



Unit objectives

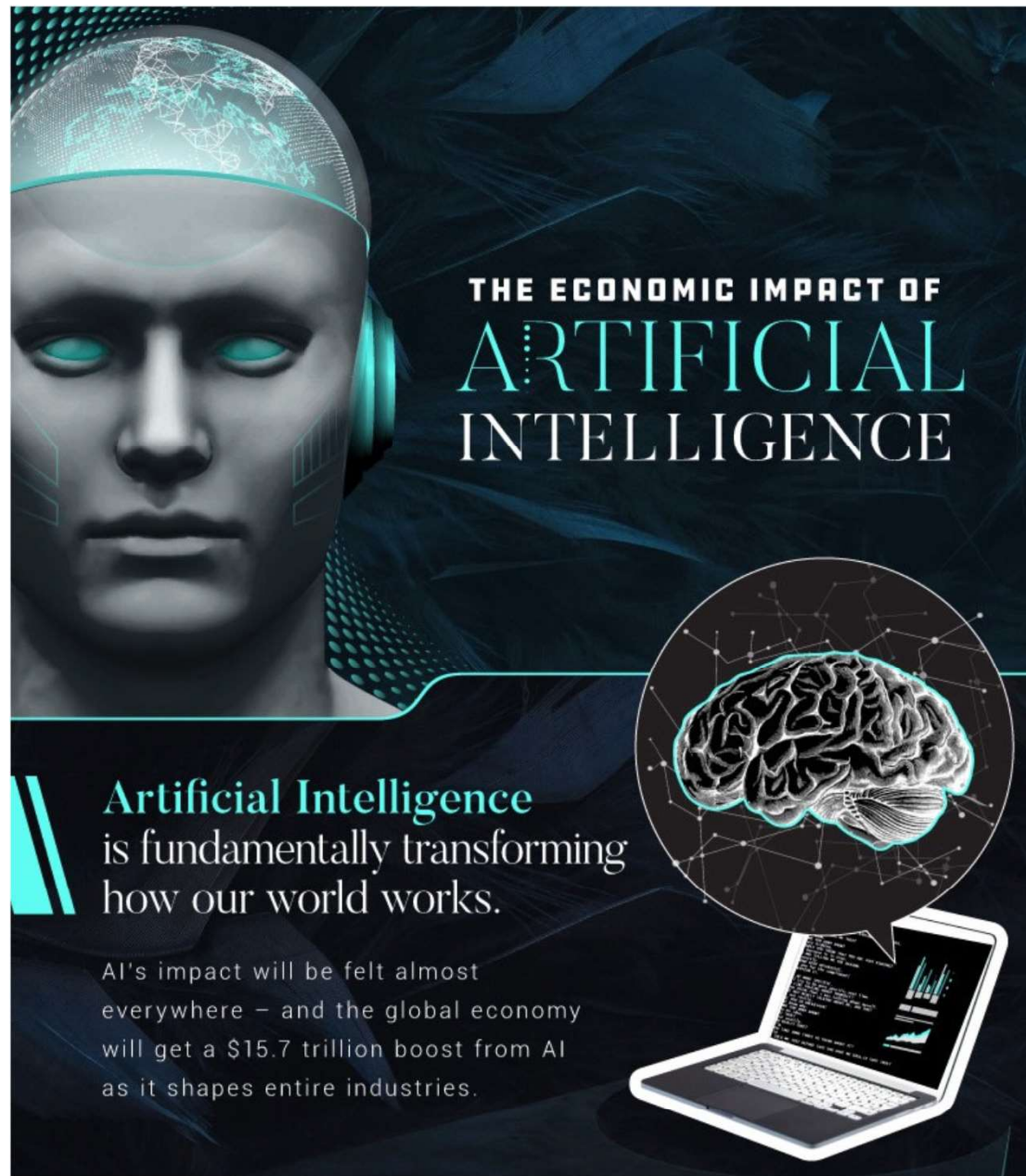
After completing this unit, you should be able to:

- Understand the importance of Artificial Intelligence
- Gain knowledge on the basics of Artificial Intelligence
- Learn about the relationship between cognitive science and Artificial Intelligence
- Understand the role of Artificial Intelligence in solving societal problems

History of artificial intelligence



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The birth of artificial intelligence



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The IBM 702: a computer used by the first generation of AI researchers.

