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ARTIFICIAL INTELLIGENCE AS A BUSINESS TECHNOLOGY

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EXECUTIVE SUMMARY

"The pace and potential of AI mean it is not something we can afford to ignore. It is perhaps the single most important area of decision-making business leaders will face over the next few years. The depth of a **Chief Information Officer (**CIO's) understanding could be the crucial differentiator between success and failure of firms in a fast-changing world."

WHAT'S THE FUSS ABOUT?

- From security to blockchain technology and 3D printing, every new technology development comes with exhortations for CIOs to place it top of their agenda. However, in the case of AI, it may well be the most important change we'll see in the philosophy, practice and management of business.
- AI draws on and is combining with exponential performance developments in technologies such as computer hardware, big data management, the internet of things and the fields of machine-learning, neural networks, and robotics.
- As a result, AI is beginning to fulfill its potential of transforming businesses. CIOs have to ensure they are investing the time and attention to understand what AI is, why so much is being invested and where the opportunities are.

Credits/References: Raconteur

WHAT IS ALL THIS “AI” BUZZ ABOUT?

DEFINTIONS

WHAT IS AI? (1/3)

AI has become a buzzword. It is often used alongside terms like Machine Learning, Deep Learning, Neural Networks etc. It is important to understand how these terms are interrelated.

COMPUTER SCIENCE (CS)

The study of automating algorithmic processes that scale. A computer scientist specializes in the theory of computation and the design of computational systems

ARTIFICIAL INTELLIGENCE (AI)

Artificial intelligence (AI) is intelligence exhibited by machines. An ideal "intelligent" machine is a flexible rational agent that perceives its environment and takes actions that maximize its chance of success at some goal

MACHINE LEARNING (ML)

The study and construction of algorithms that can learn from and make predictions on data

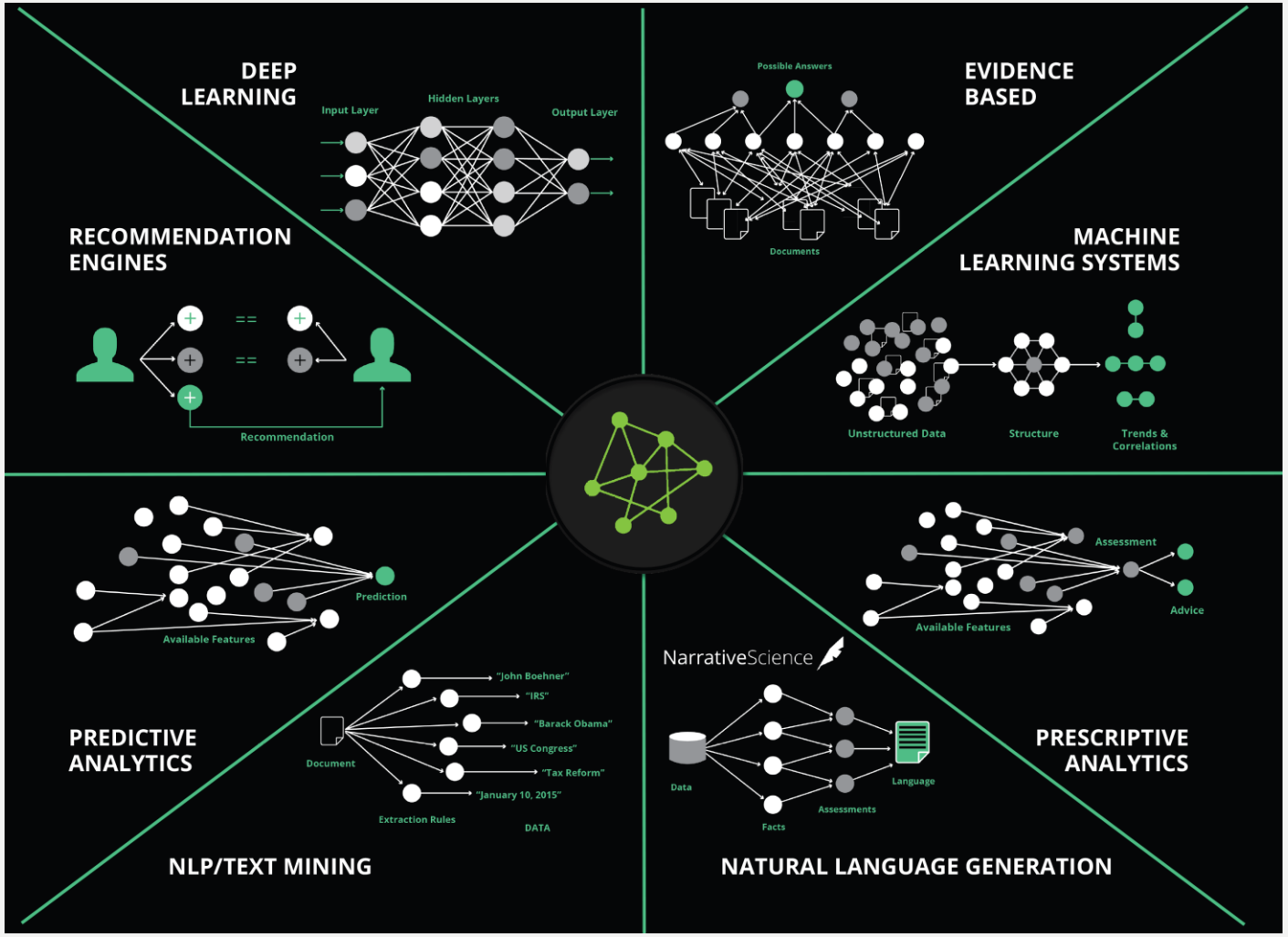
DEEP LEARNING (DL)

