three days.

• As you approach a favorite bagel shop, your wearable indicates you are low on blood sugar and tells Felix to make sure you eat, within the timeframe allowed for the next client meeting.

• Your personal mobile app suggests your favorite bagel options and lets you choose one. Your order is available at the pickup point, and the payment is automatically completed.
Prior to arrival, Felix had noted that you’d ordered a dozen bagels to take home when you were last in New York. It asks if you’d like to add to your order, and whether it would be a corporate or personal expense. Personal it is, and you think ahead to bringing the bagels to your parents’ house over the weekend.

**Today, Sometime in 2017**

These scenarios are not very far from reality, and the technologies required to accomplish these activities are already around us but are not widely deployed, integrated or delivering value beyond precise point solutions. Persistent companies and researchers can bring these separate pieces together in a seamless way to create these kinds of experiences.

**UNPACKING ARTIFICIAL INTELLIGENCE**

AI has many meanings, ranging from HAL, the antagonist of the film 2001, to the 45,000 books, articles and videos found in a single search on Amazon. Among technicians, AI has a more precise definition. Linguists would say the term has “semantic overload” because of its multiple meanings, many of them emotional or personal.

But is AI merely a science experiment? A charming robot giving advice at the airport, replacing an information desk? If AI serves only as a point solution or parlor trick, such as conveying the weather forecast or choosing a song recommendation, we’re missing its potential.

The fact is, AI is not just software recognizing someone’s voice or identifying objects in a photograph. These task-oriented point solutions are interesting and important but not complete.

We believe AI has real meaning only when it provides a multi-dimensional experience that recognizes and combines rational, emotional and cognitive levels of intelligence across a larger process. In the New York scenarios described above, the AI assistance during the course of the day enhances the life of the person using it by recommending and assisting along multiple touchpoints and dimensions. At the very center of a satisfying AI experience is the blending of dimensions of what make us human, in combination with our processes and tasks.
A DIFFERENTIATED APPROACH TO AI

Just as no one company can make a smartphone and all of its underlying components, no single company can claim to “solve AI.” The human brain has various dimensions of intelligence, including creative intelligence, social intelligence, perception intelligence and emotional intelligence (see Figure 1). Our applied AI approach brings together these dimensions of human cognition in a very real way.

Our core philosophy revolves around creating an ecosystem of AI solutions that augment and simulate each of the major dimensions of human intelligence while also staying connected to each other through a system of intelligence.

Elements of AI’s Systems of Intelligence

- **CREATIVE INTELLIGENCE**
  AI can observe and learn from human creativity, and answer back with its own constructs. AI can author business articles, write poems and create paintings.

- **SOCIAL INTELLIGENCE**
  AI can observe social relationships, identify influencers and map a path for marketers to appeal to those influences.

- **EMOTIONAL INTELLIGENCE**
  AI can both observe emotional states with voice stress and word analysis, and behave in a warm and contextual way that uses emotional insights to tailor the best response.

- **JUDGEMENTAL INTELLIGENCE**
  AI can observe the process of human judgment and learn how to make decisions that optimize a range of complex outcomes.

- **MANEUVERING AND SPATIAL INTELLIGENCE**
  AI can develop a meaningful sense of location and context to physical behavior, such as self-driving cars or maintenance drones.

- **PERCEPTION INTELLIGENCE**
  AI can be trained to identify key features from images, conversations, documents and sensor nets, and use these identified features in making decisions and recommendations.
An ‘Applied Artificial Intelligence’ Definition

With this in mind, AI takes on a new shape. The “intelligence” in AI should perceive and behave in human and familiar ways, while the “artificial” provides scale and repeatability not otherwise possible. When properly applied, AI will augment and enhance, rather than automate and replace, our human experiences, but only when combined in a meaningful way. Anything else is just a science experiment.3

In practice, anything AI does – image recognition, a chatbot, a medical recommendation, walking on uneven pavement and stairs, even distinguishing a child’s laugh from a cry – could be or has been performed by people for thousands of years.

