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Artificial Intelligence: Investment Trends and Selected Industry Uses

By Xiaomin Mou

The global race to fund, develop, and acquire artificial intelligence technologies and start-ups is intensifying, with commercial uses for AI proliferating in advanced and emerging economies alike. AI could increase GDP growth in both advanced countries and emerging markets. In energy, AI can optimize power transmission. In healthcare, diagnosis and drug discovery will benefit enormously from AI. In education it can improve learning environments and learning outcomes and can better prepare youth for transition to the workplace. In manufacturing, AI can help design better products in terms of functionality, quality, and cost, and improve predictive maintenance. AI can help extend credit and financial services to those who lack them. The potential impact of AI on transportation and logistics goes far beyond automation and road safety to span the entire logistics chain. Yet with the exceptions of China and India, emerging markets have received only a modest share of global investment in this advanced technology, despite the fact that they may benefit more from AI implementation than advanced economies.

Artificial intelligence, or AI, has the potential to imitate the human brain, which makes it unique among technologies in that it can learn and solve problems that would normally require human intelligence. In general, AI includes natural language and processing, visual perception and pattern recognition, and decision making. These processes in combination give AI enormous potential in multiple disciplines and across many economic sectors.[1] And they may help address persistent development challenges such as a lack of infrastructure or underdeveloped healthcare or financial sectors, which can leave many individuals underserved.

Despite its revolutionary potential, AI—at least in its most basic form—has existed for decades. First-generation AI-equipped computers played chess, solved puzzles, and performed other relatively straightforward tasks.

Yet the sophistication level of AI has evolved dramatically in recent decades, and the technology is now prevalent in many areas of everyday life. Google Maps uses AI to dynamically learn traffic patterns and create efficient routes; smartphones use AI to recognize faces and verbal commands; AI enables efficient spam filters in email programs, smart assistants such as Alexa, and recommendation engines. These are a small sample of familiar technologies that leverage AI's capabilities. AI applications can be found in virtually every industry today, from marketing to healthcare to finance.

Of course, the development and implementation of AI is not without its share of controversy, and the debate about the risks and rewards of this unique and revolutionary technology tend toward extremes, with many observers predicting that AI will destroy jobs and even eventually threaten humans. Some scenario analyses[2] suggest a potentially positive impact of AI on GDP growth, but virtually all are focused on developed economies. In general, the aggregate impact is predicted to hinge on several factors including skills, availability of open source data, and

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technological progress, with some countries expected to gain more than others. The impact on jobs is much more uncertain, as it depends on the particular economic sector and the skill composition of the labor force.

Controversial or not, the race to develop AI proceeds apace. Because the distribution of venture capital (VC) investment into AI-specific technologies closely tracks the flow of overall VC flows, the latter can be used as a proxy for interest in AI by country. And it is clear from the data that the United States and China lead in AI investment, with China dominating global AI funding. Chinese AI companies raised a total of $31.7 billion in the first half of 2018, almost 75 percent of the global total of $43.5 billion. China looks poised to lead the AI space in several sectors including healthcare and autonomous driving. China's progress with AI is largely the result of strong and direct government support for the technology, leadership from Chinese tech industry giants, and a robust venture capital community.

With the exceptions of China and India, emerging markets have received a modest share of global investment in advanced technologies. Total VC flows to emerging markets between 2008–2017 excluding China and India was just $24 billion, compared with global flows to the United States over the same period of $694 billion (Figure 1).