Deep learning is a branch of machine learning based on a set of algorithms that attempt to model high-level abstractions in data by using a deep graph with multiple processing layers, composed of multiple linear and non-linear transformations.

Credits/References: Arno Candel, H2O.ai

WHAT IS AI? (2/3)

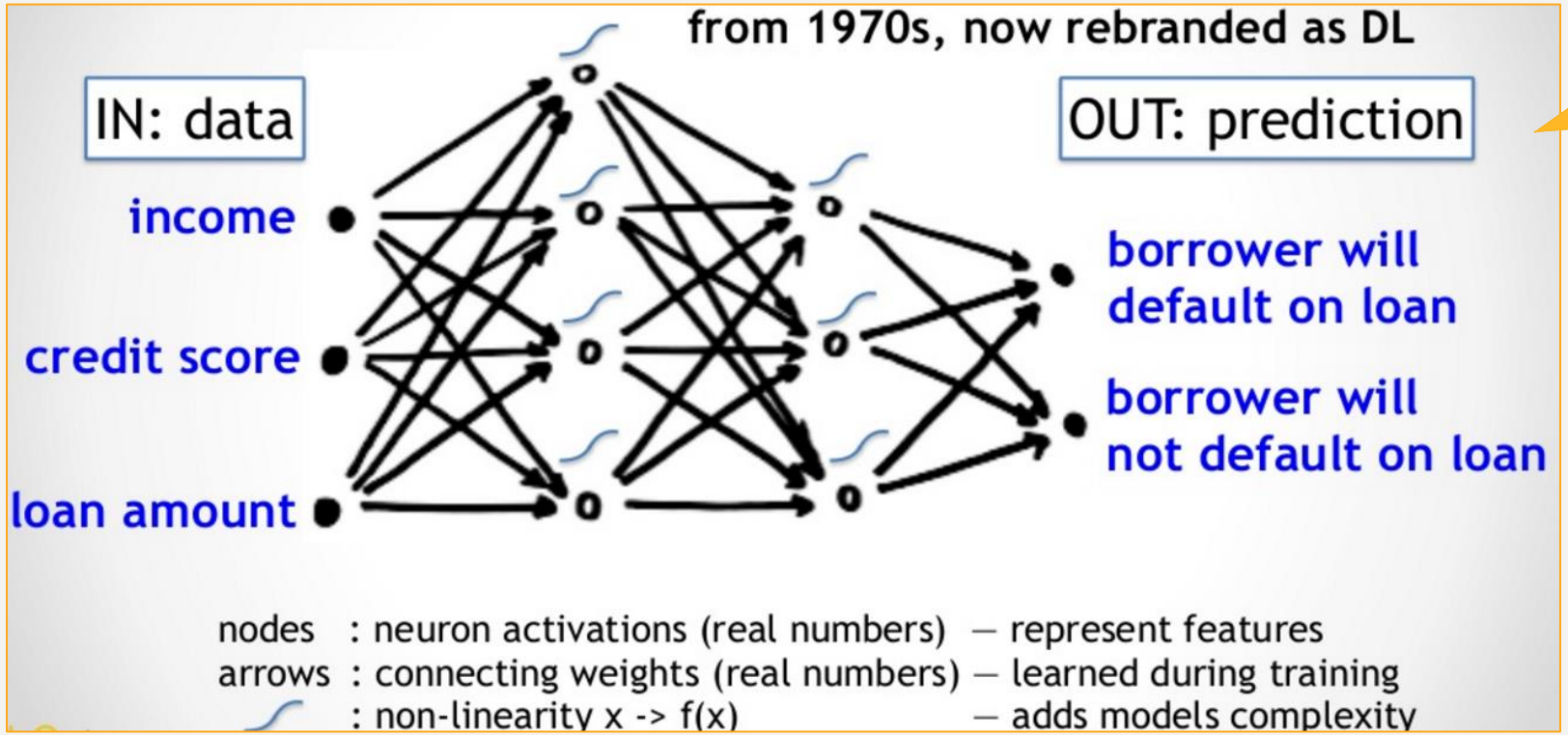
The artificial intelligence ecosystem is complex. It runs from machine learning to natural language processing and generation to predictive analytics to deep learning systems!



