Theme: Artificial Intelligence

An overview of the rapidly evolving AI landscape
Introduction

From robots that make espressos to algorithms that match you with a driver on a ridesharing app, the world is becoming automated. As we go from robots that assemble cars to cars that drive themselves, we're increasingly tasking "smart" computer algorithms with critical decision-making.

At the heart of all this is the technology known as artificial intelligence. "AI" – as it's commonly known – involves engineering intelligent computer programs to complete tasks and goals without human intervention. The idea that we can emulate human cognitive capabilities through intelligent software to solve problems both mundane and high-stakes is fueling people's imagination about what's possible with AI.

What does it mean to have AI exposure in your portfolio?

Exposure to AI - indirectly, through an investment in US-listed stocks and ADRs of companies that may develop or provide AI-related products or services - is exposure to the market for software, hardware, and services that deliver sophisticated cognitive capabilities to solve problems for people and businesses. AI today is less about automating manual work and more about automating cognition and bringing intelligence to systems and processes.
Artificial intelligence at a glance

Just what is AI? If you’ve ever clicked on a product recommendation on Amazon, searched for something on Google, or asked Siri to find you the nearest gas station, you’ve interacted with AI.

AI is a field made up of many specialized technologies that draw from fields like computer science, mathematics, neuroscience, and linguistics. It is the ability of machines to perform cognitive tasks typically associated with human brains, such as perception, reasoning, learning, interacting with the environment and problem solving, without human intervention. AI is not strictly drones and robots, but rather the underlying ecosystem that powers these systems.

A number of AI deployments are powered by a subfield of AI known as machine learning. This technology involves feeding the system a learning algorithm, exposing it to massive amounts of data to train it so it can eventually figure out on its own how to predict, interpret, and act on the data. For instance, you might feed an image recognition system terabytes worth of photos, to recognize the faces in those images.

From language translation to image recognition, the ability of machines to interpret data is inching towards human-like accuracy, giving rise to more mainstream implementations. AI applications such as speech recognition used by virtual assistants like Amazon’s Alexa and Netflix’s recommendation engines are made possible by a branch of machine learning called “deep learning.”

The Future of AI

Let’s look under the hood of self-driving cars, as an example. These vehicles are enabled by a powerful ecosystem that perceives, reasons, navigates, and monitors, culminating in a driver-free experience.

Source: NVIDIA Investor Presentation May 2017
Artificial intelligence is being driven by the explosion of data

AI was built on decades of research that started in academia and other non-commercial research institutions. But the advances in the field have accelerated in the last few years, giving way to a vibrant AI ecosystem amid a convergence of the following key developments:

- **The advent of “big data.”** The volume of data generated by ever-growing number of sources – machines, devices, software, online services – has grown exponentially. Data is the raw material required to train and improve machine learning algorithms.

- **Advances in computational power.** Massive computational power allows machines to do everything from recognizing objects to translating speech in real time. Powerful graphics processing units (GPUs) are key here because they enable complex computations in learning algorithms, making AI applications potentially scalable.

- **Investments made in AI.** Over the years investments in AI are starting to bear fruit. These include improvements in the design of learning systems, system architectures and software infrastructure.

- **Cost reduction.** Dramatic declines in data storage costs – from $569/GB in 1992 to $0.03/GB in 2012.
Implications for Participating Companies

Today, the volume and variety of data that is generated by humans, software and machines surpass our ability to process and consume them. In this “Internet of Things” and “Everything as a Service” era, we have more data-generating sources than ever. To put this into perspective, as of 2017, 90% of the world’s data had been created in the previous two years.²,³

Companies that enable, supply, and build data networks and infrastructure may benefit in this landscape where data is both an input and output. These include providers of high-performance computing semiconductor chips, connectivity and network components, analytics solutions, and sensory devices.

An additional AI opportunity may lie in the fact that only 9% of the world’s data is structured or tagged.³ Machine learning and deep learning may be helpful in processing and making sense of this raw, unstructured data.

"It will soon become impossible for conventional engineering solutions to handle the increasing amounts of available data. Machine learning offers the ability to extract certain knowledge and patterns from a series of observations." - Gartner⁴
Democratizing AI through AI-as-a-Service

AI is largely still in its early days despite the research efforts of the last 60 years. Some AI technologies, however, are hitting their stride and being applied at a greater scale than ever.