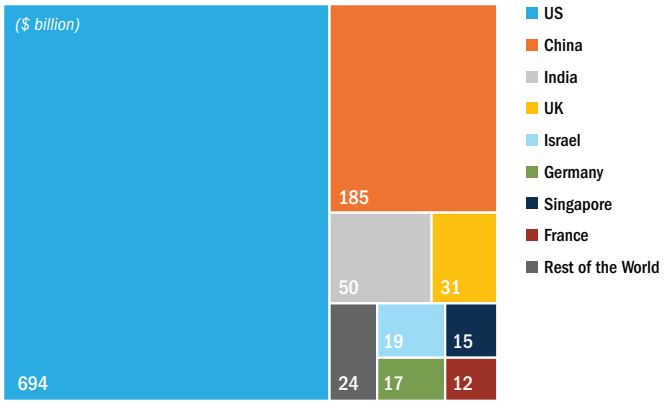

FIGURE 1 Global VC Investment 2008-17

Source: Pitchbook 2019

AI development in China has important implications for other emerging markets, too. A microlending algorithm developed using the credit scoring of Chinese consumers can be much more readily applied in another emerging market than one developed using credit reports of American consumers. That's due to the fact that, unlike borrowers in advanced economies, borrowers in China and other emerging markets often do not have credit cards or traditional mortgages. In China, companies like AntFinancial and Tencent have credit scoring solutions that leverage e-commerce data, as well as payment platforms that provide insight to credit-based decision making. These technologies, much like those in agribusiness and other sectors, have enormous potential to be applied to other emerging markets such as Sub-Saharan Africa.

Machine learning, in which machines are inspired by biological processes and learn from observation and experience, is the most invested category of AI. The AI industry is moving toward consolidation, with large corporates and industrial players making frequent acquisitions of start-ups, a phenomenon that tends to drive up valuations and limit opportunities for VC investors.

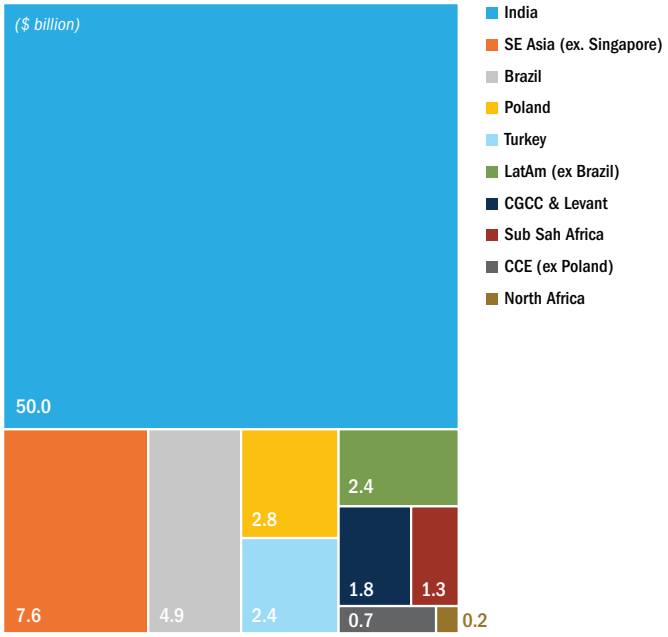

FIGURE 2 EM VC Investment 2008–17 (ex-China)

Source: Pitchbook 2019

The Evolution of AI

Artificial intelligence can be categorized into three basic stages of development.

Basic AI or Artificial Narrow Intelligence (ANI) is limited in scope and restricted to just one functional area. AlphaGo, a computer program that plays the board game Go, is an example.

Advanced AI or Artificial General Intelligence (AGI) is advanced and usually covers more than one field, such as power of reasoning, abstract thinking, or problem solving on par with human adults.

Autonomous AI or Artificial Super Intelligence (ASI) is the final stage of intelligence expansion in which AI surpasses human intelligence across all fields. This stage of AI is not expected to be fully developed for several decades.

The Rapid Growth of Data

Today, advances in other technologies are creating an environment conducive to the rapid acceleration of AI technology. Massive amounts of data that are being created by increasingly ubiquitous connected devices, machines, and global systems—including the Internet of Things, or IoT—are becoming increasingly helpful in training learning systems to make them more realistic and humanlike in their behaviors.

For example, electric vehicle carmaker Tesla aggregated some 780,000,000 miles by the close of 2016—a rate of one million miles every ten minutes—through its connected cars. The data generated by those miles can be instrumental for AI applications.

The more data available, the better the AI algorithms become. In addition, significantly faster computers allow for much more rapid processing of the data. Lower-cost computing power, particularly through cloud services and new models of neural networks, have dramatically increased the speed and power of AI. Graphic processing units (GPUs), repurposed to work on data, allow for faster training of machine learning systems compared with more traditional central processing units (CPUs). While CPUs load and process data sequentially, GPUs can "parallel" process data, which allows AI to manipulate vectors and matrices in parallel. By repurposing these graphics chips, networks can iterate faster, leading to more accurate training in shorter time periods. GPUs can also replace expensive high-performance hardware. The effect of these chips has been described as allowing processing speeds to "jump ahead" seven years, relative to what Moore's Law would have allowed.[3]

New Approaches to AI

Beyond data generation and computing power, new approaches to artificial intelligence are driving the technology forward. The first such approach involves modelling the human brain. This includes physically building an electronic model of the brain, as well as using logical approaches like neural networks that mimic the way neurons in the brain interact.