Credits/References: NarrativeScience

WHAT IS AI? (3/3)

Deep Learning is probably the hottest area in AI today. CIOs can't afford to ignore it!



Deep Learning explained with an example

Two+ Minute Papers - How Does Deep Learning Work?

Károly Zsolnai-Fehér

8 months ago • 24,227 views

Artificial neural networks provide us incredibly powerful tools in machine learning that are useful for a variety of tasks ranging from ...

CC

A short yet very powerful video about Deep Learning

Credits/References: Arno Candel, H2O.ai

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WHAT'S THE HISTORY OF AI? (1/3)

THE PROMISE OF INTELLIGENCE

- The quest for artificial intelligence (AI) began over 70 years ago, with the idea that computers would one day be able to think like us. Ambitious predictions attracted generous funding, but after a few decades there was little to show for it.
- But, in the last 25 years, new approaches to AI, coupled with advances in technology, mean that we may now be on the brink of realizing those pioneers' dreams.

1950

- **Science fiction steers the conversation:** In 1950, I Robot was published – a collection of short stories by science fiction writer Isaac Asimov. Asimov was one of several science fiction writers who picked up the idea of machine intelligence, and imagined its future.

1956

- **A 'top-down' approach:** The term 'artificial intelligence' was coined for a summer conference at Dartmouth University, organized by a young computer scientist, John McCarthy. Top scientists debated how to tackle AI.

1968

- **2001: A Space Odyssey – imagining where AI could lead:** Minsky influenced science fiction too. He advised Stanley Kubrick on the film 2001: A Space Odyssey, featuring an intelligent computer, HAL 9000.

1969

- **Tough problems to crack:** AI was lagging far behind the lofty predictions made by advocates like Minsky – something made apparent by Shakey the Robot - the first general-purpose mobile robot able to make decisions about its own actions by reasoning about its surroundings But it was painfully slow, even in an area with few obstacles.

Credits/References: BBC

WHAT'S THE HISTORY OF AI? (2/3)

1973

- **The AI winter:** By the early 1970s AI was in trouble. Millions had been spent, with little to show for it.

1981

- **A solution for big business:** The moment that historians pinpoint as the end of the AI winter was when AI's commercial value started to be realized, attracting new investment. The first successful commercial expert system, known as the RI, began operation at the Digital Equipment Corporation helping configure orders for new computer systems. By 1986 it was saving the company an estimated $40m a year.

1990

- **Back to nature for 'bottom-up' inspiration:**
  Then AI scientist Rodney Brooks published a new paper: Elephants Don't Play Chess. Brooks argued that the top-down approach of pre-programming a computer with the rules of intelligent behaviour was wrong. He helped drive a revival of the bottom-up approach to AI, including the long unfashionable field of neural networks.

1997

- **Man vs machine: Fight of the 20th Century:** Supporters of top-down AI still had their champions: supercomputers like Deep Blue, which in 1997 took on world chess champion Garry Kasparov. The supercomputer won the contest, dubbed 'the brain's last stand', with such flair that Kasparov believed a human being had to be behind the controls.

2002

- **The first robot for the home:** Rodney Brook's spin-off company, iRobot, created the first commercially successful robot for the home – an autonomous vacuum cleaner called Roomba.

2005

- **War machines**: Having seen their dreams of AI in the Cold War come to nothing, the US military was now getting back on board with this new approach. They began to invest in autonomous robots. BigDog, made by Boston Dynamics, was one of the first.

Credits/References: BBC

WHAT'S THE HISTORY OF AI? (3/3)

2008

- **Starting to crack the big problems:** In November 2008, a small feature appeared on the new Apple iPhone – a Google app with speech recognition. It seemed simple. But this heralded a major breakthrough. At first it was still fairly inaccurate but, after years of learning and improvements, Google now claims it is 92% accurate.

2010

- **Dance bots:** At the same time as massive mainframes were changing the way AI was done, new technology meant smaller computers could also pack a bigger punch. These new computers enabled humanoid robots, like the NAO robot, which could do things predecessors like Shakey had found almost impossible. At Shanghai's 2010 World Expo, some of the extraordinary capabilities of these robots went on display, as 20 of them danced in perfect harmony for eight minutes.

