HCSC 255: Discover AI

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Agenda:

- Course overview
- Books and helpful resources in AI
- What is Data Science?
- What is artificial intelligence (AI)?
- History of AI
- Basic terminology used in the AI process
- Basic types Of AI technology
- What are the different types of AI?
- Careers in AI
- Trends shaping the future of AI
- Big Data

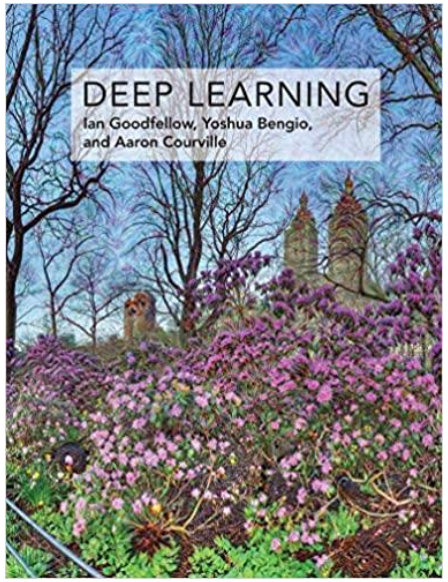
Course Overview (see syllabus)

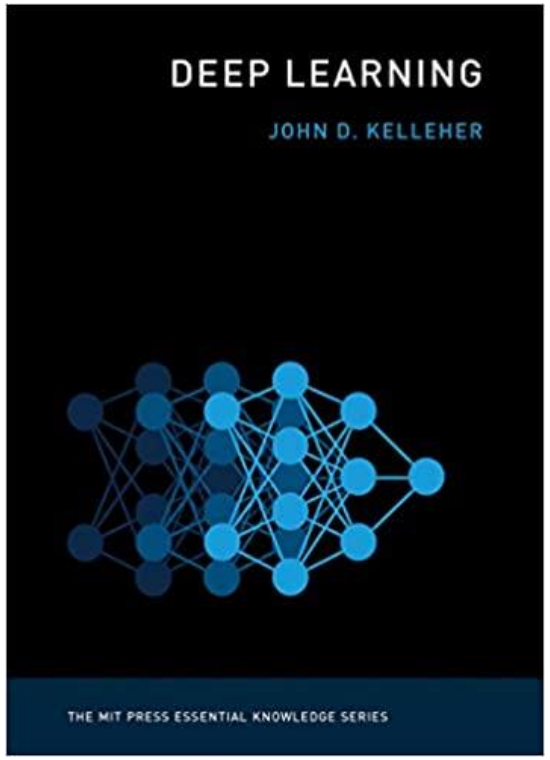
HCSC 255, Discovery AI, is a unique research-based course that pairs with AI4ALL College Pathways to focus on developing projects as an active mechanism to dive into the applications of AI. The core research topics in AI include problem solving, reasoning, planning, natural language understanding, computer vision, automatic programming, machine learning, and so on. Unquestionably, these topics are closely linked with each other. Your investigations will leverage the aforementioned topics with real world applications. Though this course is largely non-technical, you will have the opportunity to learn the fundamentals of the Python programming language and learn how to build a model in Python using standard libraries.

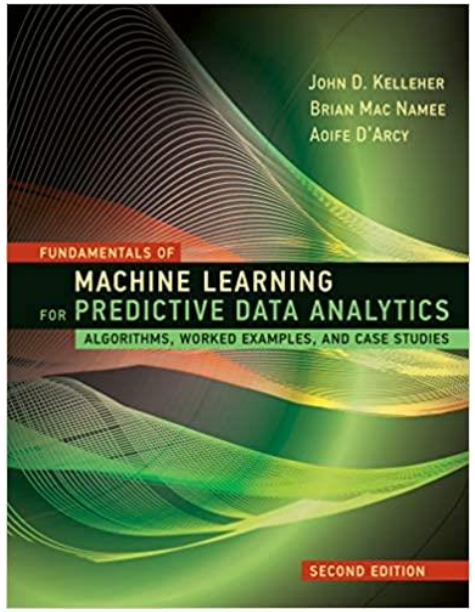
Course Learning Objective:

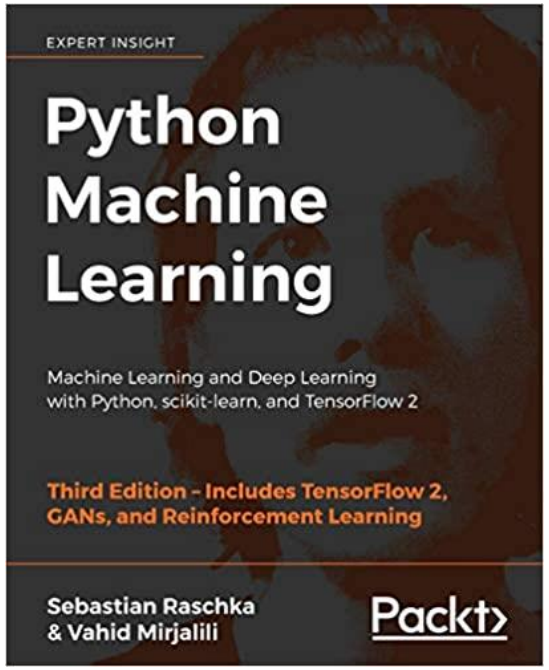
- A comprehensive guide to the basics of AI and machine learning
- The meaning behind common AI terminology, including neural networks, machine learning, deep learning, and data science
- What AI realistically can--and cannot--do
- How to spot opportunities to apply AI
- How to navigate ethical and societal discussions surrounding AI
- Develop machine learning and data science projects
- Gain an overview of the Python programming language using virtual classroom platform (VCL)

