

Is the robocalypse nigh?

A special report by the Portfolio Advisory Group – U.S. Equities

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**Wealth
Management**

Is the robocalypse nigh?

Robotics and artificial intelligence are no longer just sci-fi tropes. They are actively transforming how we live and work. So rather than fret about the rise of the machines, we think it's appropriate to consider how this theme is changing the business and investment landscape.








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Humans have been worried about being replaced by technology since the invention of the shovel and the wheel. Automation unleashing mass unemployment is an old argument that can be traced back to the First Industrial Revolution. However, we believe that technology can invigorate GDP growth, spurring more jobs that evolve in tandem with advances in automation, as seen in past industrial revolutions. The growing integration of the broad range of robotics in the future is nothing to fear, in our view, and should be embraced as yet another technological leap that can save companies money, improve workplace safety, and enhance people's lives. We explore the likely near-term growth areas of robotics as well as provide a compilation of companies with exposure to this nascent industry.

Why are robots suddenly upon us?

The emergence of robotics as a mainstream technological advancement stems from the culmination of several different technologies colliding at the same period of time, transforming the once-futuristic vision of robotics into reality. Physical capabilities, sensory perception, machine learning,

Major areas of development in robotics capabilities

Physical capabilities Dexterity and precision of robots have improved. Powered with GPS and other sensory technologies, robots can now perform delicate tasks. 	Sensory perception Equipped with sensors and machine vision capabilities, robots can assess and respond to changes in their surrounding environment. 	Machine learning Instead of coding instructions for specific situations, software engineers now build algorithms and then run them through vast datasets to learn to respond to complex real-life situations. 	Natural language processing Natural language processing enables computer programs to interpret human languages, either through verbal input or in the form of unstructured data. 	Cloud robotics Cloud robotics integrates individual robotic devices with a wide network of other devices and software. Robots connected to the cloud can be part of the Internet of Things (IoT). 
Medtech companies, such as Intuitive Surgical, TransEnterix, and Johnson & Johnson, have developed robots to handle delicate surgeries. Liquid Robotics, recently acquired by Boeing, offers robots that can work in water, with a wide range of industrial and energy applications.	Cognex provides machine vision-based inspection systems for manufacturers. Analog Devices provides autonomous driving solutions based on its LIDAR technology (a way of translating the surroundings into machine vision).	Nvidia's graphics processing units (GPUs), which supply the high computing power required for machine learning, have seen high demand. Japanese industrial robot maker FANUC has developed "learning software" powered by Nvidia's GPUs to teach robots manufacturing tasks.	Natural language processing empowers smart speakers, such as Google Assistant, Alexa, and Siri, to interact with humans by taking verbal instructions and responding in coherent human-like speech.	European automaker KUKA recently built a cloud-connected factory on Microsoft's Azure platform. Real-time feedback from connected devices and sensors on the factory floor reduces robot downtime and optimizes maintenance through predictive analysis.

Source - RBC Wealth Management

natural language processing, and cloud robotics are all more advanced and cheaper than they have ever been, making robotics more affordable for mass production and usage.

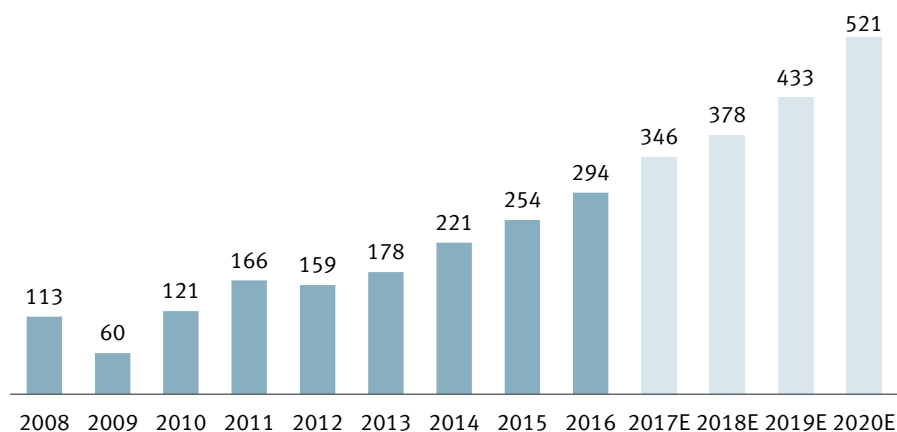
When will robots arrive en masse?

The robotics industry is now worth \$24.5B, according to VC firm Loup Ventures and trade group International Federation of Robotics, and projected to double in five years. Until now, the majority of robot usage has occurred within factories to automate menial processes, replace manual labor, or mitigate safety risks. Unsurprisingly, Amazon.com was in early on investing in this disruptive wave, buying warehouse robotics company Kiva in 2012 for \$775M. Kiva's technology automates the picking and packing processes within warehouses, and an Amazon executive has said that these robotic systems have cut operating expenses by 20%. This trend is occurring not only in the U.S., but even more so in Asia, where annual shipments of industrial robots are eclipsing the rest of the world.

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Growing supply of industrial robots worldwide

Actual and estimated annual worldwide supply of industrial robots (thousand units)



Source - International Federation of Robotics figures and estimates, RBC Wealth Management

Health care and professional service robots are also likely to be integrated more into our daily lives. The International Federation of Robotics projects global sales of service robots for professional use to grow by 20% to 25% from 2018 to 2020. We are already seeing signs that artificial intelligence (AI) can improve the lives of people with disabilities, allowing them to interact with everyday processes and people in ways they simply could not before these emerging technologies. The relatively new home digital assistants, such as Alexa and Google Home, are also seeing integration with virtual health, propelled by voice recognition technology.

