Artificial Intelligence Industry Insights

June 1, 2020

Artificial Intelligence Industry Insights

M. R. Pamidi	Matt Pamidi	Ajay Nair
Senior Editor	Designer	IT Analyst
IT Newswire	IT Newswire	

Contents

Executive Summary

Artificial Intelligence (AI) has seen tremendous momentum in the last five years, thanks to unparalleled advances in computing, ever-falling prices of computing resources (CPU/GPU, network gear, software, storage), and increasing realization by companies/countries around the world of the need to address major challenges and opportunities. Buzz phrases like Big Data and Analytics have been replaced by AI, Machine Learning (ML), and Deep Learning (DL). We emphasize AI subsumes ML which, in turn, subsumes DL; but in this paper, we use these terms interchangeably.

This paper looks at the current AI landscape in terms of vendors, nations, and companies pursuing in-depth research in these areas. We also discuss relevant use cases in various industries such as healthcare, defense, manufacturing, fintech, autonomous vehicles, and cybersecurity. We conclude, despite its implications to humans and their careers, AI is here to stay and, in the long run, will help humanity, just as Industrial Revolution did in the 18th and 19th centuries and technological advances did in the 19th and 20th centuries.

1. Introduction

The field of AI research began in the 1940s, but an explosion of interest in AI started around 2010 due to the convergence of three enabling developments: (1) the availability of "big data" sources, (2) improvements to ML approaches, and (3) increases in computer processing power.

Most pundits agree the United States still leads the world of AI (dominated by the G-MAFIA—Google, Microsoft, Amazon, Facebook, IBM, Apple), closely followed by China (dominated by BAT—Baidu, Alibaba, Tencent), Israel, the U.K., and Canada. There are over 3,400 companies worldwide involved in AI.[1] U. S. venture capitalists reportedly invested an estimated $8 billion in 2018 alone.

> *"AI is the new electricity. I can hardly imagine an industry which is not going to be transformed by AI."*
> — Andrew Ng, Landing AI and deeplearning.ai

2. Global Market Leaders

Table 1 lists the countries leading in AI based on the number of companies.

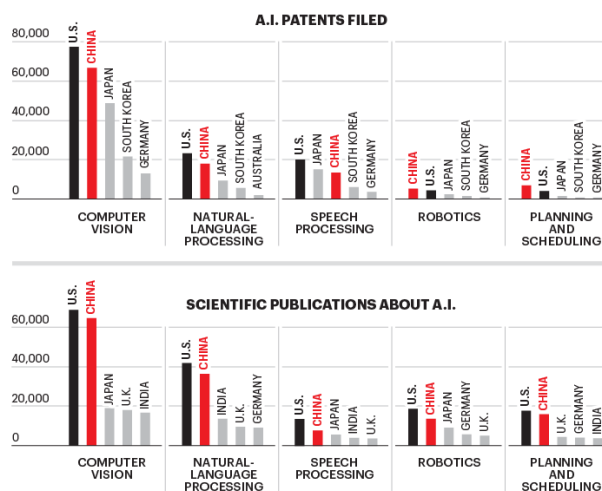| No.	Country	Share (%)	Comments
1	U. S.	40	Mainly attributed to companies in Silicon Valley, Boston/New York corridor; CMU, MIT, Stanford; Federal Agencies—CIA, DARPA, NSA
2 (tie)	China	11	Intends to be the world leader in AI by 2030, with AI contributing to $150 billion to Chinese GDP; has invested billions into research centers in Beijing ($2.2 billion), Shanghai ($15 billion), and Tianjin ($16 billion).[2] China is making direct investment from the government down to city level.
	Israel	11	Israel's success is a result of close connection between the Israeli military and the digital sector. It also has world-class universities such as, Bar-Illan, Ben-Gurion, Jerusalem, and Technion. Of course, Israel is the undisputed leader in cybersecurity, where AI plays an important rule.
3	U. K.	7	London is a global financial hub and attracts AI funding. Besides, its proximity to top-notch universities—Cambridge and Oxford—helps.
4	Canada	3.8	Led by world-renowned researchers—Geoffrey Hinton, Yann LeCun and Yoshua Bengio (often called "deep learning conspiracy"; others call them the "Canadian Mafia")—from Toronto and Montreal's MILA (Montreal Institute for Learning Algorithms)
5 (tie)	France	3.1	The French Government published its France IA (France AI Plan) on March 21, 2017, which included about 50 recommendations. This was followed by a report, "For a Meaningful Artificial Intelligence: Towards a French and European Strategy," delivered in March 2018, promoting better access to data with a focus on health, transport, ecology and defense
	Japan	3.1	As noted above, of the top 20 patent applicants, 12 are Japanese.
6	Germany	3.0	The low numbers of filings for Germany may be because applicants prefer to use the European Patent Office to secure protection in Germany.