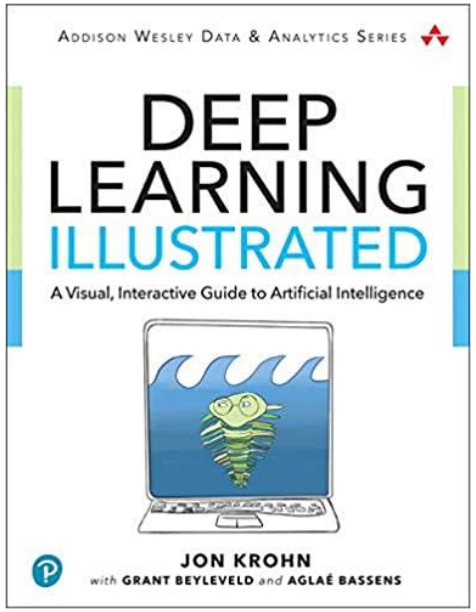
Supplemental texts in AI







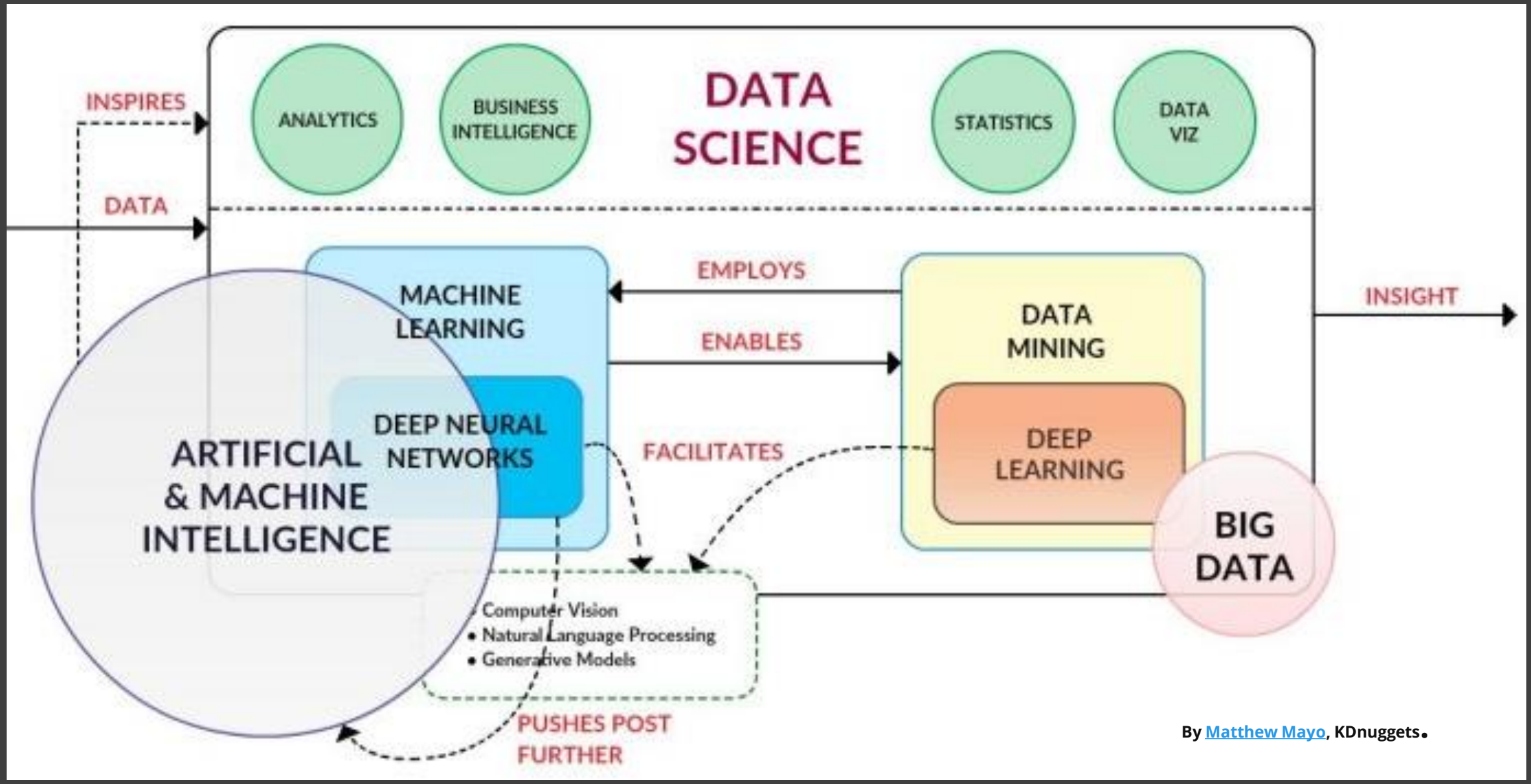




Data Science is the science which uses computer science, statistics and machine learning, visualization and human-computer interactions to collect, clean, integrate, analyze, visualize, interact with data to create data products.

Data science is the extraction of actionable knowledge directly from data through a process of discovery, or hypothesis formulation and hypothesis testing.

Based on the data science process, lets define some terms that are used..



What is artificial intelligence (AI)?

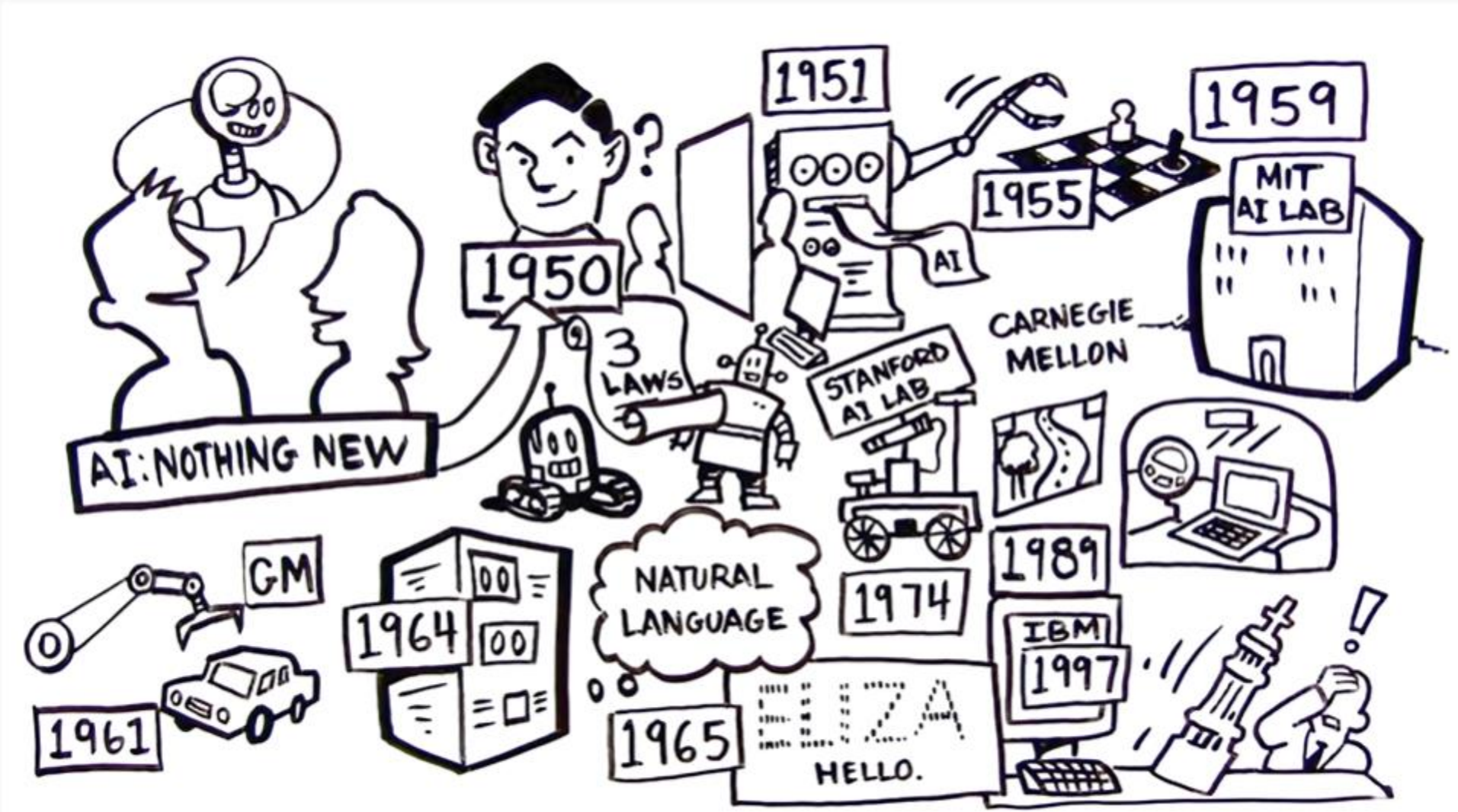
Here are some of the results to what is AI:

- AI is the theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.
- AI, sometimes called machine intelligence, is intelligence demonstrated by machines, in contrast to the natural intelligence displayed by humans and other animals.
- AI makes it possible for machines to learn from experience, adjust to new inputs and perform human-like tasks.
- AI is an area of computer science that emphasizes the creation of intelligent machines that work and react like humans.

AI is used in two ways:

- Assist people in their day-to-day tasks, personally or commercially, without having complete control of the output. It can also reduce errors, for example, using a virtual assistant and in data analysis.
- AI can help automate processes by functioning without the need for any human intervention—for example, robots performing process steps in a fulfillment center.

A Brief History of Artificial Intelligence



https://www.youtube.com/watch?v=056v4OxKwlI

- (Gartner) forecasted that by 2020, AI will be a top-five investment priority for more than 30 percent of CIOs.
- A (McKinsey) study estimates that tech companies are spending between $20 and $30 billion on AI, mostly in research and development.
- Global spending on cognitive and AI systems will reach $58 billion in 2021 (IDC)
- AI industry will be generating revenues of $119 billion a year by 2025. (Statista)
- The AI market will grow to a $190 billion industry by 2025 (Markets and Markets)
- The wearable artificial intelligence market will reach $180 billion by 2025. (Global Market Insights)
- The AI industry could be worth more than $15 trillion by 2030. (PwC)

Data Source: https://medium.com/

3 Types of Artificial Intelligence (AI)

Narrow AI

Dedicated to assist with or take over specific tasks.

General AI

Takes knowledge from one domain, transfers to other domain.

Super AI

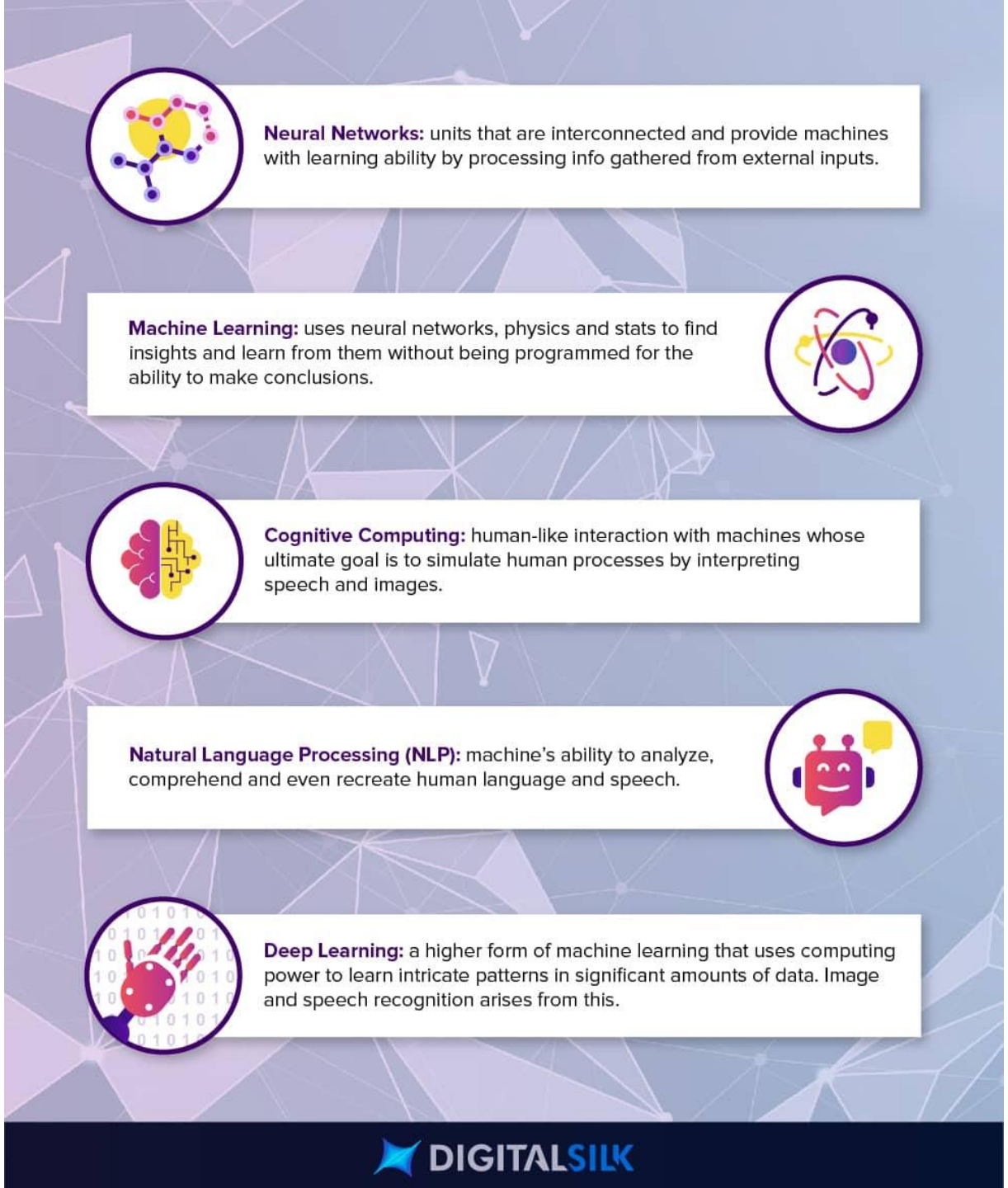
Machines that are an order of magnitude smarter than humans.