Given the impact of these advancements on improving health and quality of life, the National Institutes of Health announced \$2.2M of funding over the next five years for the development of three innovative co-robots (robots that work cooperatively with people). Additionally, IBM's Watson is at the center of computer-aided diagnosis and treatment of patients. We believe it's unlikely that we'll be seeing robotic doctors anytime soon, and enjoying their bedside manner may be far off into the future, but it is quite

possible that in the near future co-robots could assist in record-keeping and quick diagnosis.

In what form will AI arrive?

Personal preferences

Hardly any occurrences in our digital lives happen by chance nowadays. The shows we watch on Netflix, the recommendations on Amazon, and the top items on Google search results are all strategically placed there through intelligence gathered about each individual and then processed by AI and big data. Machines seem to know about our needs and wants better than ourselves. And the ability to communicate with consumers, in terms of both intake and output, makes the intelligence more powerful and valuable.

Transportation transformation

Autonomous driving is fast becoming a reality. There is increasing investment from a wide array of companies and self-driving cars are being tested on public roads. These powerful machines combine optical sensors and computerized communication to analyze and react to road and traffic conditions, optimize driving directions, and hopefully, over time, provide a safe journey. Major players have developed highly functional software platforms, such as Baidu's Apollo, Alphabet's Waymo, and Nvidia's Nvidia Drive. Automakers are continuously churning out generation after generation of autonomous vehicle prototypes, and self-driving cars and trucks will continue to enter the market in the near future.

Productivity boost

In offices and factories, AI has made significant contributions to enhance efficiency and reduce costs. Manufacturers are seeing a significant productivity boost from process optimization powered by AI. Applications include supply chain and demand management, output optimization, and predictive maintenance. Enterprise data solutions provided by tech giants help companies streamline their processes and improve cost efficiency. Health care remains an area where technology hasn't impacted productivity in the same way as other industries, and it should benefit from AI and robotics in the future via saving both patients' and doctors' time, more accurate diagnosis of patients, as well as driving an evolution of the doctor/patient relationship, which is being seen with virtual health care offerings.

Connectivity is the future

In the foreseeable future, more and more "things" that we use in our daily lives, physical or virtual, will connect to the internet. These will join the network of objects, devices, and software platforms that forms the Internet of Things (IoT), which enables connected objects to exchange data. The IoT is likely to not only support smart homes, but smart companies and smart cities as well. This is occurring because of the expansive broadband coverage compared to several years ago, the declining cost of broadband, and the increasing number of connectable devices.

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Who is involved in the robotics theme?

To determine whether the robotics theme is a good fit for your portfolio, we believe this conversation is best to have with your RBC financial advisor in order to gauge appropriate exposure and risks. That said, we have provided a table below with companies that have exposure to robotics.

Industrials, autonomous driving, health care, and consumer devices are the main areas that have significantly embraced and adopted robotic technologies. The list below is far from complete but provides a snapshot of the participants in this theme.

List of companies with AI/robotics exposure

Industrials, autonomous driving, health care, and consumer devices are the main areas that have significantly embraced and adopted robotic technologies.

Artificial intelligence	Consumer devices
Alphabet Inc. (GOOGL)	Alphabet Inc. (GOOGL)
Amazon.com Inc. (AMZN)	Amazon.com Inc. (AMZN)
Apple Inc. (AAPL)	Apple Inc. (AAPL)
Baidu Inc. (BIDU)	Samsung Electronics (SSNLF)
IBM (IBM)	Hardware & software
Intel Corp. (INTC)	Analog Devices Inc. (ADI)
Nvidia Corp. (NVDA)	IBM (IBM)
Tencent Holdings Ltd. (TCEHY)	Intel Corp. (INTC)
Autonomous driving	Microchip Tech Inc. (MCHP)
Alphabet Inc. (GOOGL)	Nvidia Corp. (NVDA)
Analog Devices Inc. (ADI)	Siemens AG (SIEGY)
Aptiv plc (APTIV)	Health care
Baidu Inc. (BIDU)	Intuitive Surgical Inc. (ISRG)
Deere & Co (DE)	Johnson & Johnson (JNJ)
General Motors Co. (GM)	Siemens AG (SIEGY)
Intel Corp. (INTC)	Stryker Corp. (SYK)
Tencent Holdings Ltd. (TCEHY)	TransEnterix Inc. (TRXC)
Tesla Inc. (TSLA)	Zimmer Biomet Holdings Inc. (ZBH)
Nvidia Corp. (NVDA)	Industrials
WABCO Holdings Inc. (WBC)	ABB Ltd. (ABB)
	FANUC Ltd. (FANUY)
	Rockwell Automation Inc. (ROK)

Source - RBC Wealth Management

Ready or not, change is coming

We are optimistic that new jobs will be created in tandem with productivity growth as a result of advances in robotics.

Predictions can be wildly inaccurate at these early stages of change, so robotics' ultimate penetration into our lives and the changes it may bring are still far from known. Looking back at how past industrial revolutions played out, we are optimistic that new jobs will be created in tandem with productivity growth as a result of advances in robotics. *The Wall Street Journal* projects AI to displace workers from 1.8 million jobs while generating 2.3 million new jobs by 2020. Robotics technology and AI are bringing exponential changes to how we live, work, and interact with the rest of the world. Change, particularly technological change, remains a constant in our lives, so we think it's prudent to embrace and understand it.

Thank you to Catherine Li for her contribution to this article.

Disclosures and disclaimers

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