Table 1. Countries Leading in AI

---

[1] "The Global Artificial Intelligence Landscape," Roland Berger, Asgard Capital.
[2] "TikTok: China Starts the Clock," *Fortune*, February 2020, pp: 76-80.

Another way of looking at AI leaders is to examine the number of patents scientific publications by countries. Figure 1 clearly shows the U. S. leading in most areas, followed closely by China.[3]

Figure 1. Countries Leading in AI Patents and Research

Here are some interesting factoids about patents:[4]

- Companies represent 26 of the top 30 patent applicants. Most of these are conglomerates active in consumer electronics, telecommunications and/or software, as well as sectors such as electric power and automobile manufacturing. Just four of the top 30 are universities or public research organizations.
- IBM has the largest portfolio of AI patents with 8,290 patent applications, followed by Microsoft with 5,930 patent applications.
- Of the top 20 companies, 12 are Japanese.
- The main functional application mentioned by the top companies in their patent applications is computer vision (19 out of 20), though IBM has a greater focus on natural language processing (NLP).
- ML is by far the most represented AI technique in the top applicants' portfolios.
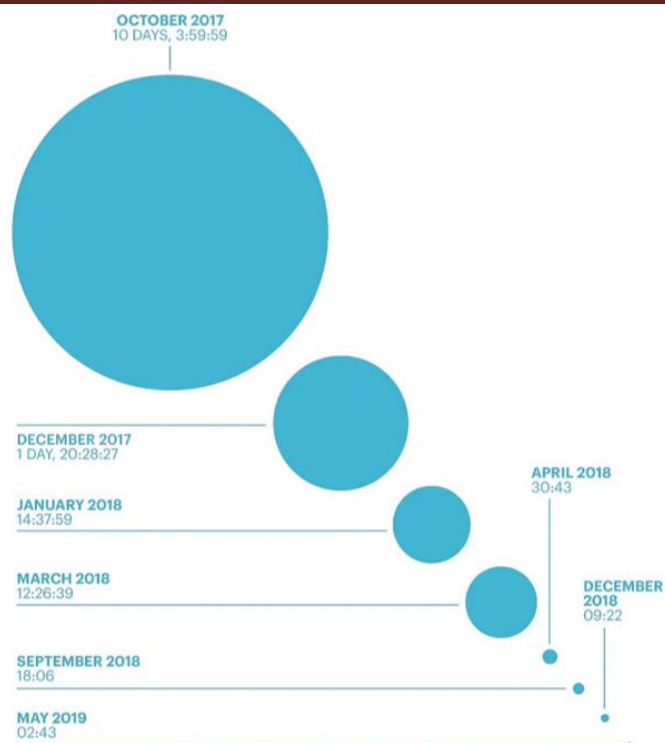
As for market forecasts, the McKinsey Global Institute estimates that the application of narrow A.I. will add some $13 trillion to the global economy by 2030, an amount that it says would make the technology more impactful than the steam engine was in the 1800s.

3. Current AI Usage

Traditional AI, as we know it, has often been labeled *narrow* and has resulted in such products as Amazon Alexa, Apple Siri, Google Assistant, and Microsoft Cortana; the ability to route Amazon orders to your home and decide which agent handles your customer service call to your bank; chatbots; and Facebook's auto-tagging of your friends in the photos you upload. Traditional AI comprises training and inference. The training phase is extremely compute-intensive and time-consuming, even with the tremendous advances the industry has made in less than three years (Figure 2), thanks to improved algorithms and computer hardware

---

[3] *ibid*.
[4] "Artificial Intelligence," WIPO Technology Trends 2019, World Intellectual Property Organization, 2019.

OCTOBER 2017
10 DAYS, 3:59:59

DECEMBER 2017
1 DAY, 20:28:27

JANUARY 2018
14:37:59

APRIL 2018
30:43

MARCH 2018
12:26:39

DECEMBER 2018
09:22

SEPTEMBER 2018
18:06

MAY 2019
02:43

Source: Stanford University

Figure 2. Progress in AI—Computation Time Required to Achieve 93% Accuracy in a Computer Vision Test Benchmark

What is now emerging is Artificial General Intelligence (AGI, also called "strong AI" or "true AI"), where *General* is meant to differentiate it from the traditional AI discussed above. This idea was pioneered by OpenAI, initially set up in 2015 as a non-profit organization by Sam Altman and Elon Musk (yes, the Tesla guy). The concept here is that AGI systems can perform at superhuman level. Microsoft has invested $1 billion in the for-profit arm of OpenAI.

