INDUSTRY 4.0 – IMPACTS AND STAKEHOLDERS ROLE

PIDS – SEMINAR

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INDUSTRY 4.0 – FIRe

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Transitions of Industrial Revolution

FIRST

Timeline – 1760 to 1840

Tagline – Mechanization using Water and Steam

Description –

- Began in Britain with the mechanization of the textile industry.
- Beforehand most manufacturing was done in homes and small shops.
- Transition from using hand tools and basic machines to power special purpose machinery and factories.

Outcomes –

- Groups of workers attacked factories and destroy machinery as a means of protest.
- Improved transportation, communication and banking.
- Increase in manufactured goods.
- Improved standard of living.
- Caused growth of industries in coal, iron and textile.

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Transitions of Industrial Revolution

SECOND

Timeline – 1870-1914

Tagline – Mass Production using Electricity

Description –

Marked by the birth of assembly lines and mass production.

New innovation in steel, petroleum and electricity production led to the introduction of automobiles and airplanes.

Steel replaced iron, it was utilized in construction, industrial machines, railroads, ships and others.

Inventions and innovations were engineering and science based.

Outcomes –

First electric railroad and electric cars.

Birth of radio communications and the first radio wave transmission across the Atlantic Ocean.

Birth of power stations and power generators.

Birth of telephone and perfection of the light bulb.

Inventions include refrigerator, typewriter, telephone, elevator, phonograph, washing machine and diesel engine.

Due to the benefits and wealth of new inventions and new ideas, the second industrial revolution is regarded to be positive and beneficial.

Each new thing led to another and therefore created a new age of discoveries and inventions.

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Transitions of Industrial Revolution

THIRD

Timeline – 1950-1980

Tagline – Automation using digital electronics and information technology Mass Production.

Description –

- When manufacturing became digital.
- Known to be as Digital Revolution.
- Mechanical and analog electronic technologies were replaced by digital electronics.

Outcomes –

- Birth of computer, digital mobile phone, and the Internet
- Birth of technologies like cellular phones for digital communication.
- Birth of digital camera, CD-ROM, Automated teller machines.
- Birth of industrial robots, electronic bulletin boards, video games and CGI to name a few.
- Privacy became a concern.

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Transitions of Industrial Revolution

FOURTH

Timeline – Current Decade

Tagline – Innovation based on fusion of physical, digital and biological.

Description –

Emerging technology breakthroughs in fields of artificial intelligence, robotics, the Internet of Things, autonomous vehicles, nanotechnology, biotechnology, materials science, energy storage, and quantum computing.

Outcomes –

Birth of self-driving cars, drones, virtual assistants.

Birth of software that translates, invests, analyze and identify.

Birth of Social media and the demand for better service.

Companies with great vision are currently reexamining the way they do business.