1. Narrow (ANI): A branch of AI that excels in performing singular tasks by replicating human intelligence, and AI's basic concept. Found in speech recognition systems and voice assistants.
2. General (AGI): AI whose purpose is general and whose efficiency can be applied to diverse tasks. This type of artificial intelligence can improve itself by learning and is the closest to the human brain in terms of capacities.
3. Super (ASI): Exceeding human intelligence, this AI concept is way more sophisticated than any other artificial intelligence system or even a human brain.

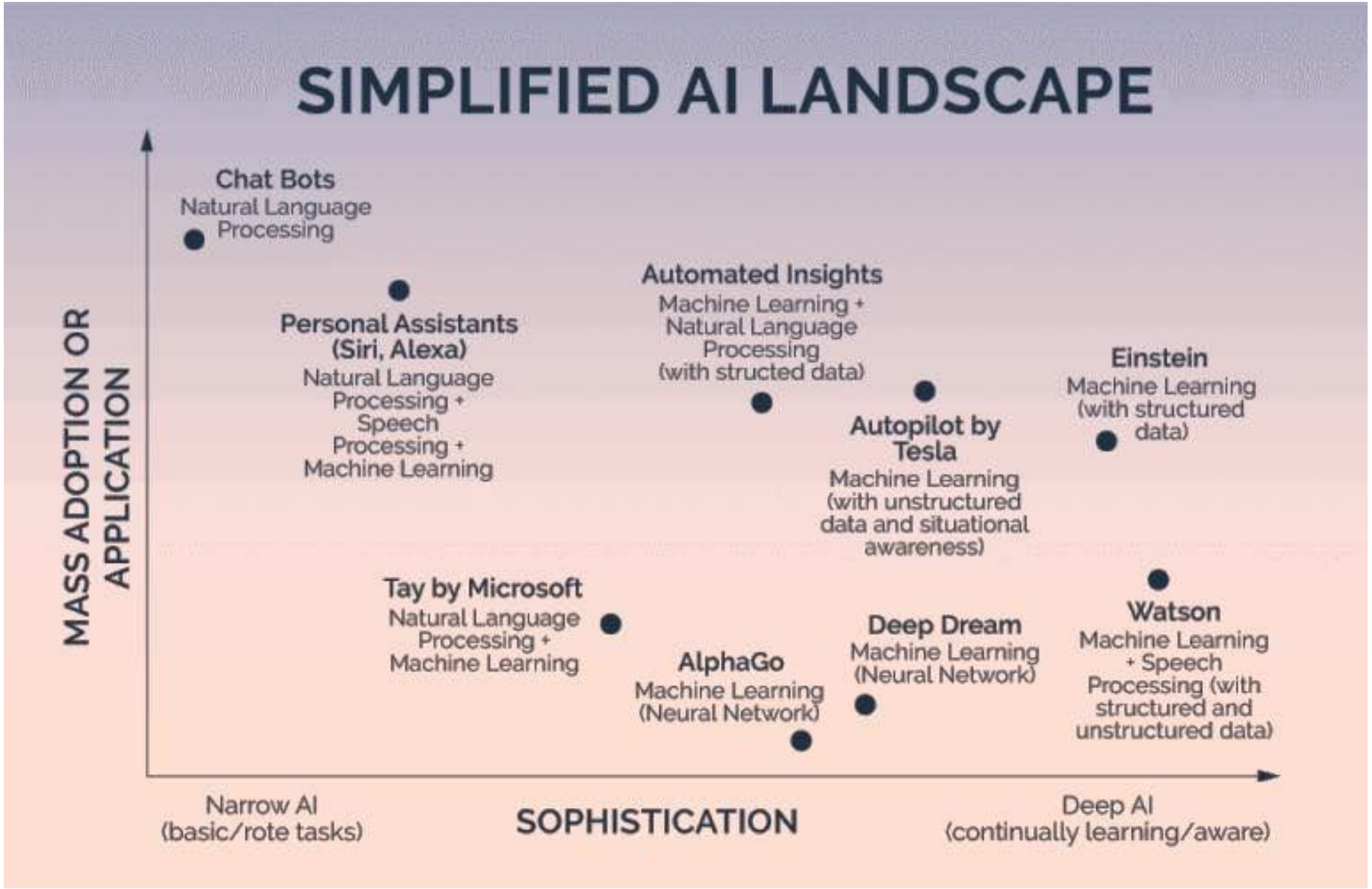
AI can be categorized in different ways by:

- **Application scope:** using Narrow AI and general AI.
  - Narrow AI systems, the AI systems in use today, are focused on a specific task like extracting data from documents.
  - Achieving human-like general intelligence (AGI) that can be applied to a diverse set of tasks is among the field's long-term goals. Prominent AI scientists expect AGI to take a few more decades to be realized.
- **Application areas:** Narrow AI applications are specialized in different application areas such as Natural Language Processing (NLP), computer vision, robotics etc.
- **Technical approaches used in development**: AI field draws upon computer science, information engineering, mathematics, psychology, linguistics, philosophy among other areas. As a result, there are numerous technical approaches such as genetic algorithms, artificial neural networks, decision trees, deep learning etc.

Basic types of AI technology



SIMPLIFIED AI LANDSCAPE



Components of AI

Applications
- Image recognition
- Speech recognition
- Chatbots
- Natural language generation
- Sentiment analysis

Types of models
- Deep learning
- Machine learning
- Neural networks

Software/hardware for training and running models
- GPUs
- Parallel processing tools (like Spark)
- Cloud data storage and compute platforms

Programming languages for building models
- Python
- TensorFlow
- Java
- C

Artificial Intelligence will generate $13 trillion in value by 2030,

according to a McKinsey Global Institute report.

Artificial Intelligence Industry Overview

Multiple

Market Size Growth

The AI industry could be worth more than $15 trillion by 2030. 80% of emerging technologies will have AI foundations by 2021.

80%

Business Adoption

37% of organizations in 2019 use AI in the workplace. The number of enterprises using AI in business grew by 270% between 2015 and 2019.

37%

Challenges

59 % of organizations named 'shortage of data science talent' as the primary barrier to realizing value from their big data technologies.

59%

AI vs. Human Labor

Cognitive technologies such as robots, AI, machine learning, and automation will replace 16% of U.S. jobs by 2025.