Google, a subsidiary of Alphabet, has built a billion-dollar business by getting people to click the ads they serve on their platforms. Behind this magic are algorithms that predict at high-speed and large-scale which ads to serve each person who visits their various platforms. Now, this company wants to further monetize their algorithms by offering them to other businesses at scale, typically delivered via application programming interfaces (APIs).

Among AI's latest buzzwords is “democratization.” Many of the biggest AI players are in it to “democratize” AI by making their artificial intelligence and machine learning technology available to anyone who wants to add AI capabilities to their technology stack.

If businesses can directly access AI capabilities, they can leverage smart algorithms to transform their business processes and customer experiences. This means no longer will only the biggest companies have access to the large-scale data and computing resources that are required to train and create sophisticated AI algorithms. Smaller companies can access these services too, leveling the technological playing field for all.

Source: Cloudguy.pro

Microsoft AI Platform

Source: Cloudguy.pro
Investment Implications

There is an expanding array of AI applications delivered through “AI-as-a-Service.” Tech companies like IBM and Microsoft currently dominate the fast-growing machine learning cloud services market (see next page). As mentioned above, these services can take the form of APIs that allow users to quickly access, leverage, and scale AI technologies developed by the tech behemoths.

In short, access to AI products and services may add insights and capabilities to drive strategy and execution across many operational domains, from relationship management to marketing and sales to supply chain management. As AI adoption increases, companies offering AI services and platforms may benefit as these functionalities continue to develop.
Trends in the Artificial Intelligence industry

Both businesses and governments have invested funds to support and foster the ecosystem for AI to potentially become a dominant technology.

In 2015, the U.S. government invested $1.1 billion in unclassified R&D in AI-related technologies, and 2016 spending has been estimated at $1.2 billion. Meanwhile, China released a national plan in 2017 to position itself as the de facto AI leader by 2025.

On the commercial front, tech companies have increased their AI exposure through a variety of vehicles over the past few years as they seek to dominate this space. These activities include acquisitions, internal investments and establishing venture funds that invest solely in AI startups.

As far as market forecasts, current estimates for AI’s revenue potential and growth rates are positive. IDC expects the global AI market to reach $57.6 billion by 2021, compared to $8.0 billion and $12.0 billion in 2016 and 2017, respectively. McKinsey estimates companies that are proactive adopters of AI currently report margins 3-15% higher than industry average, and expect this advantage to grow in the future.

These projections underline a technological trend that has found footing as AI moves into mainstream commercialization.

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**AI in numbers:**

- **U.S. government investment in AI-related technologies in 2015:**
  - $1.1 billion
  - Source: NSTC

- **Amount companies invested in artificial intelligence in 2016:**
  - $26-$39 billion
  - Source: McKinsey

- **Current profit margin differential between AI-adopters and industry average:**
  - 3-15%
  - Source: McKinsey

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**US venture capital investing in AI has inflected this decade (capital raised in $mm)**

Source: US National Science and Technology Council
While it's still early days for AI, some businesses are already benefiting from AI while others are trying to learn and experiment with the technology. The following dynamics may accelerate AI's adoption.

**Beyond the tipping points**

AI is already a key underlying capability that powers many key consumer and enterprise applications. From here, it could become even more pervasive, ushering in a new computing paradigm that includes digitizing the physical world and training machines to analyze, interpret, and predict events faster and better than humans.

**Transformative and disruptive**

The modern information age has only just begun and AI could accelerate its evolution. Remember when 10 years ago, the tools to create and publish online content became highly accessible and cheap? That gave way to the capabilities and catchphrase: “every company is a media company.”

In the last few years, the mantra has become: “every company is a software company.” This means businesses need to drive their business models and competitive advantages through software platforms. In the words of Microsoft CEO Satya Nadella: “What you want to achieve in business is fundamentally changing technology .... build systems of intelligence, built on systems of record to create a feedback loop, driving performance and efficiency.”

If you believe that businesses are in fact becoming like software companies, then AI will be front and center of this transformation.

**AI in a digitized, smarter world**

AI could be the next frontier in the current information age that seeks to make everything smarter by digitizing the physical world. If so, businesses may treat their assets – from assembly plants to customers – as data to be processed, analyzed, and acted on to generate certain outcomes.
Selected risks to Artificial Intelligence

- **Profitability risk:** The development and use of AI products and services may not be profitable for the companies developing or using AI, even if AI is successful as a technology. A company’s stock price may decline for many reasons, even if that company develops and uses AI products and services successfully.

- **Technology risk:** Stocks of technology companies and companies that rely heavily on technology tend to be more volatile than companies that do not rely heavily on technology. Factors affecting technology companies include, for example, rapid changes in technology product cycles, rapid product obsolescence, funding and spending, as well as domestic and international competition.