AGI's premise is that a single piece of software will be capable of learning almost any task at human or super-human level—a system that can master new skills quickly, perhaps by watching a single demonstration or just by reading, with no training at all, and maybe entirely at its own initiative. In other words, AGI is AI with advanced to human-like intelligence levels. If this technology delivers what it is promising, it will be a game-changer.

Another emerging field is Conversational AI, a use case of NLP commonly seen in online chatbots (virtual assistants) which use AI to mimic human conversation via online chat. Gartner predicts that 25 percent of digital workers will use virtual assistants daily by 2021. A 2017 Juniper Research report calculates that, for every inquiry handled by a chatbot, banks save four minutes of an agent's time, which translates to a cost saving of $0.70 per query. These platforms are expected to save banks an estimated $7.3 billion in operational costs by 2023. The chatbot market has taken off in the past few years and is projected to grow from US$2.6 billion in 2019 to US$9.4 billion by 2024 at a compound annual growth rate (CAGR) of 29.7%.[5]

---

[5] "The latest market research, trends, and landscape in the growing AI chatbot industry," Mai-Hanh Nguyen, Jan 23, 2020.

4. Market Segments

Practically every industry sector has already deployed AI solutions or is actively exploring them. We delve here into sectors that have implemented interesting AI applications.

4.1 Healthcare

Healthcare in the U.S. is one of the most challenging industries that is benefiting from AI. Healthcare spending in the U.S. accounts for almost 18% of the GDP, but the U.S. still lags Canada, Scandinavian countries, and the U.K. in terms of the *availability* AND *accessibility* of decent healthcare to its populace. There are many ways AI can fix the broken healthcare system and we discuss below two use cases.

4.1.1 Medical Diagnostics

The hot topic today is Coronavirus, aka COVID-19, which has taken heavy human toll and resulted in economic calamities around the world. We see three crucial requirements to understand and fight COVID-19: *Three 'T's*— Test, Track, Trace.

Test: If the tests are positive AND the subject has underlying conditions (e. g., diabetes, hypertension, obesity), compare the test results with other subjects' with similar conditions that have either succumbed to or survived the virus, and use AI algorithms to predict the possible outcome for the subject.

Track: If the subject tests positive for the virus, find out how long he/she had it and track their 'journey' during that period. This can be done by reviewing the GPS history of the subject's cellphone as well as using face-recognition software, with due respect to privacy and security, especially in civilized societies and democratic nations.

Trace: Identify all the persons the subject has been physically close to in that period, track them all, and test them for the virus. Again, face-recognition software can be used here.

In fact, Apple and Google are working together on the track-and-trace aspects.

4.1.2 New Drug Discovery and Delivery

There are at least 230 companies around the world using AI in drug discovery.[6] The various applications include: Aggregate and synthesize information; understand mechanisms of disease; establish biomarkers; generate data and models; repurpose existing drugs; generate novel drug candidates; validate and optimize drug candidates; design drugs; design preclinical experiments; run preclinical experiments; design clinical trials; recruit for clinical trials; optimize clinical trials; publish data; and analyze real-world evidence.

4.2 Defense

AI is a rapidly growing field of technology with potentially significant implications for national security. In fact, the U.S. Department of Defense (DoD) and other nations are developing AI applications for a range of military functions. AI research is underway in the fields of command and control, cyber operations, information operations, intelligence collection and analysis, logistics, and in a variety of semiautonomous and autonomous vehicles. The U.S. DoD's unclassified investments in AI grew from just $600 million in FY2016 to $927 million in FY2020, with the Department reportedly maintaining over 600 active AI projects.[7]

4.3 Manufacturing

Many issues plaguing the traditional manufacturing industry include, *inter alia*, inefficiencies, faulty products and costly machine maintenance. Those are just a few of the. But thanks to a combination of human know-how and artificial intelligence, data-driven technology (also known as Industry 4.0) is transforming the entire sector.

---

[6] "230 Startups Using Artificial Intelligence in Drug Discovery," Simon Smith, *BenchSci Blog*, April 8, 2020.
[7] "Artificial Intelligence and National Security," Congressional Research Service, R45178, November 21, 2019.

