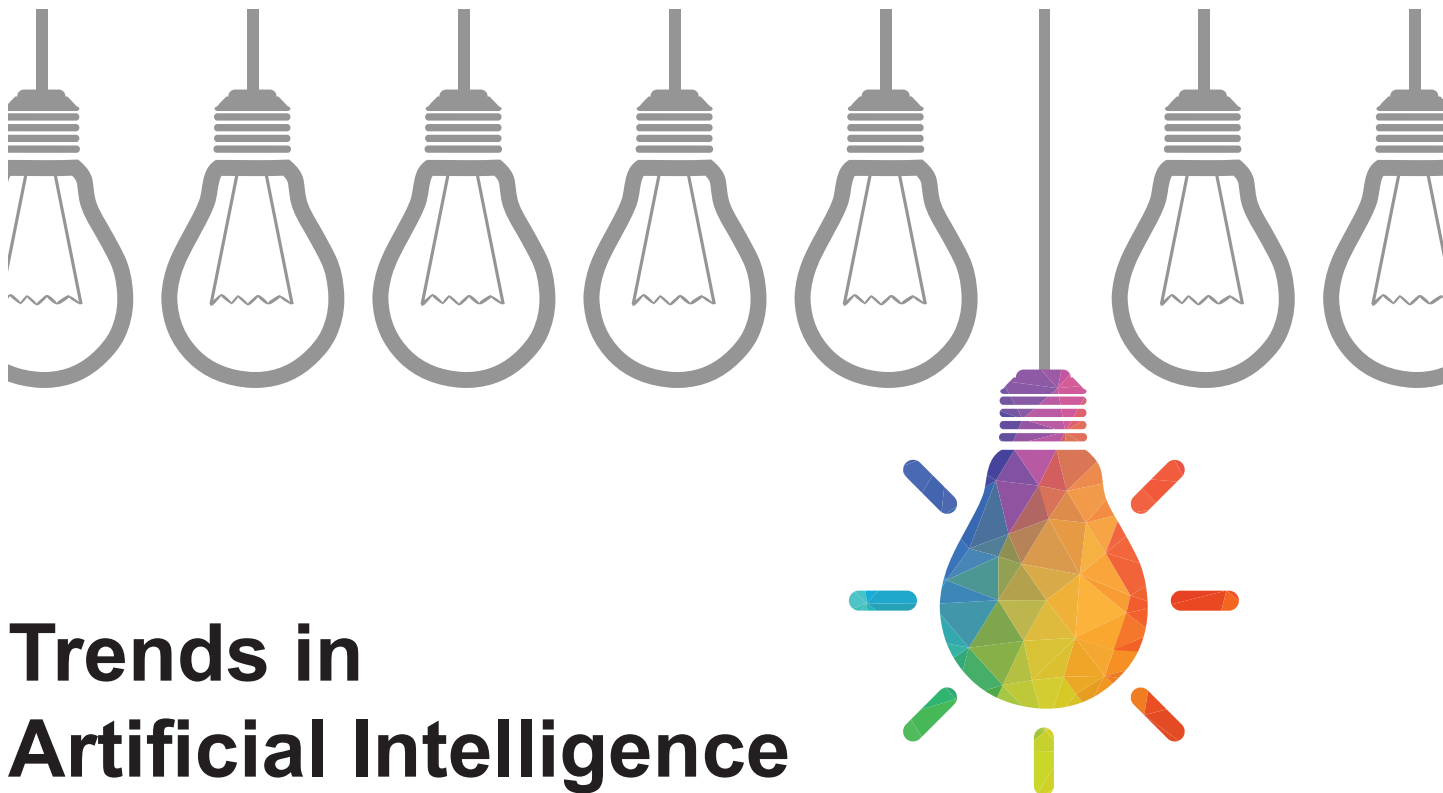




Trends in Artificial Intelligence

The competition in A.I. innovation is global and A.I. is recognized by many countries as being of national importance. The increasing global competition for A.I. dominance is reflected in the rising percentage of patent applications filed in the USPTO by foreign entities.