INDUSTRY 4.0 – FIRe

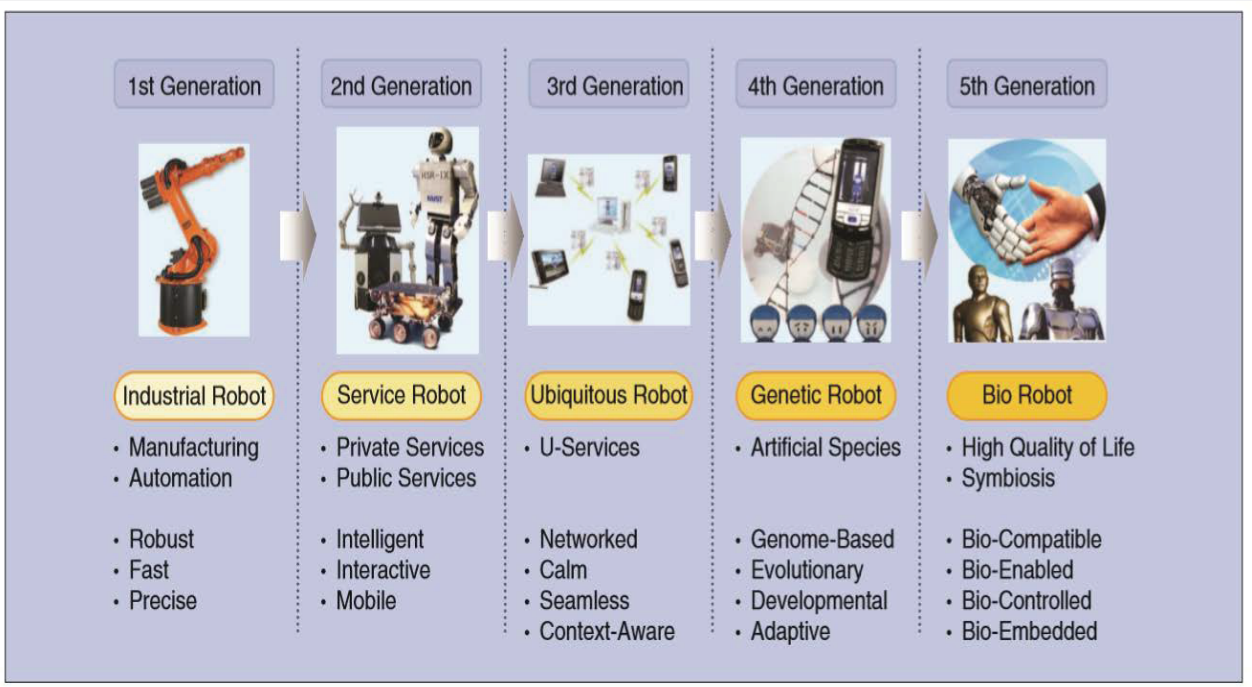
Transitions of Industrial Revolution

FOURTH

Outcomes –

- Will transform the lives of the people in the coming years.
- The report on Google self-driving car proved to be safer than the vehicles operated by humans [19].
- The application of Internet of Things (IoT) will definitely automate people's daily activities.
- Our refrigerator will text us when we run out of food.
- Our air-conditioners will switch on when we get inside our room and switch off when we leave the house.
- Intelligent robots will cook for our food.

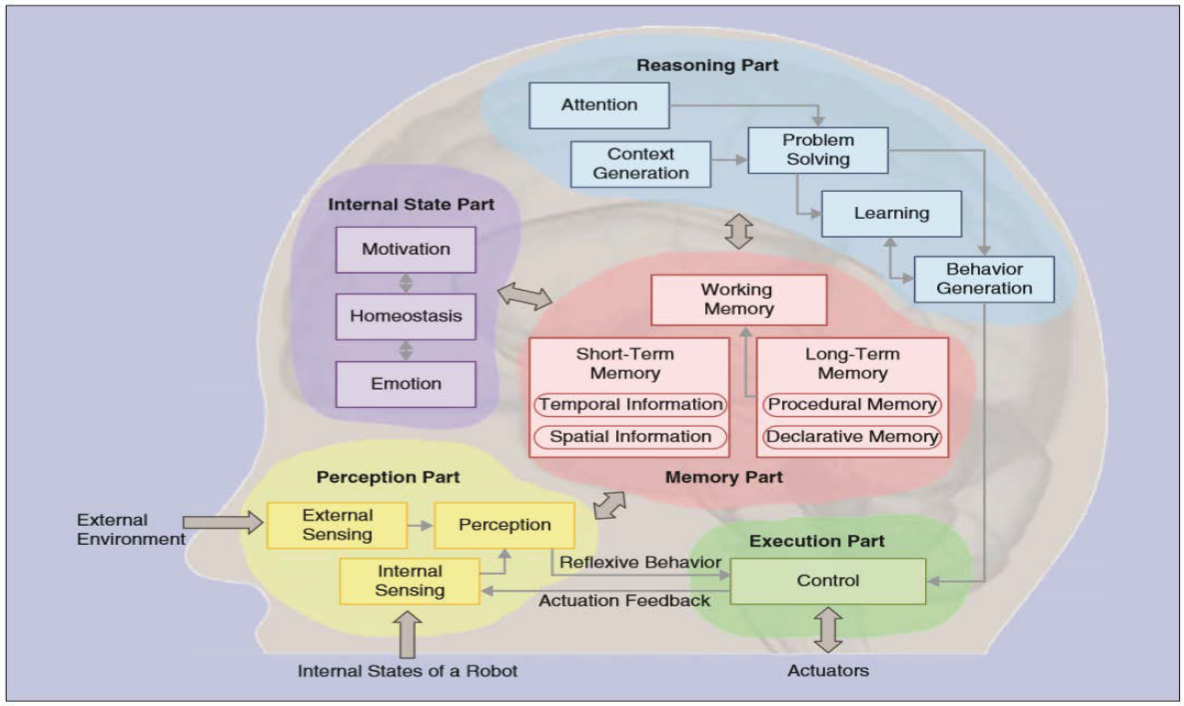
Machine Evolution



Considering the technologies that have been developed, the evolution of robots can be phased into five generations as shown in Fig. 1: industrial robot, service robot, ubiquitous robot, genetic robot and bio robot (Kim, Choi, Park, & Zaheer, 2013).