Alternative approaches involve sophisticated logical rules. These include logical programming to code human reasoning into software; evolutionary computational intelligence that allows for some degree of derived action beyond explicit coding; and statistical analysis that mimics the results of human reasoning without having to "understand" that reasoning. Natural language processing uses this latter approach with a departure from grammar building to use statistical rules.

Also, as AI becomes more widely adopted, its basic toolsets and functionality will become available as commercial services from large tech platforms. Examples include Amazon Machine Learning Services, Google DeepMind and TensorFlow, IBM Watson, and Microsoft Cortana Intelligence Suite, among others. Platform operators will offer an AI layer to add stickiness to existing offerings, and with this horizontal toolset available, start-ups will be able to scale AI more quickly and cheaply.

Funding Trends in AI

As commercial uses for artificial intelligence proliferate, the race to acquire AI technologies and start-ups is intensifying. Big corporations in every industry, from retail to agriculture, are attempting to integrate machine learning into their products.

Perhaps as a result, machine learning leads AI technology investments. Machine learning, as opposed to learning according to rules and logic, occurs through observation and experience. Instead of a programmer writing the commands to solve a problem, the program generates its own algorithm based on example data and a desired output. Essentially, the machine programs itself.

As of January 2019, Venture Scanner, an emerging technology research firm, analyzed over 2000 AI start-ups and classified them into 13 functional categories that collectively raised $48 billion in funding since 2011. Start-ups developing machine learning applications make up half of this funding. These companies utilize computer algorithms to automatically optimize some part of their operations. Examples include CustomerMatrix, Ayasdi, Drive.ai, and Cylance. Many other AI categories include pioneers and display enormous potential for growth and development.

Market intelligence firm CBInsights has identified 100 of the most promising private companies applying AI algorithms across more than 25 industries, from healthcare to cyber security. These start-ups have collectively raised $11.7 billion across 367 deals.

Perhaps due to this rapid growth in the AI space, there is now an acute shortage of AI talent in many workforces.

And this is accelerating the race to acquire early-stage AI companies with promising technologies and personnel. Notable acquisitions include Amazon's purchase of AI cybersecurity start-up Sqrrl and Oracle's acquisition of cybersecurity firm Zenedge. While tech giants continue to hunt for AI technology and talent, traditional insurance, retail, and healthcare incumbents are also on the chase. The largest deals in AI history include the 2018 Roche Holdings acquisition of New York-based Flatiron Health for $1.9 billion, and Ford Motor's acquisition of auto tech start-up Argo AI for over $1 billion in 2017. Google is the top acquirer of AI start-ups, with 14 acquisitions under its belt.

The growth of VC funding since 2012 has followed a similar path. In 2017 AI attracted $12 billion of investment from VC firms, which is double the volume of 2016, according to KPMG. Around 42 percent of AI companies acquired since 2013 had VC backing.

AI Acquisitions and Funding are Scaling Rapidly

According to ABI Research, AI start-ups in the United States raised $4.4 billion from 155 investments, while Chinese start-ups raised $4.9 billion from 19 investments,[4] as they tend to focus more on mature AI applications. The most vibrant AI hubs worldwide are California's Silicon Valley, New York City, Beijing, Boston, London, and Shenzhen. These hubs benefit not only from the creation of highly skilled and highly paid jobs, but also knowledge and innovation spillovers. Employees at AI firms tend to become AI entrepreneurs, AI workers switch between AI companies, and innovative AI products can be developed for and deployed in local markets, exposing even more people to the technology.

Silicon Valley is the top global hub for start-ups (12,700 to 15,600 active start-ups) and tech workers (two million). It is the global leader for VC investment and the headquarters for many top technology firms.

New York is the leading hub for the financial and media industries; it has an AI talent pipeline from universities; and it has a strong funding ecosystem—the world's second largest after Silicon Valley in terms of the absolute number of early-stage investments.