Artificial intelligence (“A.I.”) enables machines to learn from experience and/or to perform human-like activities. A.I. is being deployed in a growing number of industries and can achieve increasing accuracy and accomplish ever-more sophisticated tasks. National governments have taken notice of both A.I.’s promise and its national security implications, and have set national agendas for winning the A.I. race. Indeed, the White House unveiled a new initiative in February 2019, calling on federal agencies to focus on A.I. initiatives.¹⁸

To delve deeper into the trends of patenting A.I. innovation, we have defined the following technology clusters within the general industry of A.I.:

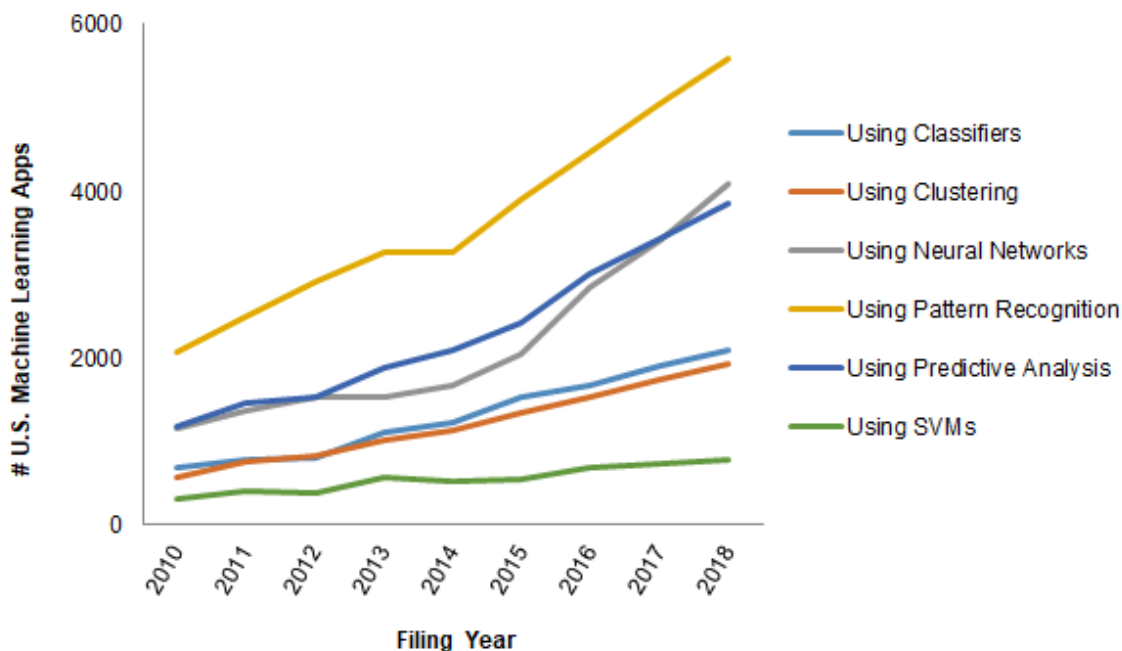
Artificial Intelligence - Level I Clusters	Level II Clusters	Level III Clusters
Artificial Intelligence Systems	Machine Learning Systems	Utilizing Classifiers
		Utilizing Clustering
		Utilizing Neural Networks
		Utilizing Pattern Recognition
		Utilizing Predictive Analysis
		Utilizing Support Vector Machines
	Knowledge Based Systems	-
Application Areas/Industry	Computer Vision	-
	Entertainment	-
	Robotics	-
	Healthcare	-
	Natural Language Processing	-
	Fintech	-
	Digital Marketing	-
	Automotive	-
	Education	-
	Cognitive Security	-
	Augmented/Virtual Reality	-

Taxonomies and expanded definitions of these clusters are included in appendix A.



¹⁸ <https://www.nextgov.com/emerging-tech/2019/02/white-house-unveils-national-artificial-intelligence-initiative/154795/>

Technology leaders emphasize patenting innovations in Pattern Recognition, Predictive Analysis, and Neural Networks



A.I. is a broad term that encapsulates many different types of techniques. Of those that we assessed, pattern recognition, predictive analysis, and neural networks correspond to the highest rate of innovation, as evidenced by the rapidly increasing year-over-year numbers of patent applications of these clusters.

Across the industry, generally, and in the top three A.I. techniques, the top filer of U.S. patent applications was IBM, followed by Microsoft and Google (switching positions between second and third position in different clusters).



The future patenting landscape for A.I. applications is dominated by IBM, but two small companies show specific strengths.

