Digital Transformation: Automation Technologies Are Changing Business and Daily Life

Digital transformation changes the way we solve problems at work and in daily life. Disruptive technologies – and the new ways of thinking that come with them – allow us to maximize efficiency and reduce costs.

For example, machine learning allows scientists to digitally transform textbook statistics into the powerful field of Big Data. Software developers who switched from silo-based development to automated flows with DevOps tools also have firsthand experience with digital transformation.

Automation Technologies

While digital transformation can come from a wide variety of new technologies, we will focus on automation technology. For our purposes here, the category of automation includes artificial intelligence, machine learning, and robotics.

Artificial Intelligence

Artificial intelligence (AI) has become a buzz-phrase in recent years, so it is important to establish a precise definition. Artificial intelligence broadly refers to machine applications that simulate human cognition. In other words, AI software can process and make decisions based on complex information. AI is automated, so the applications do not need direct instructions to complete their most complex tasks.

There are three categories of artificial intelligence. These categories are:

- Narrow artificial intelligence
- General artificial intelligence
- Super artificial intelligence

Narrow AI is applied to a single task with a limited scope. All existing applications of artificial intelligence are in this category. Virtual assistants in smartphones and text recognition programs are examples of narrow AI.

General AI refers to technology that can match human intelligence. For example, a robot that can carry on an unscripted conversation with a real human would have general AI. General AI can handle complex tasks and has broad capabilities.

Super AI is difficult to conceptualize because it refers to an intelligence that far surpasses the human brain. One way of thinking of super intelligence is to imagine a human that can instantly process and make conclusions based on vast datasets.

Machine Learning

Machine learning (ML) is a subset of AI. All machine learning is AI, but not all AI is machine learning. Machine learning is a technical term for a type of programming where programs can change and adapt to new information without explicit instructions. ML can be thought of as the opposite of hard-coding, a type of programming in which the program will only respond to direct instructions in the code.

Robotics

Robotics is a field dealing with automated machines and software. Robots have existed for several decades in industrial factories. These early robots generally complete simple and predictable tasks, so they were useful with just hard-coding. They have not needed AI or machine learning applications. However, higher intelligence allows robotics to be useful for complex tasks in many industries

Industrial robots, self-driving cars, and autonomous drones are important examples of robotics today.

Economic Benefits of Automation

These automation technologies are at the forefront of major ongoing and digital transformations. The primary benefits driving the adoption of AI, machine learning, and robotics are about economic efficiency.

Automation promotes economic efficiency for several reasons. First, machines are cheaper than human labor since they do not require compensation or benefits. Machines are also more predictable than humans. A program is easier to manage because it does not have a personality or desires. Aside from time needed for repairs and maintenance, machines also do not need breaks or holidays.

These benefits do not imply that machines are superior to humans. As we will demonstrate later, humans can become more productive by focusing on their comparative advantages instead of competing with robots. Automation can lead to massive gains in business profits and global GDP through high productivity.

Here are some leading predictions from firms closely following this phase of digital transformation:

- JP Morgan predicts that this productivity boost could increase global GDP by at least $1.1 trillion before 2040.
- Accenture Research estimates that automation will cause a 38 percent increase in profits in 16 industries by 2035.
- McKinsey Global Institute estimates that automation will increase global GDP growth by up to 0.8 to 1.3 percent annually.
- Ark Investments predicts real GDP per worker to climb to $236,000 in the United States by 2035.

It is clear that digital transformation from automation technologies is an important event for both the United States and global economies. In the coming sections, we will provide an overview of the direction of AI, machine learning, and robotics. We will first focus on ongoing digital transformations concerning automation.

Ongoing Digital Transformations from Automation

Automation is well-underway in numerous industries. Companies in the heavy industrial sectors have used robotic arms for decades. Software engineers frequently use automation scripts available through DevOps tools. While automation is not a new concept, it has earned renewed importance due to advancements in AI, machine learning, and robotics.

In general, automation has occurred in industries with tasks that are repetitive and predictable. These sorts of repetitive and predictable tasks are often suitable for hard-coded programs. Companies with fixed assembly line processes have benefited from this type of automation.