2011

- **Man vs machine: Fight of the 21st Century:** In 2011, IBM's Watson took on the human brain on US quiz show Jeopardy. This was a far greater challenge for the machine than chess. Watson had to answer riddles and complex questions. Watson trounced its opposition – the two best performers of all time on the show. The victory went viral and was hailed as a triumph for AI.

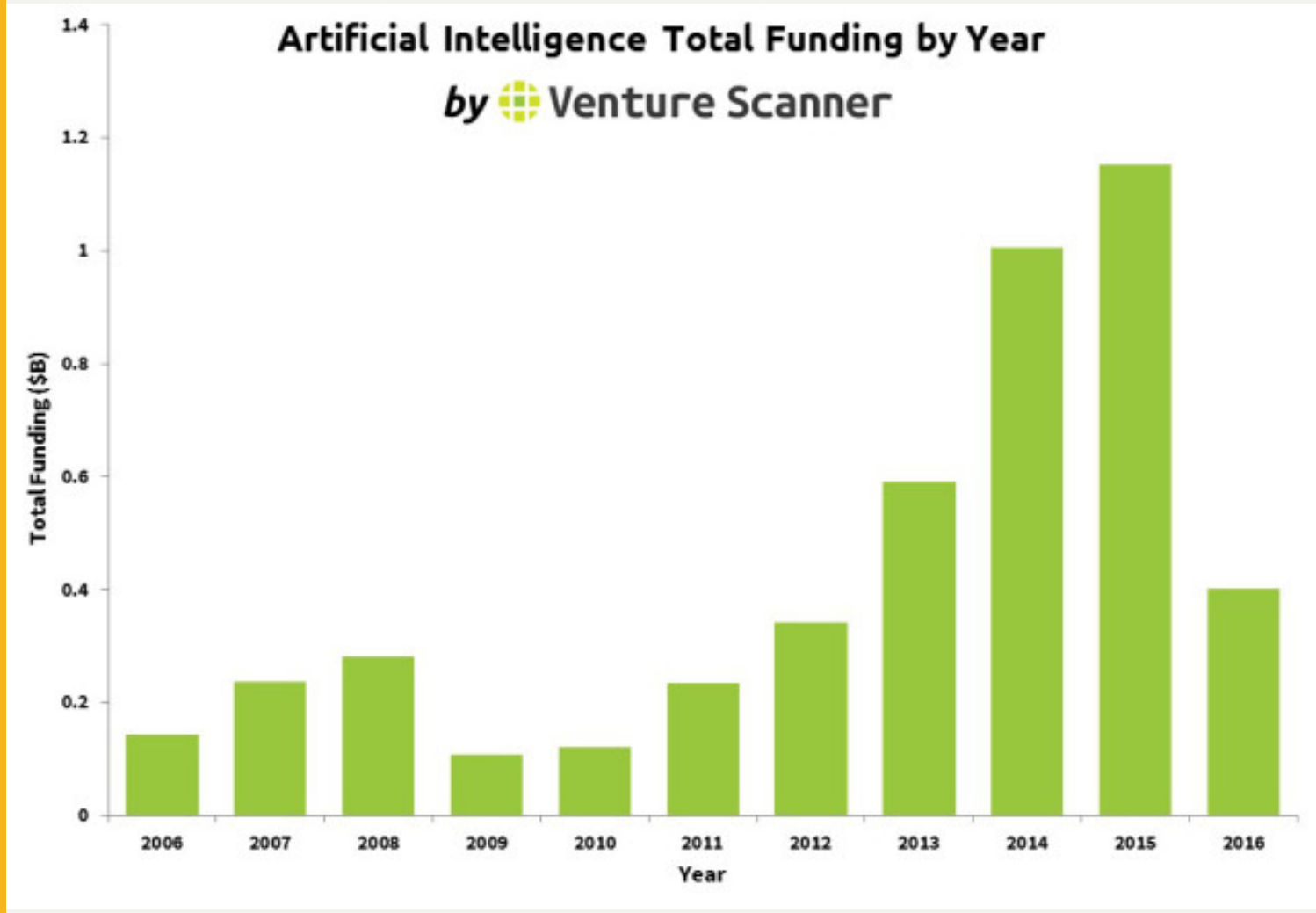
2016

- **Are machines intelligent now?**
  From Google's billion dollar investment in driverless cars, to Skype's launch of real-time voice translation, intelligent machines are now becoming an everyday reality that would change all of our lives.

Artificial Intelligence
ComputerHistory
1 year ago • 5,507 views
CHM Exhibition "Revolution: The First 2000 Years of Computing" Computers can be taught to play chess, drive cars, recognize ...