The defining characteristics for each of these generations are their salient features, intelligence and the purpose they serve.

Artificial Intelligence



The evolution of machines have seen a growth in the capabilities of machines, not only in its physical characteristics, but also in its capability to **interact "intelligently" to man and its environment.**

Artificial intelligence is the key in developing more sophisticated and intelligent machines.

Facts of Industrial Revolution

In the last three industrial revolutions, machines substituted manual labor, but the living standards of people improved over time because more value-added work was created.

FIRe - subsequent job growth could be minimal because many of the new jobs created might well be filled by sophisticated robots and machines.

Evidently the era of FIRe will introduce and undergo Disruptive Technology.

Disruptive Technologies

A disruptive technology is one that displaces an established technology and shakes up the industry or a ground-breaking product that creates a completely new industry.

Clayton M. Christensen - Harvard Business School professor coined the term *disruptive technology*. In his 1997 best-selling book, "The Innovator's Dilemma," .

Disruptive Technologies

The personal computer (PC) displaced the typewriter and forever changed the way we work and communicate.
Personal computing disrupted the television industry, as well as a great number of other activities.

Email transformed the way we communicate, largely displacing letter-writing and disrupting the postal and greeting card industries.

Disruptive Technologies

Cell phones made it possible for people to call us anywhere and disrupted the telecom industry

The laptop computer and mobile computing made a mobile workforce possible and made it possible for people to connect to corporate networks and collaborate from anywhere.
In many organizations, laptops replaced desktops.

Disruptive Technologies

Smartphones largely replaced cell phones and PDAs and, because of the available apps, also disrupted: pocket cameras, MP3 players, calculators and GPS devices, among many other possibilities. For some mobile users, smartphones often replace laptops. Others prefer a tablet.

Cloud computing has been a hugely disruptive technology in the business world, displacing many resources that would conventionally have been located in-house or provided as a traditionally hosted service.

POTENTIAL DT

World Economic Forum (WEF). 2016. The future of jobs: Employment, skills and workforce strategy for the fourth industrial revolution.