Advancements in automation are also allowing automation to be applied to more complex tasks. This means that machines can be used to solve problems in which the environment and task changes unpredictably. Some areas where complex automation can be useful are:

- Accounting
- Transportation and shipping
- Human resources
- Data analytics
- Customer service

Current Applications of Artificial Intelligence and Machine Learning

AI is already commonplace in modern life. They are found in both business infrastructure and in customer-facing products. Here are some of the current use examples of AI. Note that this is by no means a complete list; AI is transforming nearly every field.

Customer-Facing AI

Apps

Narrow AI is common in Web and mobile applications. Apps that rely on variable data often use narrow artificial intelligence to leverage sophisticated algorithms. Common examples of these AI tools are navigation apps (Waze, Google Maps), financial and investing apps (Albert Genius, Acorns, various robo-advisers), and search engine prediction services.

Price Determination

AI algorithms are also used for price determination. Fixed prices are often not appropriate for services that have volatile completion times and input costs. For example, ride-sharing apps like Uber and Lyft have variable pricing that changes based on road conditions, traffic density, the commute distance, and fuel costs. Artificial intelligence is used to produce price points in real time whenever a customer requests a ride.

Uber also uses AI to manage the supply of drivers. AI is used to identify the locations and times of peak demand to increase prices. Basic economic principles show that this price spike increases the supply of drivers to account for the high volume of people who need transportation.

In the real estate industry, ML applications are used to determine optimal asking and bidding prices in specific markets.

Image and Text Recognition

Facebook users have some experience with artificial intelligence. Facial recognition technologies are used to automatically identify users and their friends in photos uploaded to the Facebook platform. Similar technologies are used in the facial recognition locks offered on some smartphones, tablets, and PCs.

Pinterest uses AI-driven image recognition to identify objects in photos. These objects are then tagged and indexed in a searchable database. Character recognition in language and mathematics applications also use narrow AI in a branch of machine learning called optical character recognition (OCR).

Academic researchers are also benefitting from optical character recognition. For example, the economist Alex Tabarrok used machine learning to quantify restrictions in the US Code of Federal Regulations, a document with nearly 200,000 pages. AI clearly has opened research opportunities that were humanly impossible in the past.

Business Applications of AI

AI and ML applications are being adopted by firms across many industries. Artificial intelligence allows businesses to integrate internal processes and make decisions on complex data. Data science, energy, manufacturing, real estate, and many other industries are digitally transforming with artificial intelligence.

Predictive Modeling and Advertising

AI and ML are used to support data analysis in Big Data firms. Data science is still a young field, but machine learning already allows the discipline to become superior to regular statistics in many ways. Most notably, ML allows data scientists to create predictive models based on entire populations. In the past, statisticians could do this only for samples. Big Data applications of machine learning are famously used for targeted advertisements and product recommendations. This allows groups to provide personalized recommendations in numerous industries, including retail, real estate, and even politics.

Energy Management

Machine learning and data science are used to optimize energy grids. IBM has the Hybrid Renewable Energy Forecasting (HyRef) solution, a platform that used Big Data and ML to maximize energy production and storage. According to IBM, machine learning enables HyRef to "increase the amount of renewable power generated and integrated into the grid by 10 percent". This is a good example of how AI promotes efficiency.

Manufacturing

In manufacturing, ML is used with IIoT sensors, robots, and humans to integrate all parts of the manufacturing process. Data are used to predict when machines will need maintenance before the breakdown. AI connects the production side to the consumer side of the enterprise. Output instantly spikes when predictive models indicate that the demand of good increases by a certain amount.

According to Seebo, there are currently six primary uses of machine learning for manufacturing:

1. Predictive maintenance
2. Modeling the lifespan of assets
3. Supply chain management
4. Quality control
5. Human-robot collaboration
6. Responding the market conditions

McKinsey Global Institute calculates that 64 percent of 749 billion working hours spent on manufacturing tasks can be automated with current technologies.

Customer Service

Chatbots are an early example of AI in action for customer service. Chat bots are designed to answer basic questions and direct customers to relevant links on company websites.

As AI has become more sophisticated, so has machine-driven customer service. Conversations between machines and humans become more complex as AI understands the contextual meaning of human phrases. AI is already used in call centers.