A short and exciting video about the history and evolution of AI

Credits/References: BBC

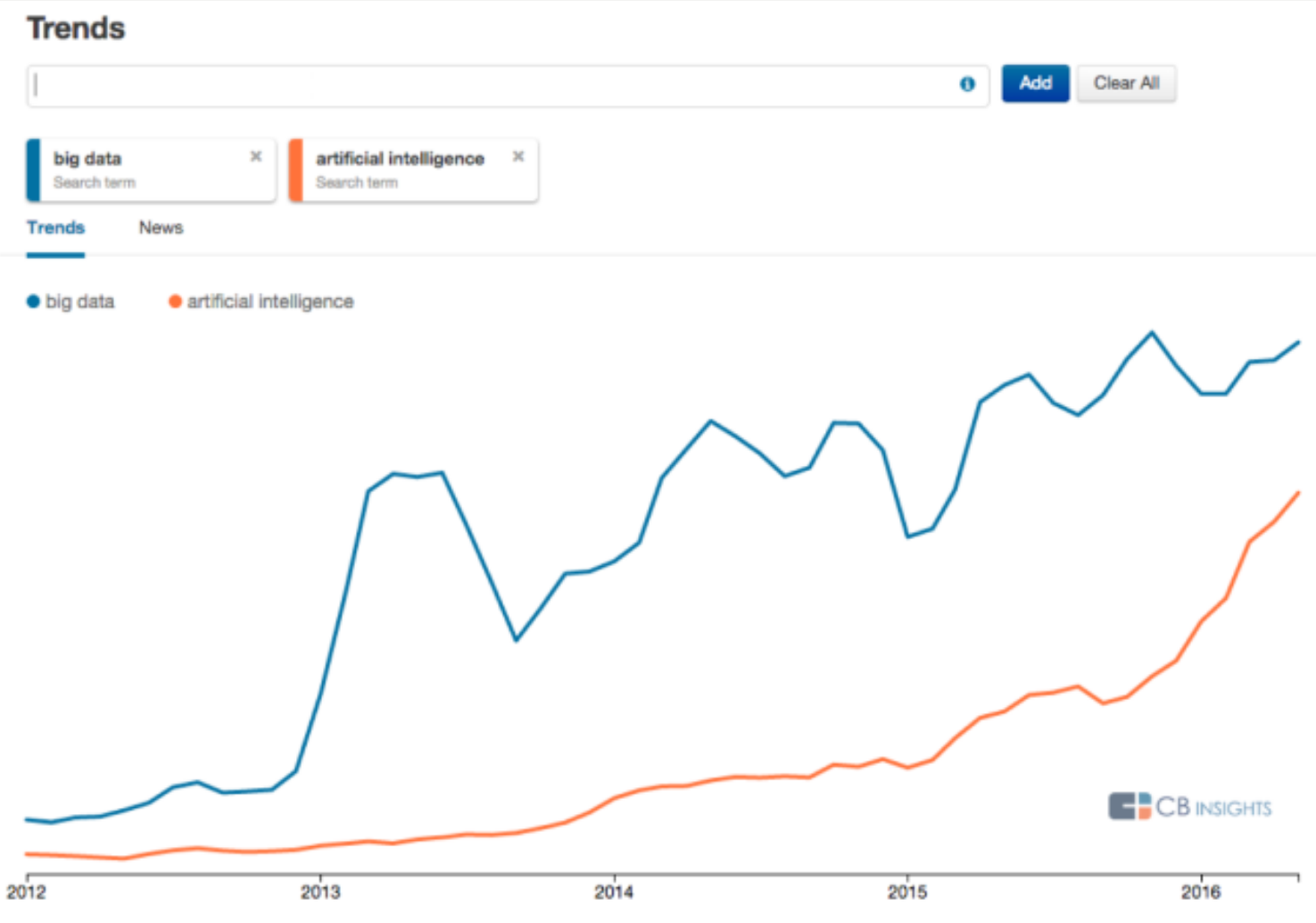


AI IS BOOMING (2/3)

RESURGENCE OF STARTUP FUNDING ACTIVITY

The Machine Learning (Applications) category is leading with over $2B in funding and 263 companies. Natural Language Processing is the runner-up in both stats with $662M in funding and 154 companies.

Credits/References: Venture Scanner



CB Insights Trends is software that analyzes millions of media articles to programmatically identify and understand the rate of adoption of emerging technologies and innovations.

Credits/References: CB Insights

AI IS BOOMING (3/3)

ARTIFICIAL INTELLIGENCE IS THE NEW BIG DATA

International Data Corp. predicts the worldwide market for cognitive software platforms and applications, which roughly defines the market for AI, to grow to $16.5 billion in 2019 from $1.6 billion in 2015 with a CAGR of 65.2%. The market includes offerings from both established tech giants and AI startups.