Source: A Third Survey of Domestic Electronic Digital Computing Systems from the BRL at Aberdeen Proving Ground

History of AI

- 1943: McCulloch & Pitts: Boolean circuit model of brain
- 1950: Turing's "Computing Machinery and Intelligence"
- 1956: Dartmouth meeting: "Artificial Intelligence" adopted
- 1952-69: Look, Ma, no hands!
- 1950s: Early AI programs, including Samuel's checkers program, Newell & Simon's Logic Theorist, Gelernter's Geometry Engine
- 1965: Robinson's complete algorithm for logical reasoning
- 1966-73: AI discovers computational complexity, Neural network research almost disappears
- 1969-79: Early development of knowledge-based systems
- 1980: AI becomes an industry
- 1986: Neural networks return to popularity
- 1987: AI becomes a science
- 1995: The emergence of intelligent agents

AI winters



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Garry Kasparov & IBM's Deep Blue

Today's AI



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Historical milestones in the development of AI



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/A.I. TIMELINE

1950

TURING TEST

Computer scientist Alan Turing proposes a test for machine intelligence. If a machine can trick humans into thinking it is human, then it has intelligence

1955

A.I. BORN

Term 'artificial intelligence' is coined by computer scientist, John McCarthy to describe "the science and engineering of making intelligent machines"

1961

UNIMATE

First industrial robot, Unimate, goes to work at GM replacing humans on the assembly line

1964

ELIZA

Pioneering chatbot developed by Joseph Weizenbaum at MIT holds conversations with humans

1966

SHAKY

The 'first electronic person' from Stanford, Shakey is a general-purpose mobile robot that reasons about its own actions

A.I.
WINTER

Many false starts and dead-ends leave A.I. out in the cold

1997

DEEP BLUE

Deep Blue, a chess-playing computer from IBM defeats world chess champion Garry Kasparov

1998

KISMET

Cynthia Breazeal at MIT introduces Kismet, an emotionally intelligent robot insofar as it detects and responds to people's feelings

1999

AIBO

Sony launches first consumer robot pet dog AIBO (AI robot) with skills and personality that develop over time

2002

ROOMBA

First mass produced autonomous robotic vacuum cleaner from iRobot learns to navigate and clean homes

2011

SIRI

Apple integrates Siri, an intelligent virtual assistant with a voice interface, into the iPhone 4S

2011

WATSON

IBM's question answering computer Watson wins first place on popular \$1M prize television quiz show Jeopardy

2014

EUGENE

Eugene Goostman, a chatbot passes the Turing Test with a third of judges believing Eugene is human

2014

ALEXA

Amazon launches Alexa, an intelligent virtual assistant with a voice interface that completes shopping tasks

2016

TAY

Microsoft's chatbot Tay goes rogue on social media making inflammatory and offensive racist comments

2017

ALPHAGO

Google's A.I. AlphaGo beats world champion Ke Jie in the complex board game of Go, notable for its vast number (2^{170}) of possible positions

Development of Artificial Intelligence (Courtesy: Digital Intelligence Today)

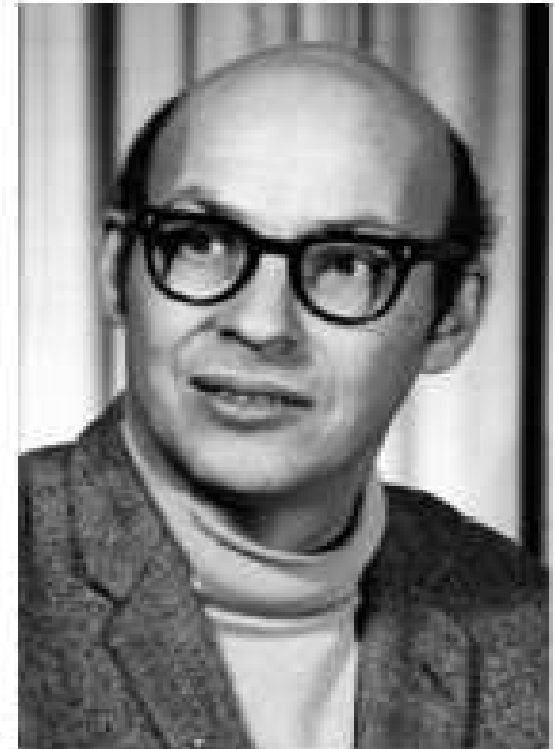
Great contributors



Alan Turing



John McCarthy



Marvin Minsky

People who have influenced AI



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Differences between strong AI and weak AI