	Illustrative rates of technology improvement and diffusion	Illustrative groups, products, and resources that could be impacted	Illustrative pools of economic value that could be impacted
Mobile Internet	**$5million vs $400** Price of the fastest supercomputer in 1975 vs that of an Iphone X. Iphone X has more computing performance. **6x** Growth sales of smartphones and tablets since iPhone in 2007.	**4.3 billion** People remaining to conneted to the Internet using mobile data connection. **1 billion** Transaction and interaction workers, 40% of global work force.	**$1.7 trillion** GDP related to the Internet. **$25 trillion** Interaction and trasaction worker employment costs, 70% of global employment costs.
Internet of Things	**300%** Increase in connected machine to machine devices over the past 5 years. **80-90%** Price decline in MEMS sensors in the past 5 years.	**1 trillion** Things that could be connected to the Internet across industries such as manufacturing, health care and mining. **100 million** Global machine to machine (M2M) device connections across sectors like transportation, security, health care and utilities.	**$36 trillion** Operating costs of key affected industries (manufacturing, health care and mining).
Cloud technology	**18 months** Time to double server versus per dollar. **3x** Monthly cost of owning a server versus renting in the cloud.	**2 billion** Global users of cloud-based email services like Gmail, Yahoo and Hotmail. **80%** North American institution hosting or planning to host critical applications on the cloud.	**$1.7 trillion** GDP related to the Internet. **$ 3 trillion** Enterprise IT spend
Advanced Robotics	**75-85%** Lower price for Baxter than a typical industrial robot. **170%** Growth in sales of industrial robots, 2009–2011.	**320 million** Manufacturing workers, 12% of global workforce. **250 million** Annual major surgeries.	**$ 6 trillion** Manufacturing worker employment costs, 19% of global employment costs. **$ 2-3 billion** Cost of major surgeries.
Next generation genomics	**10 months** Time to double sequencing speed per dollar. **100x** Increase in acreage of genetically modified crops from 1996 to 2012.	**26 million** Annual deaths from cancer, cardiovascular disease, or type 2 diabetis **2.5 billion** People employed in agriculture	**$ 6.5 trillion** Global health care costs **$ 1.1 trillion** Global value of wheat, rice, maize, soy and barley.
Energy Storage	**40%** Price decline for lithium-ion battery pack in a electric vehicle since 2009	**1 billion** Cars and trucks globally **1.2 billion** People without access to electricity	**$ 2.5 trillion** Revenue from global consumption of gasoline and diesel **$ 100 billion** Estimated value of electricity for households currently without access
3D Printing	**90%** Lower price for a home 3D printer vs 4 years ago. **4x** Increase in additive manufacturing revenue in past 10 years.	**320 million** Manufacturing workers, 12% of global workforce. **8 billion** Annual number of toys manufactured globally.	**$ 11 trillion** Global manufacturing GDP **$ 85 billion** Revenue from global toys sales
Advanced Materials	**$ 1,000 vs $ 50** Difference in price of 1 gram of nanotubes over 10 years. **115x** Strenght to weight ration of carbon nanotubes vs steel.	**7.6 million tons** Annual global silicon consumption. **45,000 metric tons** Annual global carbon fiber consumption.	**$ 1.2 trillion** Revenue from global semiconductor sales. **$ 4 billion** Revenue from global carbon fiber sales.
Renewable Energy	**85%** Lower price for a solar photovoltaic per watt since 2000. **19x** Growth in solar photovoltaic and wind generation capacity since 2000.	**21,000 TWh** Annual global electricity consumption. **13 billion tons** Annual carbon dioxide emission form electricity generation.	**$ 3.5 trillion** Value of global electricity consumption. **$ 80 billion** Value of global carbon market transactions.
Autonomous and semi autonomous vehicles	**300,000+** Miles driven by Google's autonomous cars with only 1 accident which was caused by human errror. **1,540+** Cummulatively miles driven by cars competing DARPA Grand Challenge.	**1 billion** Car and trucks globally. **450000+** Civilian, military and general aviation aircraft in the world.	**$ 4 trillion** Automobile industry revenue. **$ 155 billion** Revenue from sales of civilian, military, and general aviation aircraft.

Practical Applications of AI

Computer Vision and Machine Learning

Quick, Draw

Computer vision is an interdisciplinary field that deals with how computers can be made for gaining high-level understanding from digital images or videos. From the perspective of engineering, it seeks to automate tasks that the human visual system can do.

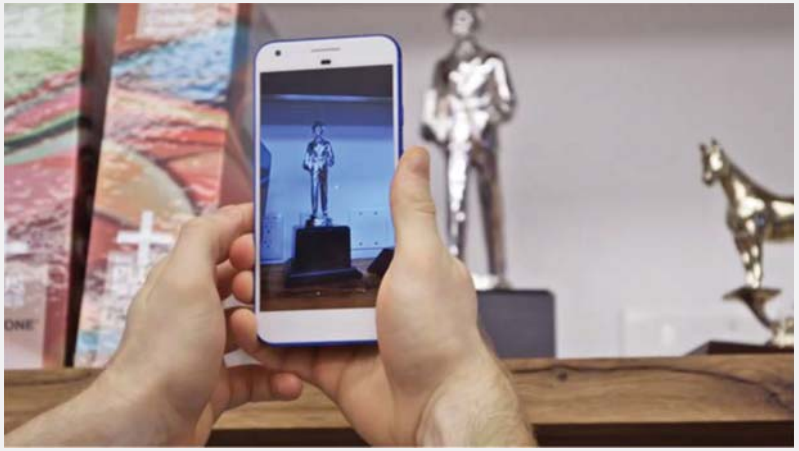
Machine learning is the subfield of computer science that, according to Arthur Samuel in 1959, gives "computers the ability to learn without being explicitly programmed".