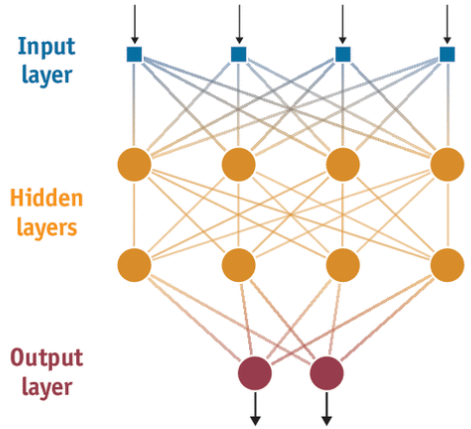
WHY IS AI BOOMING? (1/2)

The current boom in AI is based on an old idea, with a modern twist: so-called artificial neural networks (ANNs), modeled on the architecture of the human brain.

What is an Artificial Neural Network (ANN) ?

Layer cake

How an artificial neural network processes data



A neural network is organised into layers. Information is fed into the input layer, and artificial neurons in a series of "hidden" layers combine signals by applying different weights to them, and passing the result to the next layer. A "deep" network with many hidden layers can detect increasingly subtle features of the input data. Training the network involves adjusting its internal weights so that it gives the desired response when presented with particular inputs.

Why ANNs weren't as effective in the past?

- ANNs were starting to achieve some useful results in the early 1990s, for example in recognizing handwritten numbers.
- But attempts to get them to do more complex tasks ran into trouble; neural networks learn by example, and the standard training technique didn't work with larger (or "deeper") networks with more layers.
- After a flurry of excitement, enthusiasm for ANNs waned.

Credits/References: Economist

WHY IS AI BOOMING? (2/2)

3 CHANGES THAT HAVE LEAD TO THE REVIVAL OF ARTIFICIAL NEURAL NETWORKS (ANNS) AND AI IN THE PAST FEW YEARS

1. First, new training techniques made training deep networks feasible.
2. Second, the rise of the internet has made billions of documents, images and videos available for training purposes. But #2 requires a lot of number-crunching power and powerful hardware, which is where the third element comes in.
3. Around 2009, several AI research groups realized that graphical processing units (GPUs), the specialized chips used in PCs and video-game consoles to generate fancy graphics, were also well suited to modeling neural networks. GPUs could speed up training of its deep neural networks nearly a hundredfold, for example.

=

- AI now powers everything from Google's search engine, Facebook's automatic photo tagging, Apple's voice assistant, Amazon's shopping recommendations to Tesla's self-driving cars.

"A CIO pursuing AI a decade ago would have spent more than 100% of his or her budget on compute power. Now it's in the range of 10% to 20%, which frees up more resources for acquiring data sets and developing new algorithms." – IBM

Credits/References: Economist, WSJ

THE CURRENT STATE OF AI

WHERE WE ARE AND BEYOND

AI IS EVERYWHERE

"DEEP LEARNING HELPS ALPHABET'S GOOGLE IMPROVE ITS SEARCH RESULTS"

"AIRBNB USES MACHINE LEARNING TO RECOMMEND THE BEST PLACE TO STAY"

"BIG TECH COMPANIES HAVE DEVELOPED AI-POWERED VIRTUAL ASSISTANTS"

"GENERAL ELECTRIC USES COMPUTER VISION SYSTEMS TO QUICKLY IDENTIFY CRACKS IN JET ENGINE BLADES"

"MASTERCARD USES MACHINE LEARNING TOOLS TO ANALYZE MORE THAN 1.3 BILLION TRANSACTIONS PER DAY AND HELP DETECT FRAUD"

"NASDAQ IS USING ARTIFICIAL INTELLIGENCE SYSTEMS THAT PARSE TRADERS' CHATTER TO SPOT POTENTIAL INSIDER TRADING"

Credits/References: WSJ

HOW ARE BUSINESSES ADOPTING AI? (1/3)

AI IN FINANCE

- 80 per cent of the underlying data being processed in the financial services sector remains either semi-structured or not structured and has to be processed manually. With AI, firms can analyze and contextualize such data almost instantly.
- The AI-powered "financial services assistant" is capable of performing deep-content analysis and evidence-based reasoning to accelerate and improve decisions. For example, a bank could use the system to make better recommendations of financial products based on comprehensive analysis of market conditions, the client's past decisions, recent life events and available offerings.
- AI has applications is in compliance, fraud detection and security. Integrating structured and unstructured data ensures compliance rules are being applied and can help to detect offences, such as money laundering and insider trading. Natural language processing systems can uncover subtle cues in transactions that might indicate behavior that does not show up in the numbers.
- So-called "know your customer" systems are another widespread use of AI to manage unstructured and constantly changing data in order to assess risk.