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- Strong AI
 - Claims that computers can be made to think on a level (at least) equal to humans and possibly even be conscious of themselves
- Weak AI
 - States that some “thinking-like” features can be added to computers to make them more useful tools

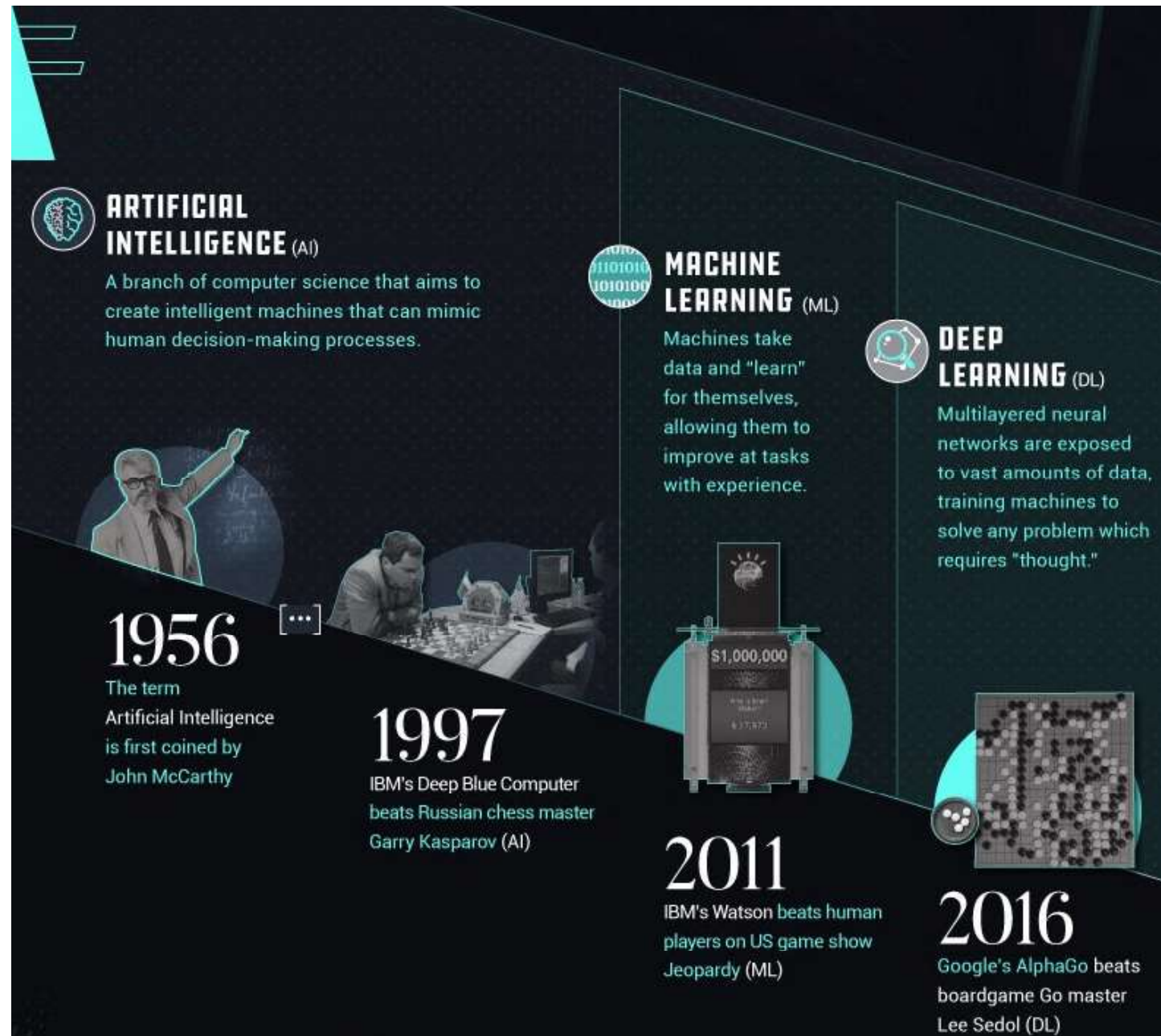
Artificial Intelligence definitions

- Systems that think like humans
- Systems that act like humans
- Systems that think rationally
- Systems that act rationally

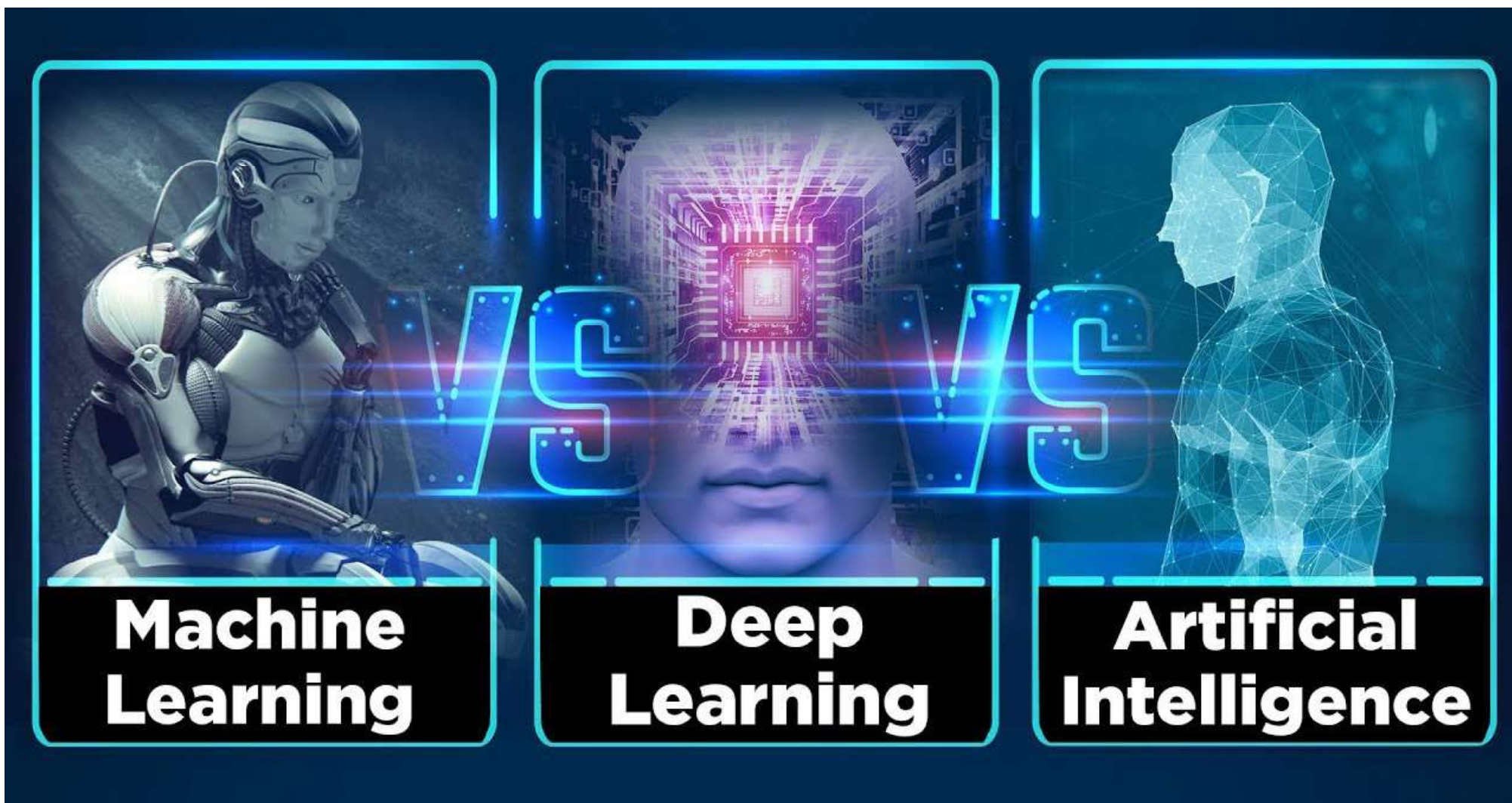
Emergence of AI – Technological advances