Some noteworthy examples include:
- autonomous robots interacting with one another and learn from their human counterparts
- computers trained to spot even the most minuscule flaws in machines and products, such as wavering pressure conditions in oil wells
- the marriage of AI and IoT devices making possible predictive maintenance that proactively assesses equipment performance in everything from diamond-tipped titanium cutters to connected meters that monitor safety levels in a smart factory.

Innovative companies using AI and robotics to improve manufacturing in the era of Industry 4.0 include:
- Automation Anywhere creates enterprise-grade Robotic Process Automation (RPA) platforms.
- Fero Labs offers an industrial ML application that helps global brands optimize their manufacturing processes.
- Invisible AI offers a platform that gives manufacturers real-time visibility into their operational practices by installing smart cameras in crucial factory.
- Landing AI creates its customizable, AI-based *Landing Light* platform to ease manufacturing operations.
- Mythic creates of intelligent processing units (IPUs) to let robots and drones communicate.
- Oqton is building an AI-integrated, cloud-based open factory operating system.
- Sight Machine offers an analytics platform that manufacturers use to gain real-time insights into every part of their manufacturing process.
- SparkBeyond offers an AI-powered research engine to find complex patterns in large pools of data and to gather data on input, business results, and world knowledge.
- Uptake designs and develops enterprise AI software for many industries.
- Veo Robotics combines 3D sensing, computer vision, and AI to make robots safer.

4.4 Fintech

AI has been steadily evolving with major improvements over the last few years. Finance is just the latest in a series of business functions being affected by the rapid increase in the use of AI and Robotic Process Automation (RPA). A range of solutions for automating accounts payable (AP) have been progressing over the past 30+ years, minimizing the need for a large staff of AP clerks. Table 2 summarizes the progress that has been made in AP technology.[8]

		Metrics			
Generation	**Technology**	Cost per invoice ($)	Cost per P.O. ($)	Salary FTE ($)	On-time Efficiency (%)
First	Manual coding & matching	15	25	20,000	80
Second	Matching with exception handling and some automation	5-10	18	50,000	95
Third	Fully automated with predictive analytics, ML, and robotics	4	10	90,000	>99
Fourth	Automated to use robotics to either fully automate or assist people with judgment-based decision making				

Table 2. Advances in Accounts Payable Technology

Additional AI applications in Fintech include Personal Finance and Insurance comprising digital financial coach/advisor; transaction search and visualization, client risk profile; underwriting, pricing, and credit risk assessment; automated claims processes; contract analyzer; customer churn prediction; algorithmic trading; augmented research tools; and valuation models.

---

[8] "3 Disruptive Trends Shaping the Future Of Finance & Procurement," Bassware Corporation, 2017.

4.5 Transportation—Autonomous Vehicles

AI is being implemented extensively in how vehicles are built and how they operate on the road. AI's role in autonomous vehicles will only increase over time. Besides the well-known automobile manufacturers, there are quite a few doing innovative work in this area.[9]

- AutoX, with a focus on grocery delivery, makes retail-based autonomous vehicles combining AI software, sensors, real-time cameras, and thousands of test miles, both virtual and real, to ensure safe decisions on the road.
- DataRPM, a subsidiary of Progress Software Corporation, provides anomaly detection and prediction solutions for a variety of industries. Its ML technology gets to know a machine's normal patterns of behavior and can predict future issues and breakdowns which saves time and money.
- Drive.ai utilizes AI art to change current transportation systems with self-driving services.
- nuTonomy is creating autonomous technology for completely driverless vehicles.
- Optimus Ride is a self-driving vehicle company that creates autonomous cars for geo-fenced locations.
- Rethink Robotics makes co-bots, or collaborative robots, for industrial automation. These robots are used to automate factory tasks that are tedious, dirty, or even dangerous for human workers.
- Waymo, a subsidiary of Google's parent Alphabet, is now creating driverless vehicles that can safely deliver people from point A to point B.
- Zoox is creating its own autonomous vehicles from scratch. The cars are being produced to be a robotic rideshare vehicle.

4.6 Cybersecurity

Today's highly sophisticated hackers are on a relentless mission, teaming up to launch coordinated, targeted, and damaging attacks across the global digital landscape. Cybercrime costs include damage and destruction of data, stolen money, lost productivity, theft of intellectual property, theft of personal and financial data, embezzlement, fraud, etc.