16%

Executives say the primary goals of AI implementation are:

Enhancing the features, functions, and performance of their products

51%

Optimize internal operations

36%

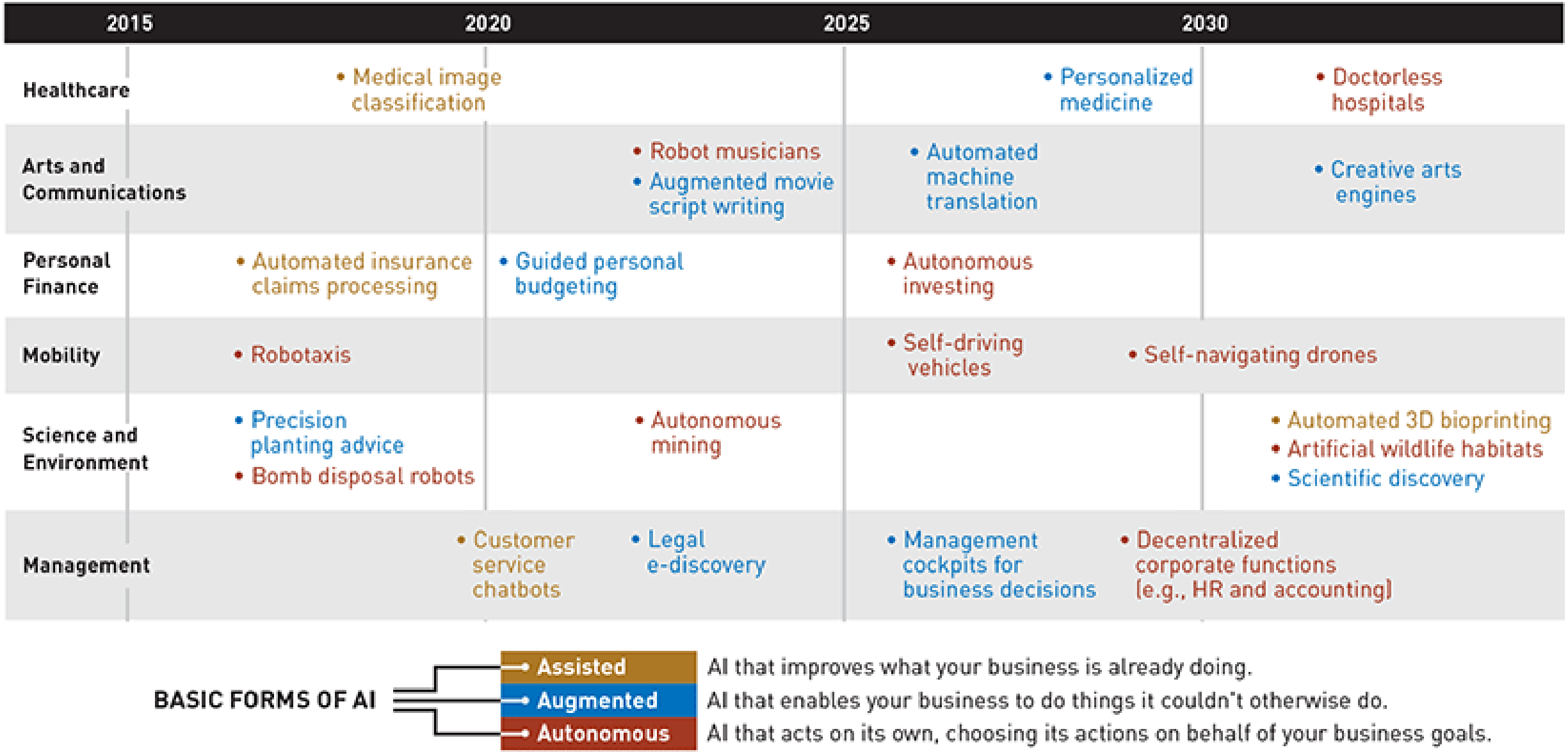
Freeing up workers

36%

Sources:
PwC's Global Artificial Intelligence Study: Exploiting the AI Revolution
Gartner
GlobeNewsWire Outlook on Artificial Intelligence in the Enterprise 2016
Harvard Business Review
Forrester, Robots, AI Will Replace 7% Of US Jobs By 2025

Exhibit 1: **Anticipated AI Applications**

Estimated dates of commercial availability for products and services incorporating the three forms of artificial intelligence.



Source: PwC research and analysis

The Jobs Landscape in 2022

WORLD ECONOMIC FORUM

emerging roles, global change by 2022

133 Million

declining roles, global change by 2022

75 Million

Top 10 Emerging

1. Data Analysts and Scientists
2. AI and Machine Learning Specialists
3. General and Operations Managers
4. Software and Applications Developers and Analysts
5. Sales and Marketing Professionals
6. Big Data Specialists
7. Digital Transformation Specialists
8. New Technology Specialists
9. Organisational Development Specialists
10. Information Technology Services

Top 10 Declining

1. Data Entry Clerks
2. Accounting, Bookkeeping and Payroll Clerks
3. Administrative and Executive Secretaries
4. Assembly and Factory Workers
5. Client Information and Customer Service Workers
6. Business Services and Administration Managers
7. Accountants and Auditors
8. Material-Recording and Stock-Keeping Clerks
9. General and Operations Managers
10. Postal Service Clerks

Source: Future of Jobs Report 2018, World Economic Forum

Careers in AI: Top trending AI jobs

- Data science consultants help companies improve their businesses leveraging their data. Data science consultants are also called machine learning consultants
- AI consulting is an emerging field that supports business leaders understand and take advantage of the AI opportunity. AI consultants help companies formulate their AI strategy, identify and prioritize AI use cases, support the implementation of AI solutions or directly implement custom AI solutions.
- "TOP TRENDING AI JOBS THAT CAN SHAPE YOUR CAREER IN MAY 2021“ by Disha Ganguli, May 8, 2021

Trends shaping the future of AI

- Data availability
  - Data been growing exponentially and is expected to continue to do so with increasing ubiquity of IoT devices. AI agents can learn more and understand human capabilities better.
- New AI algorithms are driving the growth of AI.
  - However, scientists need to rely on more complex AI algorithms to improve the performance of their solutions.
  - The main problem is that the interpretability of these algorithms reduces while the accuracy increases.
- Improved computing power
  - AI chips
  - Quantum computing
  - Economics

“Big data is a collection of data from traditional and digital sources inside and outside your company that represents a source for ongoing discovery and analysis.” (Lisa Arthur, CMO Network, 8/15/2013). “Big Data” is data whose scale, diversity, and complexity require new architecture, new tools, techniques, algorithms, and analytics to manage it and extract value and hidden knowledge from it…