When properly applied, AI will augment and enhance, rather than automate and replace, our human experiences, but only when combined in a meaningful way. Anything else is just a science experiment.

What AI offers is the ability to scale this intelligence to levels that take advantage of the enormous amount of data that pervades people, processes, organizations and things (which we call Code Halos). AI is able to harvest and understand the vast number of decision points and opportunities that digital data presents, which advances humanity and elevates our collective performance.

The resulting benefits are remarkable in both their impact on life and the relatively low technical hurdles that must be surmounted. These advances in technology can improve the routing of roads and transit to get commuters home more quickly and safely; reduce accidents and their tragic impact on families and communities; increase the accuracy of medical advice; boost farm yields; increase manufacturing quality and safety; and lower the hurdle to completing tasks for complex life events.

As said in the book What to Do When Machines Do Everything (written by Cognizant co-authors Malcolm Frank, Paul Roehrig and Ben Pring), “AI that creates business results will focus on what machines do really well, rather than trying to replicate what humans already do well.”4

What machines do really well are tasks that connect to vast quantities of information tied into increasingly digitized moments of engagement and decision, or tasks that combine a sequence of separate events into a larger business or social process. Imagine adding the benefit of warmth and experience, insight and perception, flexibility and self-learning to tasks that machines already do well, and the opportunities are remarkable.
The introduction of humanized AI will change business models, propelling companies to new heights if used creatively — or drive a company to irrelevance if ignored. Humanized AI can simplify and enrich business processes, and complement and supplement human/machine interfaces. We benefit from the endless possibilities of building systems that are able to sense, comprehend, act and learn from human-to-human, human-to-machine and machine-to-machine interactions.

IMPLEMENTING APPLIED AI

When implemented to its full potential, artificial intelligence (the technology) will become applied AI (the practice) — and will be as much a part of the fabric of our life as electricity, transportation and communications.

This section describes how to turn AI to your advantage by identifying AI opportunities, examining real-world success, building a business case and getting started.

So, how does the “artificial” become “applied”? We believe the biggest gains come from integrating what would otherwise be isolated AI technical advances to create transformative ideas for life and commerce. AI can leap from the laboratory into daily life.

Think of the difference between these two experiences coming from a personal assistant like Siri or Google Home or Alexa:

- **Pre-applied AI:** “Today’s weather is 72º, with a high of 87º.”
- **Post-applied AI:** “Today is Monday, June 5, 72º with a high of 87º at 3:00 PM. I see you’re traveling tonight to Chicago for tomorrow’s meeting, where it will be 97º. Pollen count will be high there tomorrow, your asthma medication was recently refilled so be sure to pack it, and I see an alert that the weekly sales report you always check on Monday night will not be ready until 9:00 AM tomorrow. I will summarize it for you and have it ready for review at breakfast when you wake up. Would you like me to research any topics prior to visiting your client? Your notes from the last meeting indicate an interest in the addressable market size for fast fashion among college students.”

The second scenario is easily within reach, as all of the basic facts (schedule, weather, medical history, meeting notes) are already digitized.

With this example, we can look at AI in a different way: as a means for building a world that will enrich lives, societies and businesses by enabling and simplifying how living beings and machines work with each other and among themselves. We strongly believe the power of applied AI will let components of smart AI solutions work in harmony to create real-world impact at scale.
Identifying AI Opportunities

Because the opportunities of AI are nearly endless, organizations need a mechanism with which to build a wish list, trim it down to a short list and get started. So how can organizations identify AI opportunities in the first place? We recommend building multiple suggestion lists and then merging them. Look at AI opportunities using these tools:

- **AI by trend.** Research market and social trends and consider ways that AI could participate.
- **AI by value addition.** Think of the ways in which AI can help – lowering costs, increasing revenue – and use that to find opportunities for applied AI to expand your best thinking.
- **AI by example.** Look at successful cases and assess comparable situations in your business or personal life.
- **AI by process.** Consider moments when clients or suppliers interact with your company, and how those moments stitch together into overall experiences.
- **AI by channel.** Consider how AI engages the information it needs, and returns answers and insights. Consider how AI can benefit from and enhance the channels you use.