Credits/References: Raconteur

HOW ARE BUSINESSES ADOPTING AI? (2/3)

AI IN LAW

- A proven application for AI in law is to screen claims for personal injury damages for signs of fraudulent behavior.
- AI is opening access to the law as systems become available that can reliably draft documents, such as tenancy and employment contracts, to suit individual circumstances.
- AI will make document assembly systems originally developed for lawyers accessible to lay users who need to draw up legal contracts on hand-held computers.

AI IN MARKETING & ADVERTISING

- Intelligent advertising hoardings capable of sensing the presence of passers-by before displaying an advertisement and learning from their individual reactions how relevant it is.
- Application of pattern recognition and cognitive learning systems to help process sales leads e.g. "Rachel" a virtual persona equipped with such technology from supplier Conversica, is being used in vertical markets, including technology, automotive, education and financial services.
- AI could automate the process of sorting predictively scored companies and contact profiles into campaigns by buying stage, and the custom segment is automatically deployed for programmatic ad targeting.

Credits/References: Raconteur

HOW ARE BUSINESSES ADOPTING AI? (3/3)

AI IN AGRICULTURE

- Today: Farming decisions based on tradition and intuition
- Future: Machine learning algorithms using sensor data and aerial imaging help farmers make intelligent data based decisions increasing yield.

AI IN AUTOMOTIVE

- Today: Cars driven by humans, prone to errors (nearly 1.3M people die in road accidents every year)
- Future: Driverless cars – leading to comfortable experience & less human fatalities.

AI IN CUSTOMER CARE

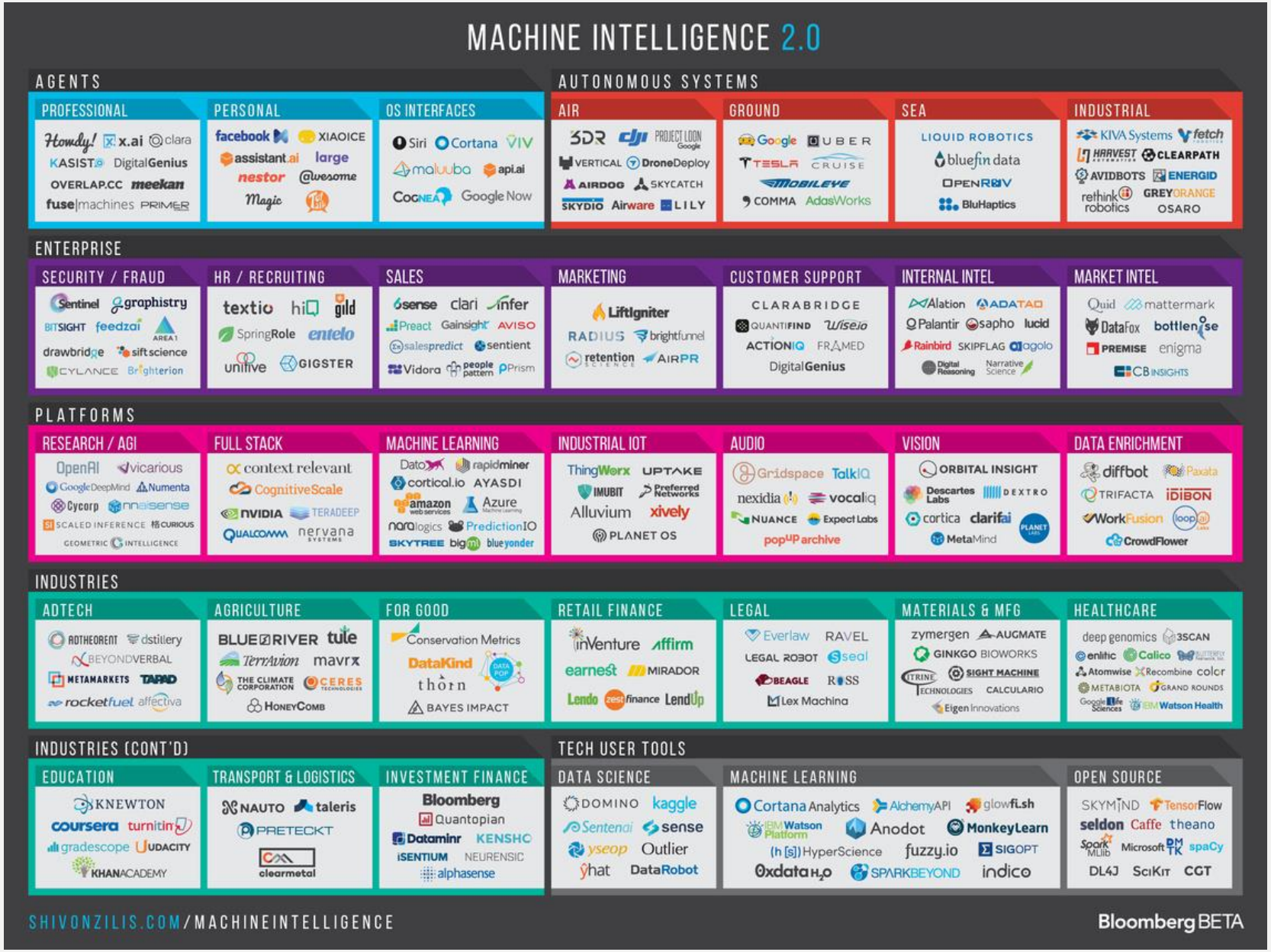
- Today: Cumbersome & time wasting Voice Menu … Press 1 for Credit Cards, Press 2 for Debit Cards, Press 3 for Loans...
- Future: Virtual assistant that can converse like humans & assist with ease