Beijing leads the volume of academic research output in AI, which comes from Tsinghua, Beihang, and Peking Universities; it has extensive involvement of tech leaders, especially Baidu; and the Chinese government considers AI to be of strategic importance.

China and AI

AI pushed total VC funds flowing to China to a record $40 billion in 2017, up 15 percent from the previous year. The Chinese government is active in promoting the AI industry and initiatives; its stated goal is to develop an AI sector worth $150 billion by 2030. The Chinese private sector is also active in the space. Internet firm Baidu has actively pursued an "AI first" agenda since launching the Institute for Deep Learning in 2013 and establishing the Silicon Valley AI Lab the following year. In January 2018 the Beijing Frontier International AI Research Institute was established under the leadership of Kai-Fu Lee of Sinovation Ventures.

There are also local AI initiatives in China with multiple cities—Beijing, Shanghai, Hangzhou, Zhejiang, and Tianjin among them—developing plans and policies for AI. For example, Shanghai plans to establish a special fund to invest in AI development, while Hangzhou has launched its own AI industrial park along with a fund that will invest approximately $1.5 billion in it.

PricewaterhouseCoopers predicts China's GDP will reach $38 trillion by 2030, with $7 trillion of that coming from AI through new business creation in fields such as autonomous driving and precision medicine, as well as existing business upgrades in terms of improved efficiencies and reduced costs. From 2010 through Q3 2017, a total of 704 AI deals were made in China, representing $6.67 billion.[5]

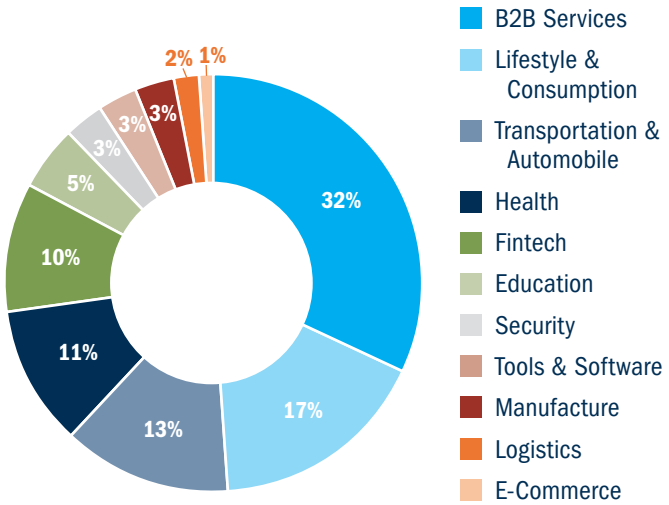

FIGURE 3 China AI Investment by Subsector (# of deals)

Source: ITJuzi

Do the Rewards of AI Outweigh its Risks?

New technologies come with risks, and there is much uncertainty around advances in AI and machine learning, particularly with regard to the technology's impact on society and the economy. AI's potential to imitate human behavior has given rise to concerns that the technology poses a significant threat to jobs, privacy, and the nature of human society itself.

Concerns about AI-driven job losses assume that humans won't be needed to manage and monitor AI machines and regulate inputs and outputs. Yet a study by the Economist Intelligence Unit that looked at the manufacturing, healthcare, energy, and transportation sectors found that AI would boost GDP by 1 percent under all scenarios it examined, with even more significant gains in developing Asian nations.[6] The EIU study also projects that employment in the manufacturing sector will remain relatively steady after AI technology penetration. The study does predict that certain job categories would be eliminated by AI, though there will be offsetting job creation among higher-skilled job categories. Still, job losses have historically been associated with the introduction of revolutionary technologies, especially in manufacturing.

Bias in AI

As AI technologies have emerged and spread, a phenomenon known as AI bias has been noticed. It occurs when an algorithm produces results that are prejudiced due to erroneous assumptions in the machine learning process. And it can lead to and perpetuate biases in hiring, lending, and security, among other areas. Bias can creep in at many stages of the learning process[7] including (1) setting what the model should achieve (potential predatory behavior to maximize profit); (2) collecting data that reflects prejudices (selecting one gender over another, for example) or is not representative of reality; and (3) preparing the data and selecting which attributes the algorithm should consider or ignore. Mitigating these biases can be challenging, but there is a strong movement within AI to do so, and researchers are working on algorithms that help detect and mitigate hidden biases in training data and models, processes that hold the users of these models accountable for fairer outcomes and defining fairness in different contexts.