https://aiexperiments.withgoogle.com/
https://en.wikipedia.org

Practical Applications of AI

Computer Vision and Machine Learning

Giorgio Cam

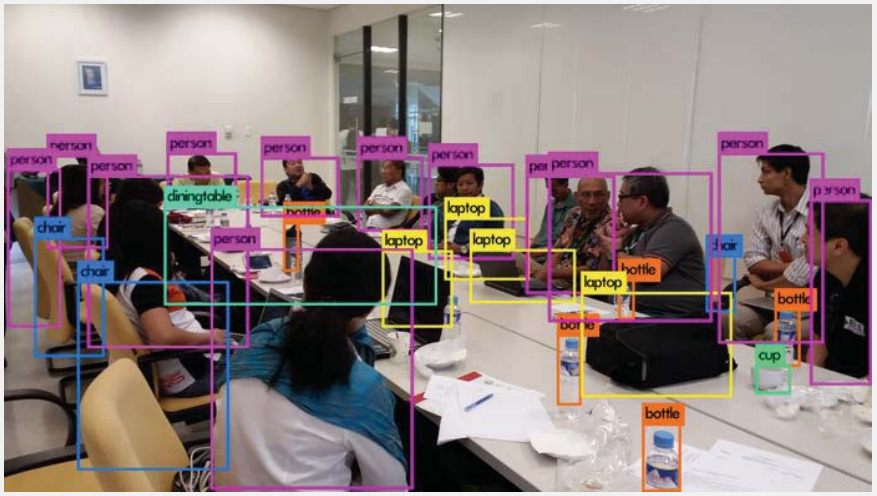


Thing Translator

https://aiexperiments.withgoogle.com/

Practical Applications of AI

Computer Vision and Machine Learning



Practical Applications of AI

Computer Vision and Machine Learning

Practical Applications of AI

Data Mining

Data mining is the computing process of discovering patterns in large data sets involving methods at the intersection of machine learning, statistics, and database systems.

AI Experiments: Visualizing High Dimensional Spaces

https://aiexperiments.withgoogle.com/
https://en.wikipedia.org

Practical Applications of AI

Virtual AI Assistants and Speech Recognition

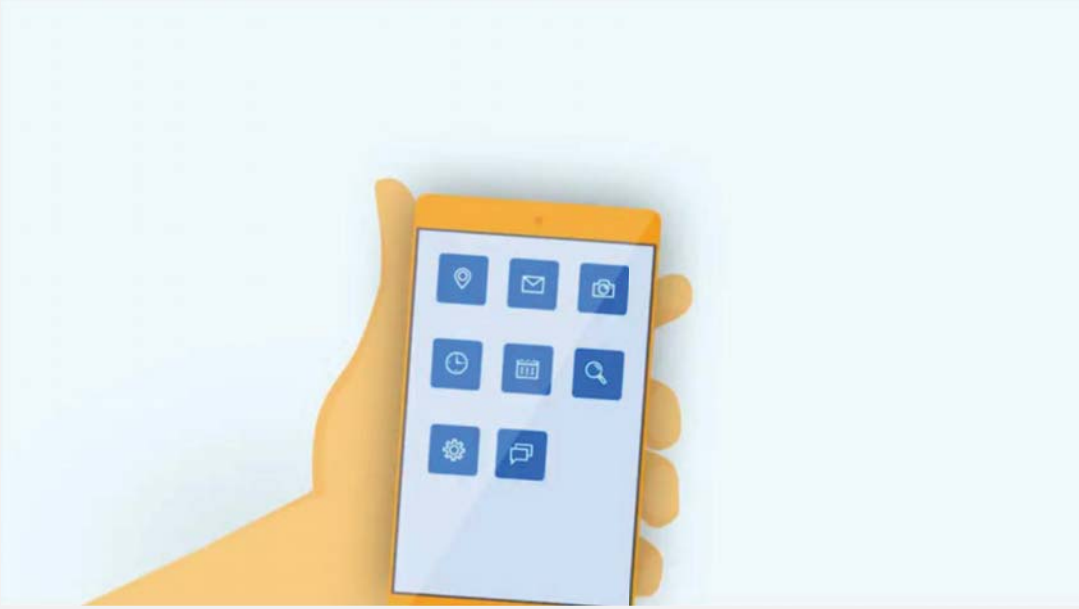
A **virtual assistant** is a software agent that can perform tasks or services for an individual. Sometimes the term "chatbot" is used to refer to virtual assistants generally or specifically those accessed by online chat (or in some cases online chat programs that are for entertainment and not useful purposes).