AI IN THE ENTERPRISE

- Today: Mundane tasks in office leading to decreased productivity
- Future: Automatic meeting schedulers, note takers, speech to text transcription & virtual personal assistants will improve productivity

Credits/References: Raconteur, Ajit Nazre + Rahul Garg

WHAT DOES THE AI VENDOR LANDSCAPE LOOK LIKE?



Credits/References: Shivon Zilis

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THE FUTURE OF AI IN BUSINESS

TOMORROW AND BEYOND

THE FUTURE OF AI IN BUSINESS (1/3)

BOTH BUSINESSES AND AI TECH COMPANIES WILL MOVE AT A FAST PACE

BUSINESSES	Today	Struggle to make heads or tails of artificial intelligence services.	Future	Heavy investment in becoming "artificial intelligence literate."
				Execs change their organizations to make use of new AI technologies
		Potential enterprise customers say: "these AI tech companies are trying to sell me snake oil" … "they can't even explain to me what they do."		Many different roles across the organization care about AI (from CEOs to technical leads to product managers).
AI TECHNOLOGY COMPANIES	Today	The corporates want to know what *current* business problems the technologies offered by the AI companies can solve, and don't care about the technology itself.	Future	AI companies figure out that they need to speak the language of solving a business problem. They start packaging solutions to specific business problems as separate products and branding them that way.
		The AI companies, on the other hand, just want to talk about their algorithms and how their platform *could* solve hundreds of problems.		They start working alongside the businesses to create a unique solution instead of just selling the technology itself, being one part educator and one part executor.

Credits/References: Shivon Zilis

THE FUTURE OF AI IN BUSINESS (2/3)

REGULATION WILL IMPACT WHICH AREAS WILL GET TRANSFORMED FIRST

AI technologies will transform the business world by starting in regulatory grey areas

- HEALTHCARE (automated diagnostics, early disease detection based on genomics, algorithmic drug discovery)
- AGRICULTURE (sensor- and vision-based intelligence systems, autonomous farming vehicles)
- TRANSPORTATION AND LOGISTICS (self-driving cars, drone systems, sensor-based fleet management)
- FINANCIAL SERVICES (advanced credit decisioning)

Strategies will evolve to overcome the difficulties of entering regulatory grey areas

- Startups are making a global arbitrage (e.g., health care companies going to market in emerging markets, drone companies experimenting in the least regulated countries).
- The "fly under the radar" strategy. Some startups are being very careful to stay on the safest side of the grey area, keep a low profile, and avoid the regulatory discussion as long as possible.
- Big companies like Google, Apple, and IBM are seeking out these opportunities because they have the resources to be patient and are the most likely to be able to effect regulatory change—their ability to affect regulation is one of their advantages.
- Startups are considering beefing up funding earlier than they would have, to fight inevitable legal battles and face regulatory hurdles sooner.

Credits/References: Shivon Zilis

THE FUTURE OF AI IN BUSINESS (3/3)

THE FUTURE OF AI IS EXCITING! WHAT TO EXPECT IN THE NEAR FUTURE?

→ The practical side of AI technologies will flourish. Most new entrants will avoid generic technology solutions, and instead have a specific business purpose to which to put artificial intelligence.

→ More combinations of the practical and eccentric. A few years ago, a company like Orbital Insight would have seemed farfetched—*wait, you're going to use satellites and computer vision algorithms to tell me what the construction growth rate is in China!?*—and now it feels familiar.

→ Researchers will continue doing things that make us stop and say, *"Wait, really?"*. Like creating fairy godmother drones to help the elderly, computer vision that detects the subtle signs of PTSD, and autonomous surgical robots that remove cancerous lesions

→ Overall, agents will become more eloquent, autonomous systems more pervasive, artificial intelligence more…intelligent. Expect more magic in the years to come!

Credits/References: Shivon Zilis

THANKS

AND

CHOOSE ANY APPLICATION AREA OF AI AND THEN PREPARE A SHORT REPORT AND PRESENTATION IN GROUP OF 5 STUDENTS

MAX MARK=10%