**AI by Trend**

Let’s take this theme a step further. Consider the significant and impending changes that will affect your business. What role can applied AI serve to meet these changes?

- About 80% of executives believe artificial intelligence improves worker performance and creates jobs.5
- By 2018, 20% of business content will be authored by machines, ranging from financial report commentary to descriptions of baseball games.6
- By 2020, customers will manage 85% of their relationships with vendors without human interaction, and roughly 57% of consumers expect voice-activated smart assistants to have a major or moderate impact on their daily lives.7

Knowing that these trends are coming, how will you and your company use AI to gain an advantage? The individual technologies that support AI are impressive, and make for great press releases by winning at Go and Jeopardy! or answering questions at a kiosk.8 When these technologies are applied to a particular job or functional activity – and do it well – they can serve a broader goal that supports your personal goals, team objectives or corporate strategy.

In the same way that decades of advances in computing power, materials science, communications, security protocols and networking come together in the simple experience of using a smartphone, so can the components of AI be skillfully blended to benefit your organization and its business partners and customers.
AI by the Numbers

According to IDC, worldwide spending on AI is estimated to grow from $8 billion in 2016 to $47 billion by 2020, at 55.1% compound annual growth. What’s remarkable is that the spending levels on the top use cases are also very similar, according to IDC. This demonstrates that AI has broad appeal and is not being driven by a single industry or business function. Figure 1 depicts a classification of AI projects based on survey responses.

- Quality Management Investigation and Recommendation Systems: 10.3%
- Diagnosis and Treatment Systems: 10%
- Automated Customer Service Agents: 9.8%
- Automated Threat Intelligence and Prevention Systems: 9.8%
- Fraud Analysis and Investigation: 9%
- Others: 51%

The classic approach to fraud detection follows either rules execution or outlier (anomalous behavior) detection. While both are useful, they also lack the additional value that AI can bring when entirely new lines of attack are created.

**AI by Value Addition**

The value of AI differs by project. Businesses should ask how AI can contribute to:

- Reducing total cost and complexity for situations with known outcomes.
- Improving product and service quality.
- Creating entirely new experiences or enhancing existing ones with regular guidance.
- Understanding safety and life quality at a broad scale that is impossible for humans to do alone.
- Apply and scale human learning and experiences.

**AI by Example**

So, how are AI opportunities discovered and qualified? Businesses can be inspired by examining examples of success that can be applied to their situation. Here are some high-profile cases drawn from our client experiences where AI has already been used – and some thoughts on how additional steps can be taken to create even more value.

- **Dynamic updating of software on medical devices.** Devices need continuous updating and maintenance, but knowing when and where they can be maintained is a complex issue. With applied AI, advanced systems can enable a deeper look at when the devices are most likely to be in use, the history of past upgrades, detection of performance anomalies and how to personalize based on the location and usage patterns of the device's deployed location.

- **Detecting and reacting to financial fraud.** The classic approach to fraud detection follows either rules execution or outlier (anomalous behavior) detection. While both are useful, they also lack the additional value that AI can bring when entirely new lines of attack are created.
A comprehensive view of fraud looks first at the purpose and culture of fraud, ranging from individuals seeking a momentary advantage, to systemic rings of cooperative fraudsters, to “inside job” behaviors. Deep social and anthropological insight can provide a look at “why,” and big data analytics provides a look at “where.” Deep learning can help organizations discover patterns of fraud that are too new and too recently constructed to be embedded in a static rules-based detection approach.