1. SIRI by Apple
2. Google Assistant
3. Amazon Alexa
4. Microsoft Cortana

Practical Applications of AI

Chatbots

- A **chatbot** (also known as a **talkbot**, **chatterbot**, **Bot**, **chatterbox**, **IM bot**, **interactive agent**, or **Artificial Conversational Entity**) is a computer program which conducts a conversation via auditory or textual methods.
- Such programs are often designed to convincingly simulate how a human would behave as a conversational partner, thereby passing the Turing test.

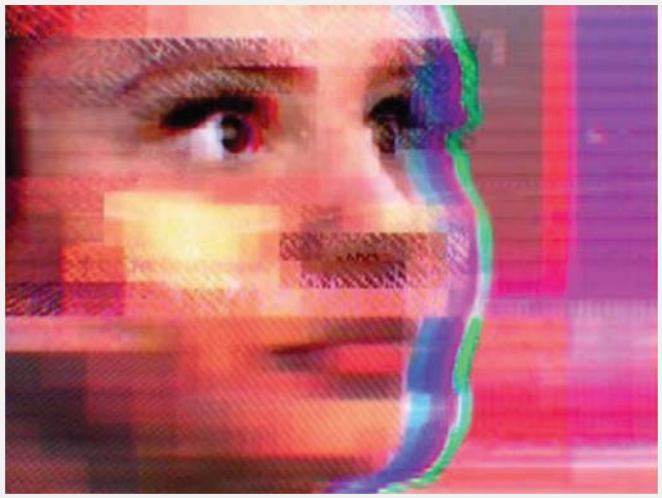


Octane AI

https://www.youtube.com/watch?v=IYJjrvXSbnM

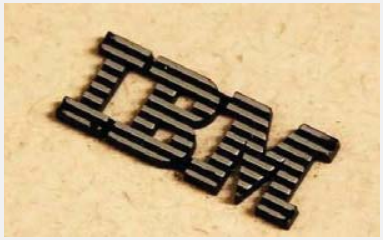
Practical Applications of AI

Chatbots



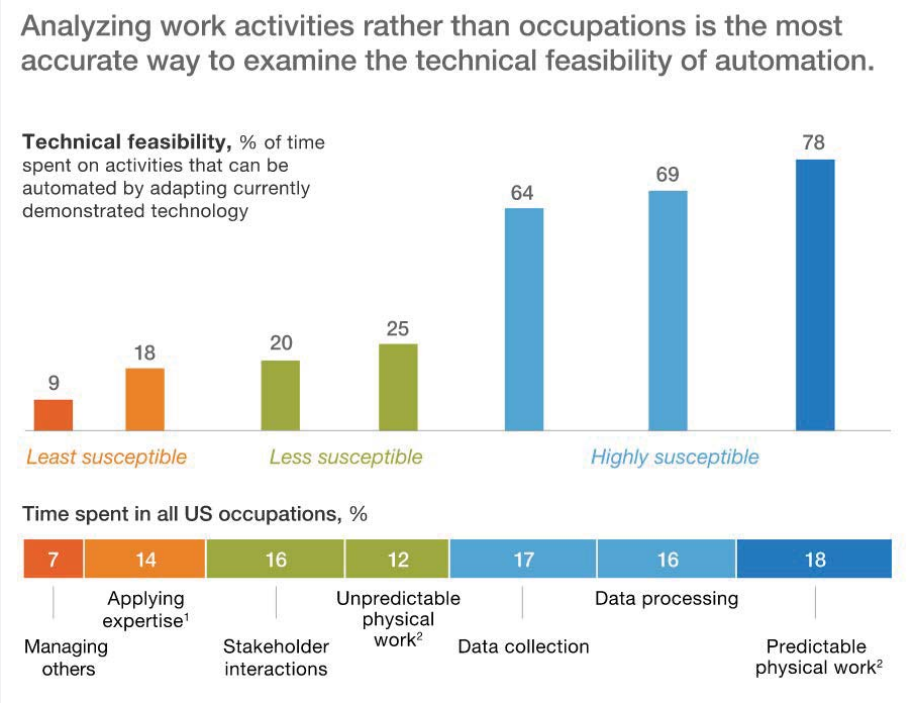
- **Tay** was an artificial intelligence chatterbot that was originally released by Microsoft Corporation via Twitter on March 23, 2016; it caused subsequent controversy when the bot began to post inflammatory and offensive tweets through its Twitter account, forcing Microsoft to shut down the service only 16 hours after its launch. According to Microsoft, this was caused by trolls who "attacked" the service as the bot made replies based on its interactions with people on Twitter