AI in Energy

AI's potential in the energy industry mostly leverages the technology's ability to analyze highly complex systems in real time and optimize them in ways not possible with conventional information technology.

The timing is particularly fortuitous, as the energy grid is changing from constant baseload systems to intermittent renewable generation, a shift that greatly increases system complexity. For example, AI could be used to optimize distributed energy resources such as rooftop solar photovoltaic and batteries to match load and capacity. Electricity meter data can be disaggregated with heuristics machine learning, generating insights for additional energy savings. And renewable energy sales and deployment can be accelerated with AI.

AI can deliver increased energy efficiencies at the grid level by reducing standby reserves of thermal base load generation by allowing the grid to follow load and renewables more closely. This directly reduces the use of coal, oil, and gas, and thereby reduces greenhouse gases. Also, through its greater level of flexibility, AI can increase renewables generation by lifting the ceiling on the amount of renewables that can be accommodated.

At the building level, AI can increase efficiency by using machine learning to predict building heating and cooling loads based on weather, time of day, weekday, etc. And AI can empower consumers through better disaggregation of electricity meter data, allowing for resource conservation through behavior modification.

AI in Healthcare

There are many uses for AI technology in the healthcare sector. These technologies are maturing rapidly and are already being used in a number of applications—from aiding diagnosis to improving operational healthcare workflow efficiencies. The goal of many of these applications is to do what humans do but faster, more accurately, and more reliably. That makes them potentially beneficial in resource-constrained environments with limited access to doctors and other health professionals, as well as in cost-containment constraints. Top uses include:

1. AI-enhanced medical imaging and diagnostics is designed to improve the speed and reliability of analysis and can be particularly beneficial in contexts where there is a lack of trained doctors, radiologists, etc.
2. AI-triage plugs into tele-health platforms and provides a pre-consult triage, even flagging potential diagnosis, to save physicians time.
3. Patient data and risk analytics. AI promises data analytics and machine learning on patient data such as electronic health records, facilitating predictive diagnostics, and ultimately improving outcomes.

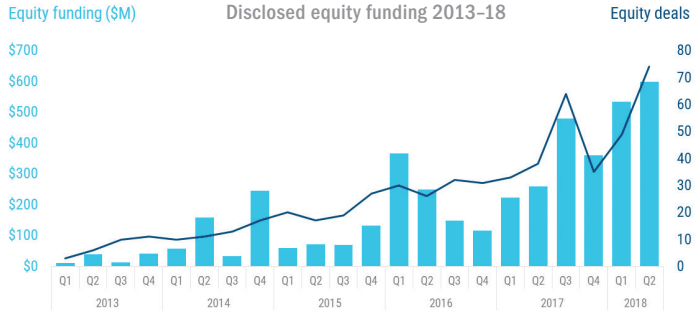

FIGURE 4 AI Investments in Healthcare, Global

Source: CBInsights

4. Drug discovery. Deep learning techniques using convolutional neural networks[8] are very effective in predicting which molecular structures could result in effective drugs. Applications are being developed by both in-house research and development departments as well as by independent start-ups that are focused on vertical systems and are expected to accelerate drug discovery. AI also supports personalized medicine, or the targeting of medicines based on individual genetics and other genomic analysis.
5. Pharmaceutical supply chain. Using AI to process real-time data and make predictive recommendations is expected to drive data-driven supply chains, improving efficiency and cost management.

AI can increase access to quality healthcare through AI-enabled triage, leveraging the time of scarce doctors and facilitating diagnoses. It can deliver more affordable care through increased productivity, allowing available healthcare professionals to focus more closely on patient care and human-interaction. It can lower costs through better data management and more efficient drug discovery mechanisms.

AI in Education

Artificial intelligence technologies can dramatically enhance the way students learn both within and outside of the classroom, as well as help expand access, relevance, and efficiency of education, although the use of this technology in the sector is still at a nascent stage of development. Machine learning can customize learning content by providing teachers and faculty with actionable insights from student performance to better understand and serve student needs. AI can improve online tutoring, help teachers automate routine tasks such as grading, and fill gaps in their curricula, and can give students immediate feedback to help them better understand concepts at their own pace and with a greater degree of individualization.