BIG DATA GLOBAL MARKET SIZE FORECAST

by 2025 **$250* billion**

According to MarketsandMarkets, Adroit Market Research

by 2021 **$70* billion**

According to Wikibon, Frost & Sullivan, MarketsandMarkets, Statista

** - average assumption*

WHAT HAPPENS EVERY MINUTE

via Internet Live Stats

6,123 TB
TRAFFIC PRODUCED BY USERS

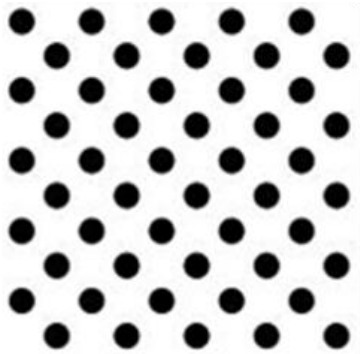
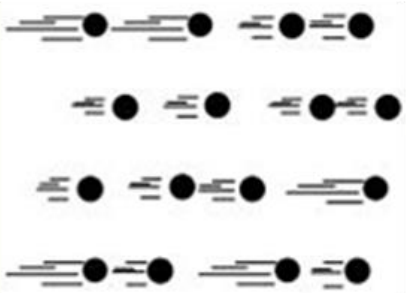
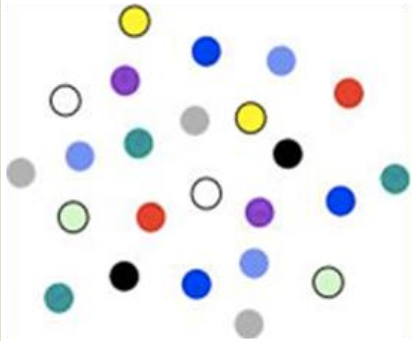
84,000
INSTAGRAM PHOTOS UPLOADED

5,200,000
GOOGLE SEARCHES

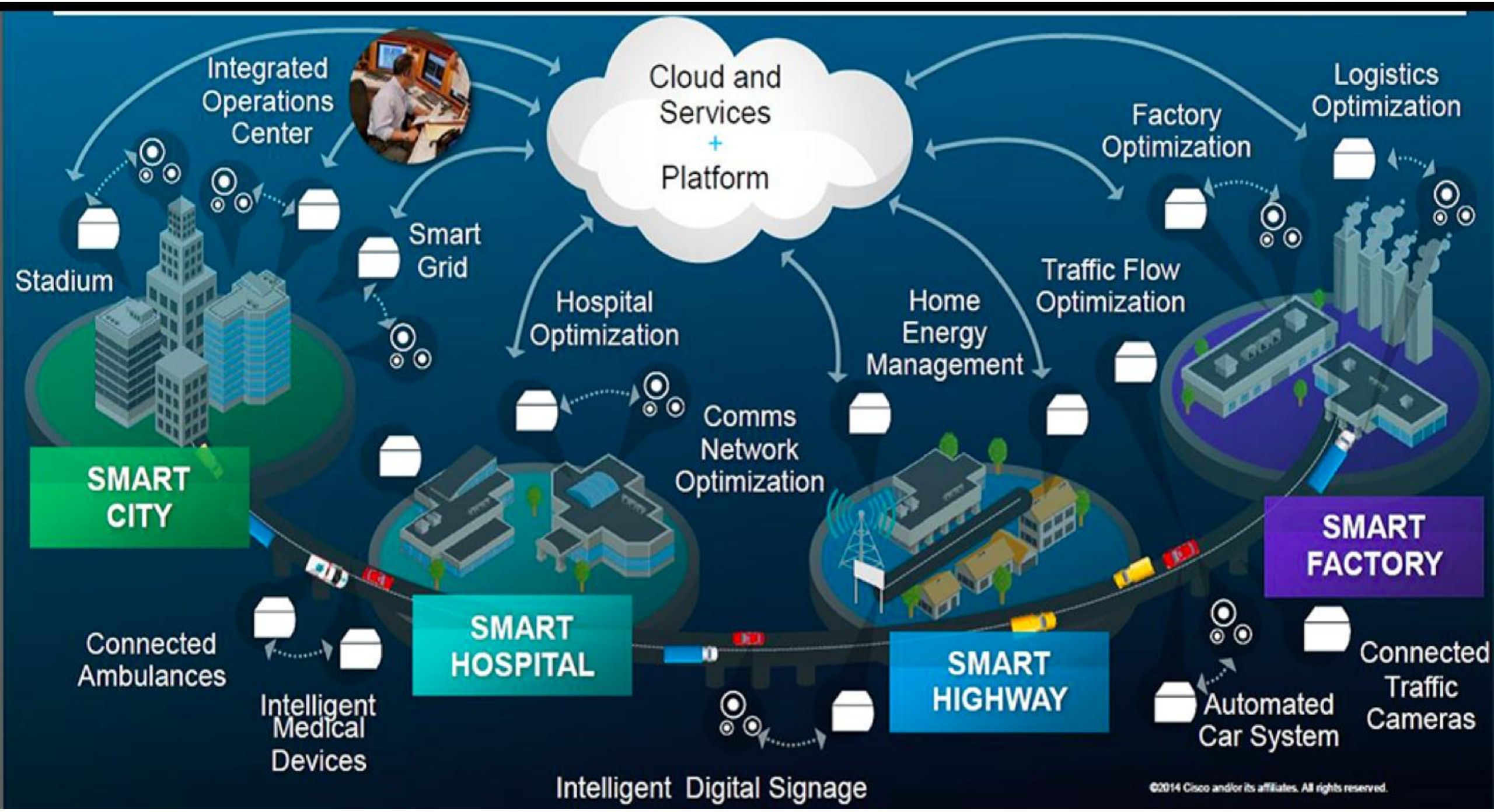
305,000
SKYPE CALLS

185,000,000
E-MAILS SENT

“Vs”of Big Data

Volume	Velocity	Variety	Veracity	Value
				
Data at Rest	**Data in Motion**	**Data in Many Forms**	**Data in Doubt**	**Data into Money**
Terabytes to Exabytes of existing data to process	**Streaming data, requiring milliseconds to seconds to respond**	**Structured, unstructured, text, multimedia,…**	**Uncertainty due to data inconsistency & incompleteness, ambiguities, latency, deception, model approximations**	**Business models can be associated to the data**

Adapted by a post of Michael Walker on 28 November 2012


Integrated Operations Center
Cloud and Services + Platform
Logistics Optimization
Factory Optimization
Smart Grid
Stadium
Traffic Flow Optimization
Hospital Optimization
Home Energy Management
Comms Network Optimization
SMART CITY
SMART FACTORY
SMART HOSPITAL
SMART HIGHWAY
Connected Ambulances
Intelligent Medical Devices
Automated Car System
Connected Traffic Cameras
Intelligent Digital Signage
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Data Definition Framework

Data Format

Structured

Data Source: Internal

Human-Generated

- Survey ratings
- Aptitude testing

Machine-Generated

- Web metrics from Web logs
- Product purchase from sales Records
- Process control measures

Data Source: External

Human-Generated

- Number of Retweets, Facebook likes, Google Plus +1s
- Ratings on Yelp
- Patient ratings ratings