- **Understanding, treating drug addiction.** Opioid addiction is a problem for insurers, policy planners, manufacturers, doctors and, most importantly, those who are struggling with addiction. The patterns of addiction follow many distinct routes based on personalities, opportunities and situations. AI’s systems of intelligence are providing a deeper look at this behavior for a major pharmaceuticals company and a major insurance provider, identifying key characteristics and channels for “drug seeking behavior” to manifest itself. The insurer is saving tens of thousands of dollars per patient through early detection of addictive patterns, while also enabling education for providers and patients. The system also helps the organization avoid potential liability and lawsuits.

  An advanced version of this AI application could combine all stakeholders in the situation, including patients, providers, payers and government, as well as the manufacturer itself, and understand the role and decision-making points of all participants. Drug treatment plans can be interwoven with drug-seeking monitoring for a complete view of both avoidance and recovery.

  In addition, a deep look at the environment and situations that surround the initial connection with addictive drugs and the ongoing struggle can be illuminated with a social and anthropological view of human behavior. These human-centered insights can frame the way that AI can best insert itself into points of engagement and points of detection, rather than relying on a purely quantitative approach to detection.

- **On-the-go engine monitoring.** The engines that power trucks are, literally, engines of the economy. When an engine designed to last for a million or more miles needs maintenance, it’s always better to catch that proactively than wait for failure. Loss of motion can add up to $5,000 per incident, according to one client, by the time the truck is towed and repaired, and the cargo is potentially rerouted to avoid spoilage.

  One logistics organization applied a deep learning algorithm to the multiple sensors and environmental factors surrounding engine performance. In addition, hundreds of other vendors and devices can be referenced from other sensors on the truck or in the environment. This deep learning algorithm informed the early-warning systems and prioritized the importance of preventive maintenance. Roughly 600 prioritized notifications from the algorithmic review are sent per day across the test fleet of 150,000 engines. Warranty costs have dropped 5%, not including the benefits of increased uptime, reduced spoilage and increased client satisfaction.
AI can integrate into the systems, thinking and lifestyles of all involved to keep goods moving from factory to consumption.

An advanced version could go beyond engine performance and consider the entire routing, driving, scheduling and cargo ecosystem and be integrated with a vehicle view rather than an engine view of performance. A deeper human look at how and why maintenance is delayed, and the ways to motivate proper behavior, can be built into a comprehensive fleet health system.

The analytics behind calculating preventive maintenance against probabilities of failure can be optimized by considering the factors of payload loss, driver disruption and reputational risk that go beyond classic break-even linear algebra. AI can integrate into the systems, thinking and lifestyles of all involved to keep goods moving from factory to consumption.

AI by Process
The journey to creating “applied AI” from its technical components should be considered along two different process dimensions. Both dimensions are meaningful to customers and employees, but might produce a very different AI wish list.

- **A moment in time:** A given moment or interaction can be enriched by understanding the roles that creative, social, emotional, judgmental, spatial and perception intelligence bring to the moment. An “AI = Applied AI” shift takes place when an interaction becomes warm, human and contextual, and the system can learn from experience.

- **A broader experience:** A given series of related steps can be held together and guided by AI as humans (and machines) interact, learn and connect point-to-point on building out broader sequences of related and meaningful tasks.

Applied AI offers very strong value when a hybrid experience is created and both dimensions come together, that is, when a deeper look at the moment is combined with a broader look at how moments connect together. Applied AI endeavors to connect these two dimensions into useful, practical and rewarding projects.
AI by Digital Channels

AI techniques, including neural networks, have been around for more than 50 years. What’s changed is that computer scientists today harness advanced computational power and enormous storehouses of data, including images, video, audio and text files.

The connection between AI can be explained through the following:

- **Digital needs AI.** We believe that digital devices, channels and interactions will create such an overwhelming amount of data and points of contact that conventional approaches to choosing next best actions, analyzing patterns or modifying experiences in real time will collapse under their own weight if solved using traditional approaches to rules-based models or programmed interfaces.