Customers should not expect to speak to a robot in the same way they would talk to a human the next time they call for support. However, AI can support human representatives in helping customers. For example, an AI-driven program can listen to the conversation and provide recommended solutions in real time. These solutions are provided based on data from previous problems and customer satisfaction.

Gartner predicts that at least 85 percent of customer interactions will be managed without a human by 2020.

Financial Data Analysis

Banks and investment firms use AI and machine learning to analyze large datasets with the appropriate statistical techniques. The analysis results can guide human investors to investments that are likely to yield strong returns. Banks also use similar tools to assess credit risk and potential fraud.

Current Applications of Robotics

It is impossible to isolate robotics from AI since all modern robots depend on AI-driven software. However, we can think of robots as different from AI. While artificial intelligence allows machines to think, robotics allows machines to interact with the physical world. To put this differently, AI is the machine brain and the robot is the machine body.

Like AI, robotics is already used in major industries.

Manufacturing and Heavy Industries

Industrial robots have been a common and important part of assembly processes since the 1970s. Robotic arms – hard-coded mechanical arms – are used to assemble products and lift heavy objects.

With machine intelligence, the role of robots has become more complex. Amazon Fulfillment Centers use collaborative robots (cobots) to support human workers. Instead of reaching and bending for merchandise, workers can depend on the cobots to retrieve merchandise. This promotes productivity and reduces ergonomic hazards.

Collaborative robots do not replace human workers. Instead, they perform tasks that are dangerous or repetitive. Humans apply their creativity and oversight while the robots handle risky and mundane tasks. Using cobots allows both humans and robots to focus on what they do best.

Barclays Capital predicts that there will be 150,000 cobots sold on the market in 2020. This is equivalent to $3 billion in sales. By 2025, the number of cobots sold could reach 700,000.

Construction

AI and robotics are being used with 3D printers to construct buildings. ICON – a startup from Austin, Texas – uses the VULCAN 3D printer to autonomously build the foundation and walls for homes. After the robotic system assembles the home, human workers install windows, plumbing, and electrical components.

At ICON's SXSW 2018 demonstration, the team announced that a 650-sqft home can be constructed by the robot in under 12 hours for less than $10,000.

Medicine

Robots are also improving the efficiency and quality of medical services. The da Vinci Surgical System allows surgeons to perform minimally invasive surgeries. Using AI, cameras, and mechanical arms, the robot is used to make precise incisions. Like many other robots, the da Vinci Surgical System does not replace the human. Instead, the human uses a robot to address limitations (e.g., shaky hands, vision, and anxiety) while they focus on their expertise of medicine.

Transportation

Self-driving cars and autonomous drones are leading the digital transformation of the transportation sector. Early versions of autonomous vehicles – like Tesla's autopilot-enabled cars – are already on the road. Amazon has experimented with delivery drones that can quickly send packages from fulfillment centers to customers' homes. Prototypes also exist for autonomous seafaring ships and freight trucks.

Automation Will Not Replace Humans

While PWC reports that 38 percent of current jobs in the United States will be delegated to automation technologies by the 2030s, it is unlikely that automation will make humans irrelevant.

This wave of digital transformation – with its narrow AI – will mainly automate physical predictable tasks. The manufacturing and food service sectors are at a high risk of automation. The barrier to automation is low in these sectors because most tasks are repetitive and predictable. Automation may occur to a lesser degree in sectors with data applications or unpredictable physical tasks.

[There is a good infographic on the likelihood of automation here**: https://www.mckinsey.com/business-functions/operations/our-insights/human-plus-machine-a-new-era-of-automation-in-manufacturing**]

Automation is unlikely in fields for tasks that require special expertise, human leadership, or so-called soft skills like creative thinking, value judgements, and subjective decision-making. In these fields, humans will work alongside robots and AI.

Data scientists will use machine learning to make better sense of large datasets. Doctors will use robots to perform low-impact treatments on their patients. Construction workers will use automated 3D printers to quickly erect buildings. These types of applications of automation allow human workers to maximize the value of their expertise while compensating for their limitations.

Human-machine collaboration – not replacement – is the main way automation will digitally transform business and daily life.