Machine-Generated

- GPS for tweets
- Time of tweet/updates/postings

Unstructured

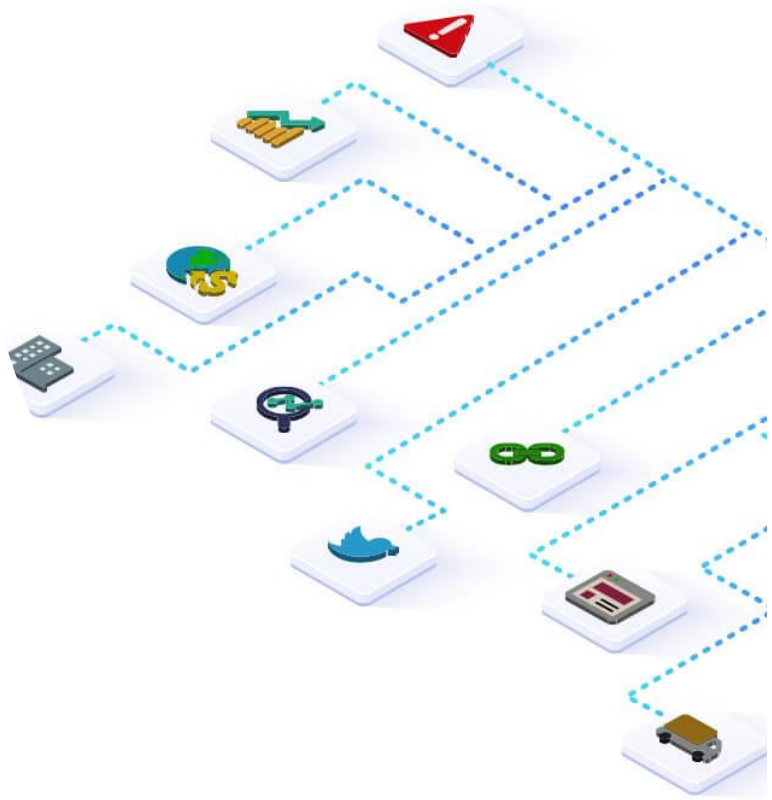
Human-Generated

- Emails, letters, text messages
- Audio transcripts
- Customer comments
- Voicemails
- Corporate video/communications
- Pictures, illustrations
- Employee reviews

Human-Generated

- Content of social media updates
- Comments in online forums
- Comments on Yelp
- Video reviews
- Pinterest images
- Surveillance video

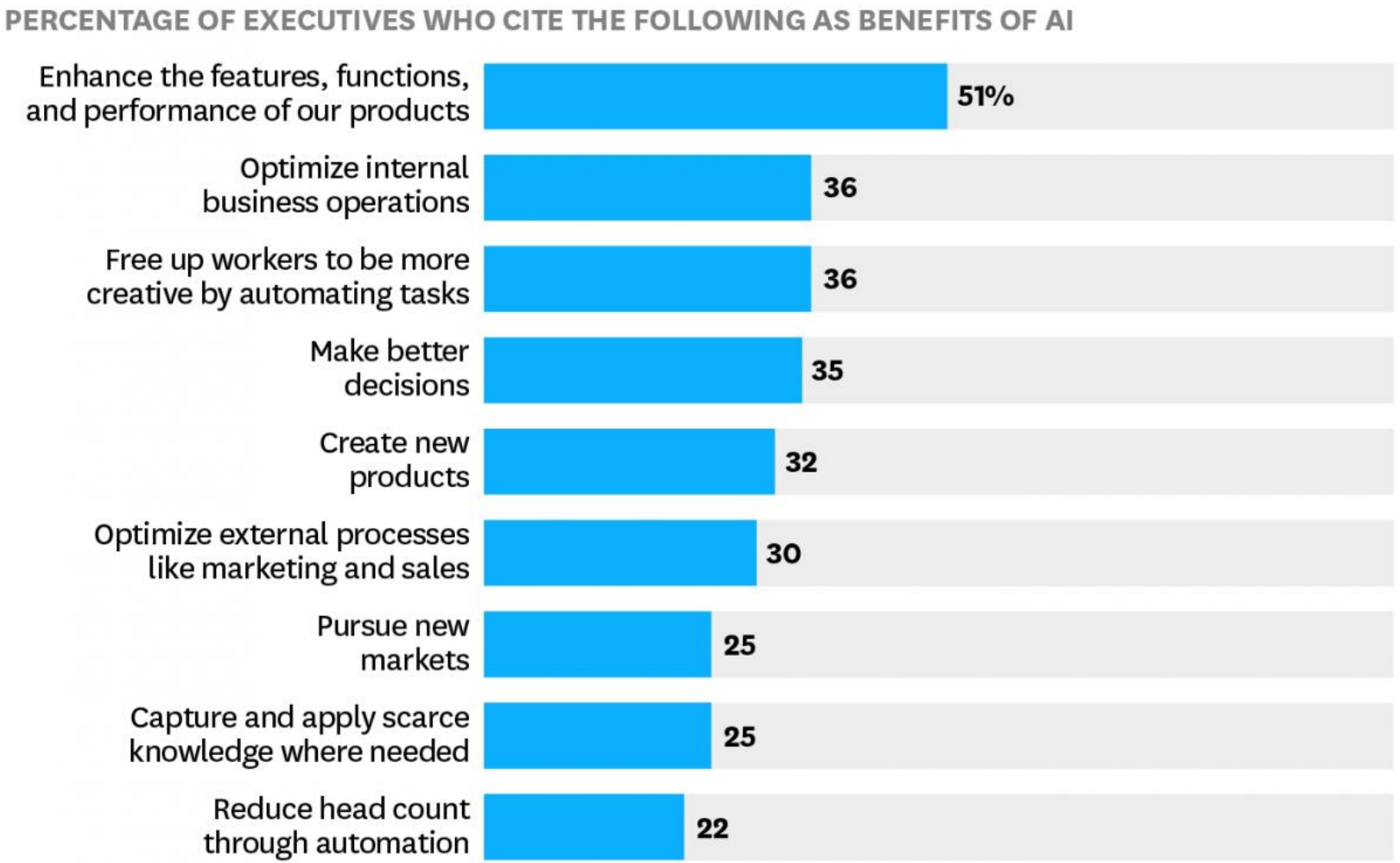
Types of Data Sets



- Record
  - ✓ Relational records
  - ✓ Data matrix, e.g., numerical matrix, crosstabs
  - ✓ Document data: text documents: term-frequency vector
  - ✓ Transaction data
- Graph and network
  - ✓ World Wide Web
  - ✓ Social or information networks
  - ✓ Molecular Structures
- Ordered
  - ✓ Video data: sequence of images
  - ✓ Temporal data: time-series
  - ✓ Sequential Data: transaction sequences
  - ✓ Genetic sequence data
- Spatial, image and multimedia:
  - ✓ Spatial data: maps
  - ✓ Image data
  - ✓ Video data

The Business Benefits of AI

We surveyed 250 executives who were familiar with their companies' use of cognitive technologies to learn about their goals for AI initiatives. More than half said their primary goal was to make existing products better. Reducing head count was mentioned by only 22%.