- **AI needs digital.** Digital creates a wonderful opportunity as a two-way flow: While data establishes a fresh set of digitized insights and monitoring points that provide the raw material that grows AI, it also provides a channel by which insights can be returned to a point of decision or point of interaction and bring value. What kept AI in the laboratory and out of commerce over the previous six decades was both a lack of computing power and a lack of opportunity for interaction – and without interaction, a lack of opportunity to justify AI’s return on investment. The ability to scale AI to take on massive opportunities to engage and connect machine-to-machine or consumer-to-machine is the only method to show AI’s return on investment.

**LOOKING FORWARD: GUIDELINES FOR APPLYING AI IN YOUR ORGANIZATION**

So how can AI apply to your industry, your company and your business unit? Ideas include:

- **Move beyond point solutions.**
- **Evaluate your business model and ask what you could do if your best ideas, best thinking and best experiences could be scaled 10, 100 or 1,000 times across more points of interaction.**
- **Expand the humanity behind the services or products your organization delivers, in terms of the benefits customers obtain, and the societal advances that can be gained by your stakeholders.**
- **Imagine integration and discovery, guided by automated assistance and connected insights.**

We recommend kicking off three major workstreams or tracks to introduce innovative AI solutions in your organization. Our experience shows that AI solutions can and should be pursued in parallel. That is, the opportunities in AI are so diverse and so important that several good ideas should be launched simultaneously. Start small, fail fast, learn and recover as you embark on this journey.
The ability to scale AI to take on massive opportunities to engage and connect machine-to-machine or consumer-to-machine is the only method to show AI's return on investment.

A successful AI initiative typically follows three steps:

1. **Identify AI ideas and opportunities, classify and prioritize, pick a short list.**

   Use the guidelines as discussed throughout this paper.

2. **Conduct due diligence on the readiness for these ideas within your organization.**

   As noted in *What to Do When Machines Do Everything*, review your organization’s capacity and institute plans to scale up the necessary machinery and material infrastructure to execute AI applications. Ensure your organization has or can acquire the following pieces needed for successful AI:
   - A platform to run AI in terms of computing power, AI components, self-learning abilities and expert guidance.
   - The ability to execute, now and in the near term.
   - Data from classic transactional systems (sales, marketing, supply chain).
   - Data from newly digitized points of interaction (point of sale, hyper-location, social, mobile apps).
   - Data from context partners: Government, weather, surveys, reviews, call center.
   - Low-cost learning opportunities.

3. **Get started.**

   Finding the platform and data to get started can be simplified by following the “1-1-1-1” rapid development timeline, which recommends the following schedule:
   - One day: Provision the space and computing power.
   - One week: Load data and use built-in reporting and functions to gain confidence with the data and the system.
   - One month: Customize and learn.
   - One quarter: Productize and launch.
The principle of “applied AI” encourages the use of existing vendor or open source capabilities. For example, cognitive technologies are provided by IBM Watson, Microsoft Cortana Intelligence Suite and Google’s Tensorflow (among others), in partnership with existing AI platforms, such as Cognizant’s BigDecisions AI edition. (Learn more about BigDecisions here.)

Use freely available open source software to quickly develop solutions. Google, Microsoft, Facebook, Amazon and Yahoo have all released open source machine learning or deep learning algorithm libraries.

In the coming years, artificial intelligence will change the way we interact with our colleagues, family and the world around us. We will expand our capabilities and understanding of the way we interact with others. AI will drive growth for the companies that embrace this new change.

In this new AI era, we will be able to automate processes that will allow our associates to embrace new challenges while freeing them from time-consuming repeatable tasks. By bringing together AI and the world of digital, we can connect and expand the capabilities of entire industries to push human knowledge to previously unknown heights.
FOOTNOTES


3 This material was included in a presentation at Informatica, May 17, 2017, by James Jeude, entitled “Applying Artificial Intelligence in the Very Real World,” www.informaticaworld.com/iw17/iw17assets/iw17assets.html.


7 Ibid.

8 Ibid.


12 Malcolm Frank, Paul Roehrig and Ben Pring, What to Do When Machines Do Everything, John Wiley, 2016, page 64.
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ABOUT COGNIZANT

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