USING 2016 DATA:		
		Most Families Filed by
		(Applicants in alphabetical order)
Artificial Intelligence		Facebook, Google, IBM, Microsoft, Samsung
Level I		
Application Area/Industry		Facebook, Google, IBM, Microsoft, Samsung
Artificial Intelligence Systems		Google, IBM, Intel Microsoft, Samsung
Level I	Level II	
Application Areas/Industry	Augmented/Virtual Reality	Facebook, Google, Magic Leap, Microsoft, Sony Corp.
	Automotive	Ford, General Motors, Hyundai, IBM, Toyota
	Cognitive Security	Cisco, Cylance, Google, General Electric, IBM, Intel, Microsoft, NEC Corporation, Qualcomm, Symantec Corporation
	Computer Vision	Adobe Systems, Facebook, Google, IBM, Microsoft, Samsung, Siemens
	Digital Marketing	Adobe Systems, Facebook, Google, IBM, Microsoft
	Education	Fanuc Corp., Ford, Fujitsu, IBM, Intuit, Microsoft, Oath, Tata Consultancy Services
	Entertainment	Facebook, Google, IBM, Microsoft, Rom Guides
	Fintech	Cognitive Scale, Facebook, Google, IBM, Microsoft
	Healthcare	General Electric, IBM, Microsoft, Samsung, Siemens
	Natural Language Processing	Facebook, Google, IBM, Microsoft, Samsung
	Robotics	Fanuc, Google, IBM, Microsoft, Samsung
Artificial Intelligence Systems	Knowledge Based Systems	Facebook, Google, IBM, Microsoft, Samsung
	Machine Learning Systems	Google, IBM, Intel Microsoft, Samsung

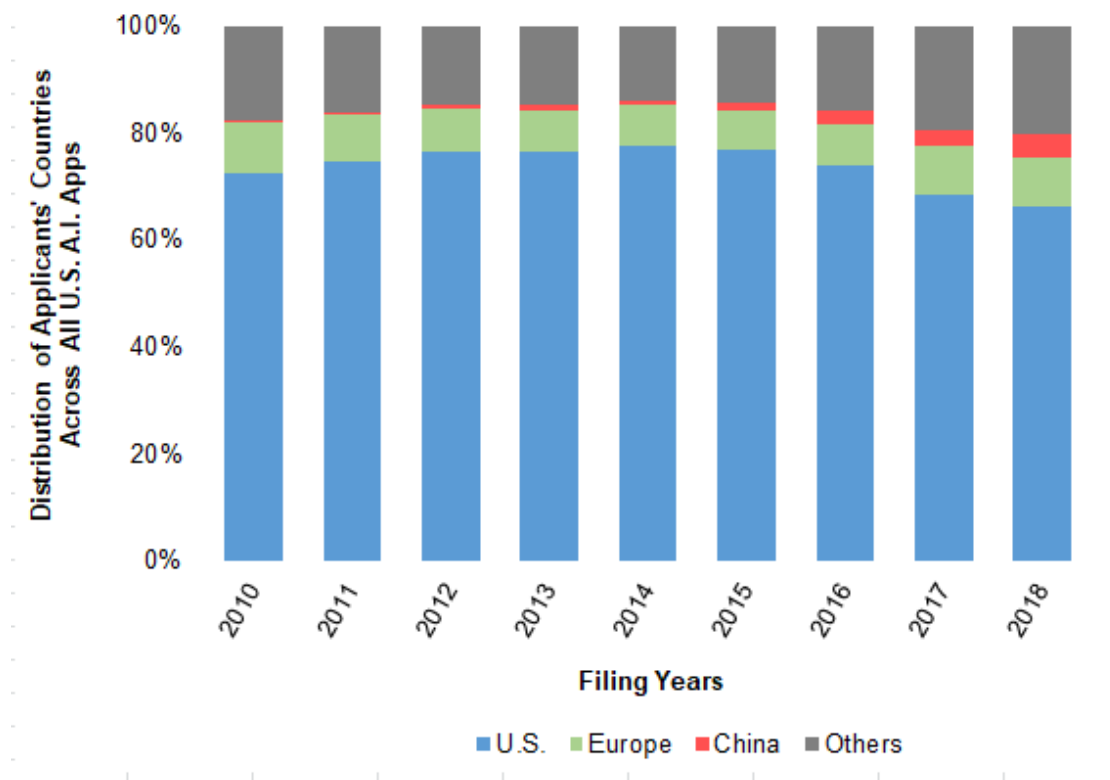
IBM's dominance in applying for patents on A.I. applications is striking in its ubiquity. It is, however, consistent with IBM's stated focus on using its A.I. platform, Watson, to offer A.I.-related solutions to a variety of business problems¹⁹ and its overall embrace of the patent system.²⁰

¹⁹ <https://www.computerweekly.com/news/450411363/IBM-results-show-shift-to-AI-and-cloud-business-focus>

²⁰ <https://www.research.ibm.com/patents/>

Meanwhile, several smaller entities have captured top patent-filing spots within particular application clusters. For example, Magic Leap, a startup developing a head-mounted virtual reality retinal display, is a prolific filer of patent applications in the Augmented/Virtual Reality cluster. Cognitive Scale builds industry-specific augmented intelligence solutions, with the financial services industry being its core constituency. Its patent filings in the FinTech cluster reflect its focus on that industry.