SOURCE DELOITTE 2017
FROM "ARTIFICIAL INTELLIGENCE FOR THE REAL WORLD,"
BY THOMAS H. DAVENPORT AND RAJEEV RONANKI, JANUARY–FEBRUARY 2018

AI from the consumers' perspective…..

- For 55% of virtual assistant users, being able to control their device hands-free is a major reason why they use speech recognition apps. (Pew Research Center)
- Two in three Americans believe self-driving cars will be safer than human-driven ones. (DriversEd.com)
- 35% of Americans say they would never sit in an autonomous car (DriversEd.com)
- 87% of Americans would rather see self-driving cars with a human driver who's ready to take the wheel if need be, according to stats about AI. (DriversEd.com)
- 63% of consumers believe AI will be able to solve complex problems in the future. (PwC)
- 72% of companies using AI believe it will make their jobs easier. (PwC)
- 63% of people prefer to message a chatbot rather than. talking to a human when communicating with a business. (G2 Crowd)
- 63% of businesses say pressure to reduce costs will require them to use AI (Forbes)
- 73% of global consumers say they are open to businesses using AI if it makes life easier. (Pega)

Small group discussion: think on the stats on slides 28-29, what is the impact to Black society?

Consider……..

a. Discrimination and bias,
b. Adverse uses of AI,
c. AI and developing economies and
d. AI and jobs.

What are the drivers, risk, restraints, and opportunities?

a. Discuss advancements
b. Discuss drawbacks
c. Discuss the future

Consider the three main ways that businesses can or will use AI:

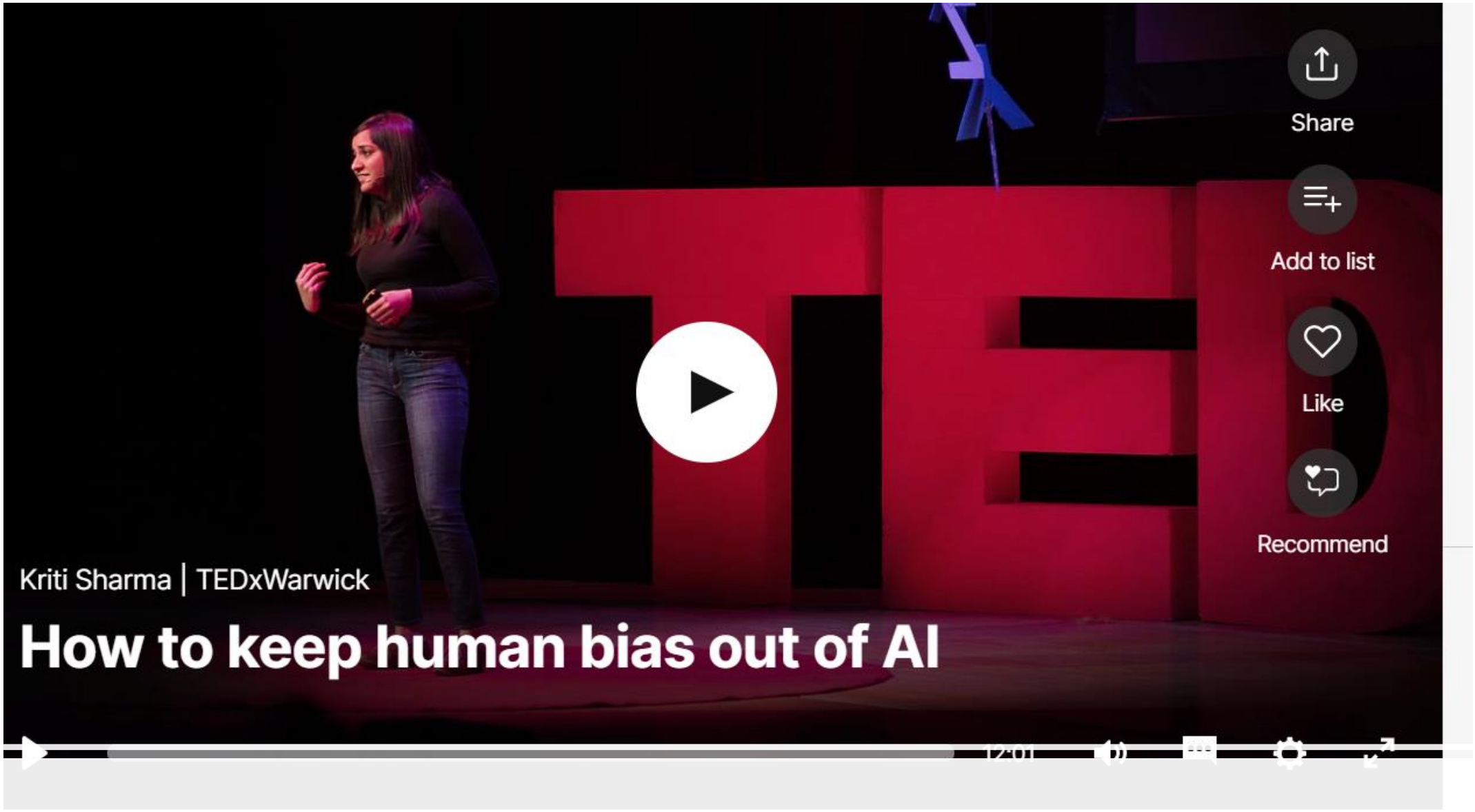
1. Assisted intelligence, now widely available, improves what people and organizations are already doing. [1]
2. Augmented intelligence, emerging today, enables organizations and people to do things they couldn't otherwise do. [1]
3. Autonomous intelligence, being developed for the future, creates and deploys machines that act on their own. [1]

.....AI also brings bias.....

[1] A Strategist's Guide to Artificial Intelligence by Anand Rao

Bias

Are you asking the right questions when it comes to systemic bias?



https://www.ted.com/talks/kriti_sharma_how_to_keep_human_bias_out_of_ai/transcript

Maximize AI and minimize risk

1. Avoid regulatory and ethical issues
2. Optimize AI through control and collaboration
3. Create a robust AI quality assurance process
4. Harness the power of AI to deliver real business value

Resources in AI

- "9 Black Women in Data Science You Should Know"

- #BlackinDataWeek (Online data conference, Took place November 17th in 2020)

- Black in AI
  - Advocacy has focused on removing barriers faced by Black people around the world in the field of AI. https://twitter.com/black_in_ai

- Inequality Project, project featuring deep reporting and cutting-edge research on inequality of all kinds, all over the world.
  - @GdnInequality, https://twitter.com/GdnInequality