The use of AI in education can not only improve learning environments and learning outcomes, it can also save teachers and faculty time and allow them to focus on learners with special needs and can make curricula more relevant to the needs of employers and industry. It also has the potential to democratize education by providing quality teaching in non-traditional learning environments. And AI can give parents a greater role in their children's education through new tools and platforms, and can decentralize education to reduce school, campus, and class sizes.

All of these applications are useful not only for academia, but also in making on-the-job training programs more efficient. AI applications also have the potential to better prepare youth transition to the workplace through specialized work readiness programs, while helping working adults remain competitive in the workplace through customized reskilling/upskilling offerings. Experts predict great potential for AI in assessments, intelligent tutoring, the development of global classrooms, language learning, and matchmaking between the demand for and supply of skills.

AI in Manufacturing

Manufacturing offers multiple opportunities for AI technologies, with innovations encompassing both hardware and software. The top uses are:

1. Product and process engineering. This includes the use of AI in CAD (Computer Aided Design) systems to design better products in terms of function, quality, or cost. This area is by far the most promising for the manufacturing sector because of the scalability of CAD software solutions. Thus, Generative Design, which uses a mix of large databases of designs and an input of the critical parameters and functions of a given product, can automatically create a product optimized in its function, cost, and manufacturability.
2. Intelligent CAD systems can also be interfaced with process simulation tools to seek the best ways to manufacture a given product (for instance, deciding between 3D-printing or traditional molding for plastic parts). As we have already seen with traditional CAD systems, where the cost has fallen to 1 percent of what it was 20 years ago, such tools could quickly become affordable and therefore widespread—even in emerging markets.
3. Production management. AI-enhanced predictive maintenance is aimed at improving asset productivity by using data to anticipate machine breakdowns, particularly in cases when traditional statistical analysis tools have

already been fully deployed and costs and benefits justify adding AI to them.

In addition, collaborative and context-aware robots can recognize their environments, enabling them to alter their actions based on what is needed of them. And functions can be altered in real time.

4. Yield enhancements are a consequence of root cause analysis of defective products and improved manufacturing processes in real time to boost output. AI can help in the cases when traditional statistical analysis has already been fully deployed and if costs/benefits justify it. Some AI applications are being developed both in-house and by start-ups focused on the industry whenever costs and benefits analysis can justify them. As with other AI applications, access to large data sets and the involvement of data scientists who are also technical experts in the specific application targeted are critical to successfully deploying AI in manufacturing.

It's been proven over decades that Total Predictive Maintenance (TPM) programs can significantly reduce factory or assembly line downtime and maintenance costs. Automated, sensor-based inspection of critical parameters coupled with Statistical Process Control (SPC) is also proven to reduce online rejects significantly. In specific cases, when scale is large enough and maintenance or quality issues cannot be solved with traditional TPM or Total Quality Management (TQM) tools, AI tools could be considered. Similarly, collaborative and context-aware robots could improve productivity in specific cases.

AI in Financial Services

AI is likely to have a game-changing impact in the financial services industry in six major areas.

1. Gaining insights that can accurately predict customer behavior. An example is using AI to look at a potential borrower's past behavior and accurately predict his or her creditworthiness. IBM Watson is just one of hundreds of applications here.
2. Early detection and prevention of cybersecurity threats. Generative Adversarial Networks can generate real and fake data sets and learn over time, increasing accuracy of identification and verification.
3. Supporting financial institutions in complying with KYC/AML regulations as AI can learn, remember, and comply with all applicable laws. This can significantly reduce operating costs in an increasingly complex regulatory world.
4. Visual identification and verification can be used to identify customers and documents, streamlining processes such as account creation and loan and insurance origination. For example, Irisguard supports customer identification.
5. Humanlike chatbots, similar to the popular Siri application, can intelligently interact with customers, answer questions, and reduce loads for customer service departments. NextIt is an example of a chat bot provider.
6. Using AI technology and data analytics to support consumer access to mortgage financing, especially for those who are informally employed and applicants with weak documentation. Aavas, a specialized housing finance company in India, relies on data analytics and AI tools to assess the creditworthiness and willingness of households with undocumented and documented incomes to repay loans received.