The percentage of foreign-based patent applications is rising



The competition in A.I. innovation is global and A.I. is recognized by many countries as being of national importance. To date, over 20 countries have released A.I. strategy documents, outlining policies to foster A.I. innovation and adoption to the benefit of their respective economies and social welfare, and addressing such issues as privacy, security, and ethics.²¹

The increasing global competition for A.I. dominance is reflected in the rising percentage of patent applications filed in the USPTO by foreign entities. Even though filings from China still comprise a small percentage, the quickening pace with which it files applications is notable. The number of patent applications filed by Chinese entities has risen over sixfold between 2012 and 2018. This acceleration may well continue as China spends heavily to implement its stated goal of becoming the world leader in A.I. by 2030.²²

In view of the emphasis other countries are placing on winning the innovation race in A.I., and the declining percentage of A.I.-related patent applications filed in the USPTO by American entities, it is possible that American innovators will find themselves locked out of the U.S. market, unable to compete in their own backyard.

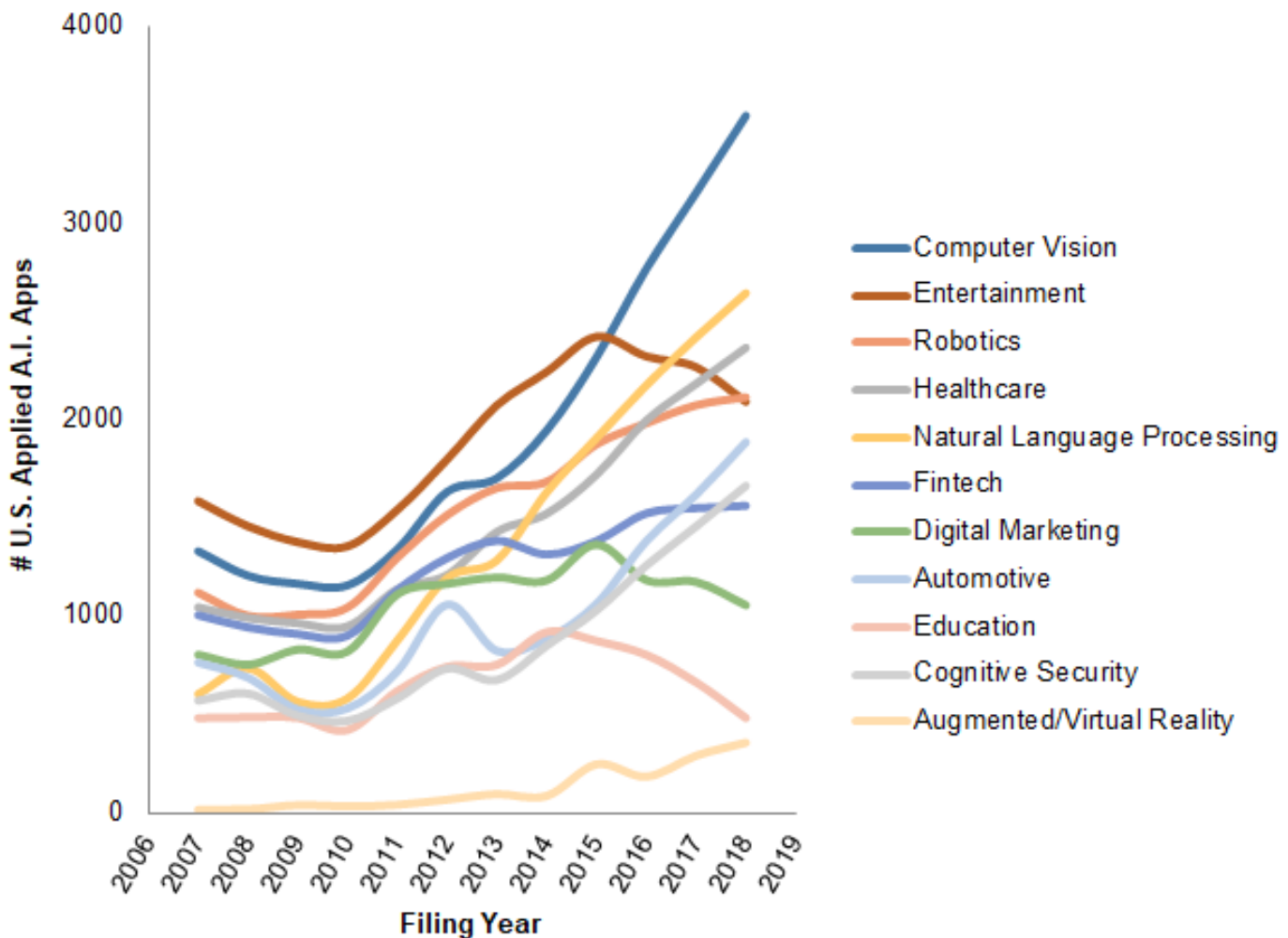
²¹ <https://www.strategy-business.com/blog/Is-AI-the-Next-Frontier-for-National-Competitive-Advantage?gko=9bfef>