Cybersecurity Ventures predicted that cybercrime would cost the world $6 trillion annually by 2021, up from $3 trillion in 2015.[10] Verizon's 2019 Data Breach Investigations Report shows the following breakdown among data breaches seeking individual names, medical records, and/or financial information (Figure 4).[11]
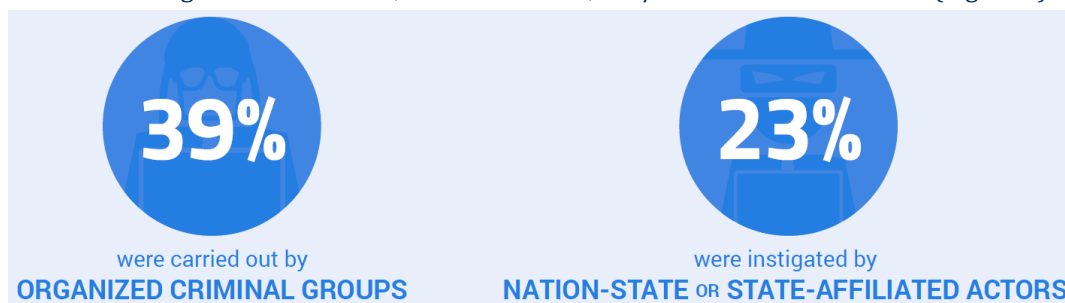
Figure 4. Sources of Cybercrimes

Applied in a practical and focused way, ML can strengthen cybersecurity defense by:

- Improving detection capabilities with network behavioral analytics, complemented by cybersecurity analysts who can validate and rate alerts.
- Broadening visibility across the threat landscape with a collective defense response to detected threats.
- Leveraging shared network data (anonymized and encrypted in transit) to collectively amplify threat detection.

---

[9] "Artificial Intelligence in Cars Powers an AI Revolution in the Auto Industry," Alyssa Schroer, March 20, 2020.
[10] "2019 Official Annual Cybercrime Report", Steve Morgan, Cybersecurity Ventures, 2019.
[11] "2019 Data Breach Investigations Report," Verizon, 2019.

5.   Future of AI

In many respects, the future of AI is already here.

5.1   Agriculture

According to a Markets and Markets Report, the agricultural AI market is presently valued at around US$ 1 billion in 2020 and is projected to grow to $4.0 billion by 2026.[12]

Besides the well-known behemoths in agricultural machinery (Caterpillar, John Deere, Komatsu, Kubota, Mahindra), there are a few startups using AI, data-capture analytics, automation, drones, and robotics to improve yield and save natural resources, like water, for more efficient farming:

- Autonomous Tractor Corporation: Self-driving tractors
- aWhere: Weather, pests, and disease prediction
- Blue River Technology (acquired by John Deere): Lettuce thinning, weed control
- Harvest CROO Robotics: Harvesting and packaging
- PEAT: Diagnosing pests and soil defects
- VineView: Crop health monitoring
- Trace Genomics: Soil analysis

5.2   Medical Diagnostics

Recently, the U.S. White House Office of Science and Technology Policy enlisted many research groups and companies to collaborate on a major AI project intended to help experts undo the mysteries of COVID-19.[13] The goal of the project CORD-19 (COVID Open Research Dataset Challenge-19) is to make thousands of medical papers related to the COVID-19 available for free, with the hope is that AI researchers can develop NLP techniques to rapidly scan studies and retrieve valuable information that may be obscured.

The White House recently also announced the new COVID-19 High Performance Computing Consortium, allowing researchers worldwide to access to the world's most powerful high-performance computing (HPC) resources to combat COVID-19. Using AI to scan through millions of potential drugs can shave months off the time needed to evaluate the potential universe of medications.

5.3   Quantum Computing

ML and quantum computing are two technologies that have incredible potential in their own right. Now researchers are bringing them together with the main goal achieving a so-called *quantum advantage*, where complex algorithms can be calculated significantly faster than with the best classical computer. This would be a game-changer in the field of AI. Quantum computing is still a field of research and it is a long way from being applied to neural networks. However, in a decade, AI could run into another plateau due to insufficient computing power and quantum computing could rise to help the advance of AI.

6.   Conclusions

There is a lot of speculation (and fear) of AI replacing humans, taking over the world, and possibly even destroying civilization.[14] We believe AI in the long run will *supplement* and not entirely *supplant* human labor. The future will be exciting, fasten your seat belts.

> *"Worrying about AI turning evil is a little bit like worrying about over-population on Mars."*
> — Andrew Ng, Landing AI and deeplearning.ai

---

[12] "Artificial Intelligence in Agriculture Market by Technology," Markets and Markets, 2019.

[13] "How A.I. may make sense of 50,000 coronavirus research papers," *Fortune*, April 28, 2020.

[14] "How to know if artificial intelligence is about to destroy civilization," Oren Etzioni, *MIT Technology Review*, February 25, 2020.