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AI in the Real World

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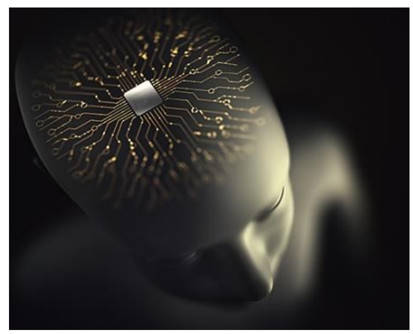

The dream of creating machines that can think and act like humans is nearly as old as machines themselves. Greek mythology gives us the tale of the robot Talos, constructed by the inventor and blacksmith Hephaestus to guard the island of Crete from foreign invaders. In the centuries since, innovators have worked to create machines that could solve critical problems, handle unappealing or dangerous jobs, and even play games from the trivial (your first Pong game) to the most sophisticated (chess and Go).

But mankind's aspiration to create thinking machines has always outpaced the availability of technology that could serve as its foundation. This changed in the mid-1950s when a young mathematician named John McCarthy joined the faculty at Dartmouth College.

During brief tenures at Bell Labs and IBM, McCarthy had become deeply intrigued by the work of mathematicians Claude Shannon and Alan Turing, and he proposed hosting an inaugural conference to explore the ideas that would become the field of artificial intelligence (AI). In fact, the term 'AI' was McCarthy's invention, too, though he later confessed he wasn't terribly happy with the moniker because, after all, it was genuine intelligence they were seeking to create, not the artificial kind. That first conference, held at Dartmouth in 1956 on a grant-funded budget of $7,500, is widely regarded as the first structured foray into what would become the field of AI.

"Our ultimate objective is to make programs that learn from their experience as effectively as humans do." *John McCarthy, Founder, 1956 Dartmouth AI Conference*

Fast forward a little over 65 years to a world in which AI is fast becoming a genuine force across a wide range of technological realms despite the occasional headwinds it has faced in its journey to today, including a tendency for overhyping and several periods of inconsistent funding. AI's greatest difficulty has, though, not been the hype cycle or even the imaginations of the small handful of people who have led developments in the field. Rather, until very recently, AI's principal challenge has been that its ambitions have so wildly outpaced the computer processing and data management technologies necessary to make those aspirations a reality. Only in recent years, with the advent of advanced sensors, big data, and petaFLOP computing capabilities, has AI truly come into its own.

Make no mistake: the field of AI has indeed come a long way, not just in terms of academic research and pie-in-the-sky concepts, but in delivering genuine scientific and business innovation—the kind you can quantify with jobs created (and, yes, sometimes lost), patent applications, and dollar signs. You would now be hard-pressed to identify a field or industry in which AI has not made its impact felt. The examples described below are but a tiny fraction of the ways AI is not only delivering real business value and competitiveness but also touching the lives of everyday people, whether they realize it or not.

AI in the sky

Ever since the Wright brothers first flew at Kitty Hawk in 1903, aviation pioneers have sought opportunities to control aircraft remotely, eliminating the need to endanger a crew or limit the craft's capabilities to what human operators can physiologically endure. The first modern drone dates to 1935 and was a British innovation designed by the De Havilland company as a live aerial gunnery target (though unmanned craft date back to the 18th century if you're willing to include hot air balloons and gliders). But the field has truly taken off (if you will) in the past decade with the emergence of AI-enabled unmanned aerial vehicles (UAVs), whose purposes now span such a broad range as to be nearly ubiquitous.

Much attention is paid to UAVs in military applications, most notably the MQ1 Predator drone that entered service in 1995, a drone since used (along with its successors) to great effect in numerous conflicts around the globe, both in reconnaissance and direct combat roles. But UAVs today, enabled by a rapidly growing set of AI capabilities, serve to augment the physical and technical restraints on the workforce through photography and delivery of goods, seeding and monitoring agriculture fields, and tracking environmental emissions.