²² <https://www.nytimes.com/2017/07/20/business/china-artificial-intelligence.html>

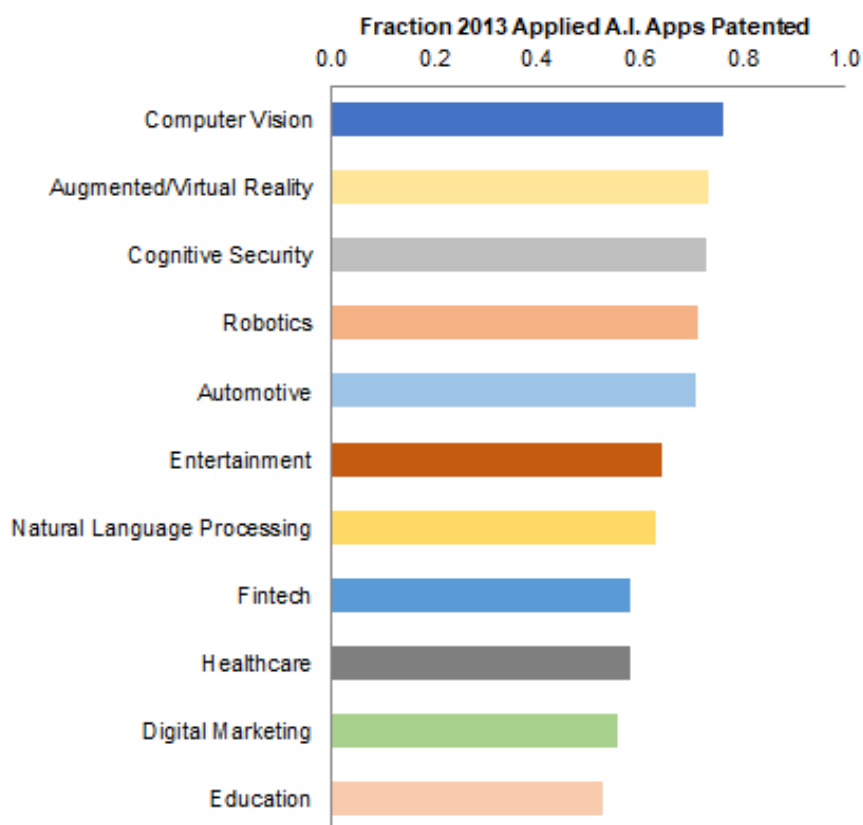
Trends in applications of A.I.

As shown above, patent filings are increasing across all types of reviewed A.I. techniques. However, a different picture is uncovered when data is tagged based on the type of application that A.I. is performing. Where the A.I. applications are traditionally associated with business-method classifications at the patent office (e.g., FinTech, Education, and Entertainment), filings have dropped over the last year, in contrast to the overall increase across the rest of the applications.

This trend is similar to many other software-related innovations, for which filings have dropped significantly since the Supreme Court's *Alice* decision, which significantly curtailed the scope of software-related patentable subject matter.



A.I.-related patent applications have a high chance of being allowed



Although A.I.-related innovations are often software-related, their allowance rate is strikingly different than similar innovations in FinTech. This divergence in allowance rates is directly tied to the Art Units that are predominantly charged with examining these industries' respective patent applications. While FinTech applications are often examined in business method Art Units, A.I. patent applications are examined in Art Unit 2122 (A.I. & Simulation/Modeling), where the allowance rate is nearly double that of the business method Art Units.



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