- **Political risk:** Concerns around the displacement of human labor, and the supply and demand gap between skilled and non-skilled workers may engender policy responses that dampen further investment in automation.

- **Security and data risk:** Security threats and regulations focused on data privacy and the emergence of open source solutions could hamper the growth of data and AI.

- **Investment risk:** The impact of artificial intelligence technology remains restricted to existing applications such as online search and recommendation engines, forcing companies to write down expensive R&D expenditure.

- **Implementation risk:** This can entail risk related to poor execution of AI strategies and scarcity of talent (e.g., data scientists, engineers and statisticians). A successful execution requires a transformation along many dimensions from creating a data ecosystem that enables the “training”, choosing the right AI tools, and adapting outdated processes and culture.

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**AI in numbers:**

- **40%**
  - Percent of the world’s top 20 companies classified as technology in 2017– up from 20% in 2012
  - Source: KCPB Internet Trends Report 2017

- **$12 billion**
  - Amount of venture capital invested in AI in 2017, almost double compared to $6bn in 2016
  - Source: KPMG, Pitchbook

- **2.5 quintillion**
  - Amount of bytes of data created everyday. 90% of the world’s data has been created in past 2 years
  - Source: IBM
Identifying companies focused on artificial intelligence

We are in the early days of a potentially long-trend as the possibility of AI is just being realized. This means companies may still be able to successfully develop and deliver essential AI capabilities that could unlock economic value.

These are the AI segments that we have identified as relevant to the AI investment theme and may stand to benefit from further advancements in this field.

**Intelligent Software**
Artificial intelligence solutions such as analytics and customer relationship management

**AI Algorithms**
Machine learning algorithms that provide recommendations based on users’ likes and preferences

**AI Chips**
Semiconductors and processors used in artificial intelligence

**Intelligence Consulting**
Consulting services and intelligence platforms for automation, behavior informatics, etc.

**Autonomous Machines**
Companies providing solutions for connected cars and location-based platform services such as advanced driver assistance systems

**AI Infrastructure**
Network and connectivity for artificial intelligence solutions

**Sensors and Perception**
Software and sensors for voice and pattern recognition

**Consumer Products**
Consumer-focused products that utilize automation, learning solutions, etc.

**Healthcare Solutions**
Companies in the healthcare domain using machine learning and artificial intelligence for diagnosis
Motif Capital: Portfolio Construction

Motif’s thematic investment philosophy is underpinned by technology, helping us process and derive investment insights in an objective, systematic manner. The portfolio construction process starts with theme discovery and theme validation through rigorous fundamental and quantitative research. Motif then employs the same systematic, data-driven approach to create the theme universe and identify thematic exposure. Our starting point is to use publicly available data such as publication data taxonomy and company filings. We utilize alternative data sets, which have traditionally not been used by investors, and often come raw and unstructured. We leverage technology and a variety of computing techniques to extract valuable information from these data sources.

We built our Artificial Intelligence portfolio to provide exposure to the companies which may benefit from the development and use of artificial intelligence and machine learning technology.

Our approach to constructing this portfolio includes these key steps:

- Identify US-listed stocks and ADRs of companies which develop or use AI-related products and services based on whether a company’s public filings contain search terms related to artificial intelligence and machine learning technology.

- Determine each company’s exposure to the AI theme based on a thematic exposure score that quantifies how often a company discusses AI and related topics in public filings.

- Calculate each company’s adjusted market capitalization by multiplying its market capitalization by its thematic exposure score.

- Create the portfolio by weighting each company relative to its adjusted market capitalization and by satisfying investability constraints.

Representative Companies:

**Alphabet Inc. (Google)**
Google offers online services such as search engines that leverage AI algorithms to optimize search results and advertising. It is also a leader in autonomous vehicle research.

**Baidu, Inc.**
Fondly called the “Google of China,” Baidu offers similar web services as Alphabet. It has invested heavily in AI, and offers an AI suite called “Baidu Brain.”

**Intel Corporation**
Intel is a chip maker with applications that help power data centers and smart “internet of things” devices.

**Nuance Communications, Inc.**
Nuance is a technology company which provides products and services related to voice recognition and natural language processing, which enables crucial sensory capabilities for AI machines.

**NVIDIA Corporation**
NVIDIA is a GPU manufacturer whose products are used for high performance computing, enabling advanced AI techniques such as machine learning and parallel processing.
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