One particular area in which UAVs have excelled is in the remote surveillance of assets, including electrical transmission lines, oil and gas pipelines, wind turbine blades, and countless other infrastructure components whose primary characteristics (remoteness, height) render them difficult, expensive, and dangerous to inspect by humans. In these instances, AI plays multiple roles, not only in safely controlling the UAVs themselves in flight, but also in the real-time analysis of condition data from the assets being examined.

Visual AI in health and safety

A significant area of research and business focus for the AI community is improving the health and safety of people in dangerous work environments. This includes factory floors, power stations, or any setting where human workers can find themselves in harm's way.

In particular, the rapid growth of visual AI has enabled the development of numerous health, safety, and environmental (HSE) innovations that are already saving money, regulatory compliance penalties, and lives. Field applications monitor workers to ensure they are wearing personal protective equipment (PPE), including hard hats, safety vests, and eye protection. In addition, through facial recognition, individual workers can be identified and evaluated against training and security databases to determine whether they are authorized to be present in various high-risk areas of a plant or facility. AI-powered visual assessment systems can also monitor conditions in unmanned areas of a facility, enabling proactive responses to fires, emissions, or other events that might go unnoticed by human observers.

Predictive and prescriptive maintenance

A great deal of the maintenance on expensive assets takes place today either at pre-scheduled intervals or in response to outright failures. This approach is reactive and far less efficient than it could be. It also risks incurring greater damage to assets, along with significant downstream effects such as lost revenue, regulatory penalties, or damaged company reputation.

One of the most impactful capabilities emerging from the past decades of AI research and development is the ability to monitor asset performance and condition in real-time using complex networks of sensors. The resulting data on asset status and performance can then be analyzed to predict impending failures with hours, days, or even weeks of advance notice, thus allowing preventive maintenance to be conducted. This approach has numerous beneficial effects, not least of which is significant operational cost savings. In addition, predictive maintenance allows repair work to be scheduled in a less disruptive and more efficient manner, all while improving worker safety. This technology also enables the delivery of prescriptive maintenance

recommendations that can preclude subsequent failures or the need for expensive repairs that lead to lost revenue—for example, from a turbine bearing that’s not rotating smoothly or a solar panel that’s not generating electricity. In as much as renewable energy assets already suffer somewhat from the generation intermittency that comes from the sun not shining or the wind not blowing, it is incumbent on operators to keep these assets operating as reliably as possible when external conditions are favorable.

Maritime fleet management and optimization

Oil and liquified natural gas (LNG) tankers, along with container ships and other large maritime vessels, comprise an immense and expensive collection of assets that are in motion 24/7 around the globe. The challenge of optimizing the operation and maintenance of these fleets cannot be overstated—for, unlike a factory floor, these assets are only rarely in a location where significant maintenance and repair can take place. Reliable operation is thus paramount for operators, particularly given their frequent exposure to not only maintenance and repair issues but also exogenous events like weather and geopolitics.

AI can not only deliver real value on the operation and maintenance side of the maritime equation, much like it does for other industries, but it can also enhance planning and scheduling operations by optimizing routing, fuel usage, and other day-to-day activities that have historically relied on the expertise of ship captains and crew members.

Putting AI to work

Artificial intelligence has made tremendous strides since the humble beginnings of the 1956 Dartmouth conference. It has endured numerous highs and lows in investment and R&D focus. And it has suffered for some of its more hyperbolic predictions over the years. But there is no denying that the field has come into its own in the past 20 years and has benefitted immensely from the leaps in processing power and data collection that are now the norm in all industries.

Companies can no longer plausibly hide behind tales of past hype or unrealized value. The applications are here today, and they are delivering results in every facet of operations from asset maintenance and surveillance to applicant screening and financial management. It is incumbent on business operators to identify the areas of greatest opportunity in their organizations and to put AI to work—generating economic value, protecting worker safety, and driving environmental sustainability.