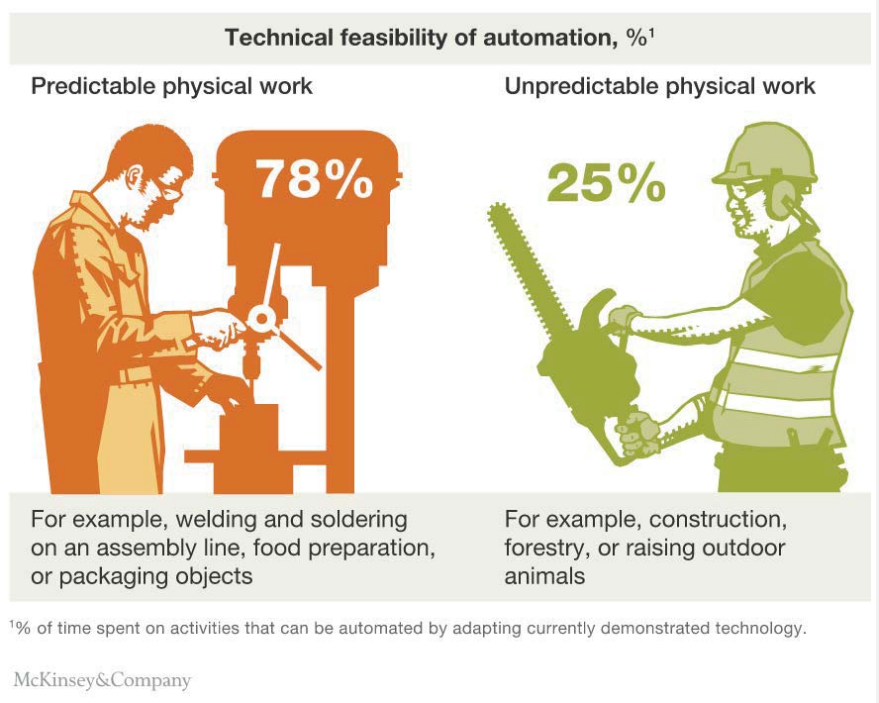
10 Technology Giants Investing in AI



http://www.techworld.com/picture-gallery/data/tech-giants-investing-in-artificial-intelligence-3629737/

Careers AI Will Replace





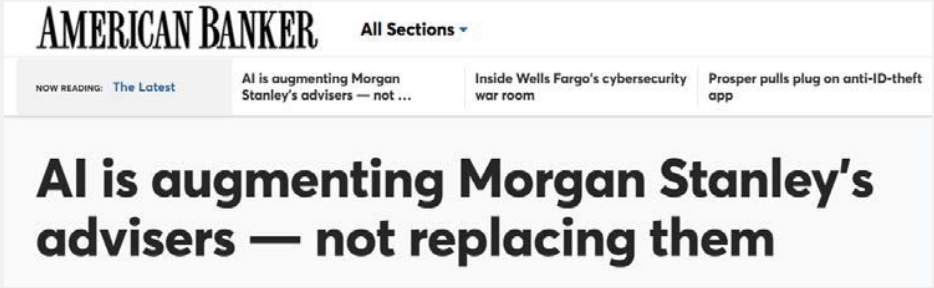
http://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/where-machines-could-replace-humans-and-where-they-cant-yet

Careers AI Will Replace

1) Telemarketers
2) Bookkeeping clerks
3) Compensation and Benefits Managers
4) Receptionists
5) Couriers
6) Proofreaders
7) Computer Support Specialists
8) Market Research Analysts
9) Advertising Salespeople
10) Retail Salespeople

https://blog.hubspot.com/marketing/jobs-artificial-intelligence-will-replace

News in AI



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