AI can significantly lower the cost of asset management, making it available to average investors and not just high net worth individuals. AI-enabled fraud detection can allow banks to accurately predict if an account is at risk. And AI can help eliminate human error from compliance processes, a challenging area for many financial institutions. From extending investment opportunities to the underbanked and the average investor, to detecting fraud and mitigating investment risks, AI has the potential to improve the financial health of people and institutions globally.

AI in Transport

Autonomous vehicles tend to dominate the discussion of AI in transportation, but the effects of AI on transportation and logistics extend far beyond AVs and even roads. An entire spectrum of transportation modes is expected to go driverless or crewless, including railways, ships, and various delivery vehicles, all of which are potentially viable in the short-to-medium term.

AI technologies have enormous potential to address challenges in transportation, particularly with regard to safety, reliability and predictability, efficiency, and environmental issues such as pollution. AI can provide innovations in traffic management for solutions to more effectively route cars and avoid accidents, crashes, and fatalities, as well assist law enforcement. Routes can be optimized to reduce traffic and increase reliability, while optimal transit networks for communities can be designed with smarter traffic signals and other transport infrastructure. Delivery routes for trucks and motorcycles in intra-city deliveries can be altered for quicker delivery times, while commute times can be reduced for individuals.

All of these solutions impact pollution, as route optimization reduces fuel use and emissions for all types of transportation, including ships, trucks, and cars, among others

The effects of AI on transportation and logistics go beyond automation and road safety management to span the entire logistics chain—from origin to final destination of cargo and goods. AI can offer shippers faster delivery times and increased reliability at lower costs to get products sent by sea from factories to land distribution centers. AI can also enable much more accurate predictions of arrival times for container ships and can spot trends and risks in shipping lanes and ports. Machine learning can help analyze historical shipping data by considering factors such as weather patterns and busy or slow shipping seasons, which can highlight inefficiencies, errors, and duplications. AI can also help provide digital chartering marketplaces for the bulk maritime industry (VesselBot already does this).

AI technologies are also being used to mimic human perception and cognitive abilities such as seeing, hearing, reading, and interpreting sensor data, and this has benefits for user interfaces aboard ships, including speech recognition programs that directly control equipment.

Looking Forward

Recent breakthroughs in deep learning have produced AI systems that match or surpass human intelligence in certain key functions and economic sectors. The United States and China are leading the race in AI. While the capital flowing to AI start-ups is similar in the two countries, in China the average dollar amount per investment is much higher, reflecting the reality that in China, AI applications are the main focus, rather than fundamental AI development.

AI development will force societies to confront the possibility of job losses, yet studies suggest that AI will add to GDP, with emerging markets standing to benefit even more than developed countries. We expect emerging markets such as China to become adopters rather than just developers of AI, with AI applications poised to proliferate in and have a significant impact on major economic sectors. These developments will capture significant gains across the value chain, with cost savings stemming from more accurate demand forecasting and tailored and targeted user experiences. Along with the promises of AI come with the challenge of AI bias, though a growing contingency of researchers are devoted to mitigating this bias to ensure fairness in AI systems across the spectrum.

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[1] See also Strusani, Davide and Georges Vivien Houngbonon. 2019. "The Role of Artificial Intelligence in Supporting Development in Emerging Markets." EM Compass Note 69, IFC, July 2019.

[2] Economist Intelligence Unit. 2017. "Risks and Rewards - Scenarios Around the Economic Impact of Machine Learning." https://eiuperspectives.economist.com/sites/default/files/Risks_and_rewards_2018.2.7.pdf.

[3] Moore's Law is the general observation that the number of transistors in an integrated circuit doubles about every two years, allowing computing power to increase at an exponential pace.

[4] ABI Research. "Artificial Intelligence Investment Monitor 2017." https://www.abiresearch.com/marketresearch/product/1030415-artificial-intelligence-investmentmonitor/

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[6] Economist Intelligence Unit. 2017.

[7] Hao, Karen. 2019. "This is How AI Bias Really Happens—And Why it's so Hard to Fix." MIT Technology Review. https://www.technologyreview.com/s/612876/this-is-how-aibias-really-happensand-why-its-so-hard-to-fix/.

[8] According to www.deepai.org a convolutional neural network is "a subset of deep learning and neural networks most commonly used to analyze visual imagery." https://deepai.org/machine-learning-glossary-andterms/convolutional-neural-network.