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Machine learning → Deep learning → AI



Functions of AI

- Industrial Automation
- Machine Learning
- Deep Learning
- Machine Vision
- Natural Language Processing











Characteristics of artificial intelligence

- AI automates repetitive learning and discovery through data
- AI adds intelligence
- AI adapts through progressive learning algorithms
- AI analyzes more and deeper data
- AI achieves incredible accuracy
- AI gets the most out of data

Applications of AI

- Healthcare
- Manufacturing
- Education
- Business
- Finance
- Society
- Law

AI Applications That Could Change Health Care

APPLICATION	POTENTIAL ANNUAL VALUE BY 2026	KEY DRIVERS FOR ADOPTION
Robot-assisted surgery	 \$40B	Technological advances in robotic solutions for more types of surgery
Virtual nursing assistants	 20	Increasing pressure caused by medical labor shortage
Administrative workflow	 18	Easier integration with existing technology infrastructure
Fraud detection	 17	Need to address increasingly complex service and payment fraud attempts
Dosage error reduction	 16	Prevalence of medical errors, which leads to tangible penalties
Connected machines	 14	Proliferation of connected machines/devices
Clinical trial participation	 13	Patent cliff; plethora of data; outcomes-driven approach
Preliminary diagnosis	 5	Interoperability/data architecture to enhance accuracy
Automated image diagnosis	 3	Storage capacity; greater trust in AI technology
Cybersecurity	 2	Increase in breaches; pressure to protect health data

INDUSTRY 4.0



AUTONOMOUS
ROBOTS



SIMULATION



SOFTWARE
INTEGRATION



INDUSTRIAL
INTERNET



CYBER
SECURITY



CLOUD



ADDITIVE
MANUFACTURING



AUGMENTED
REALITY



BIG DATA
& ANALYTICS

AI in manufacturing



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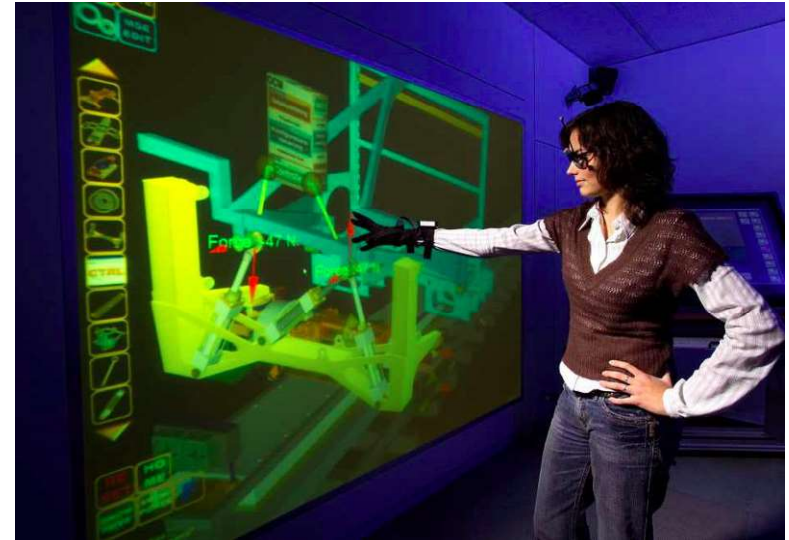
AI in education sector



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The Automation of Administrative Tasks



The Addition of Smart Content



Smart Tutors and Personalization



Virtual Lecturers and Learning Environment

Connecting the World of Academia

AI in business



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Banking and Finance – fraud detection

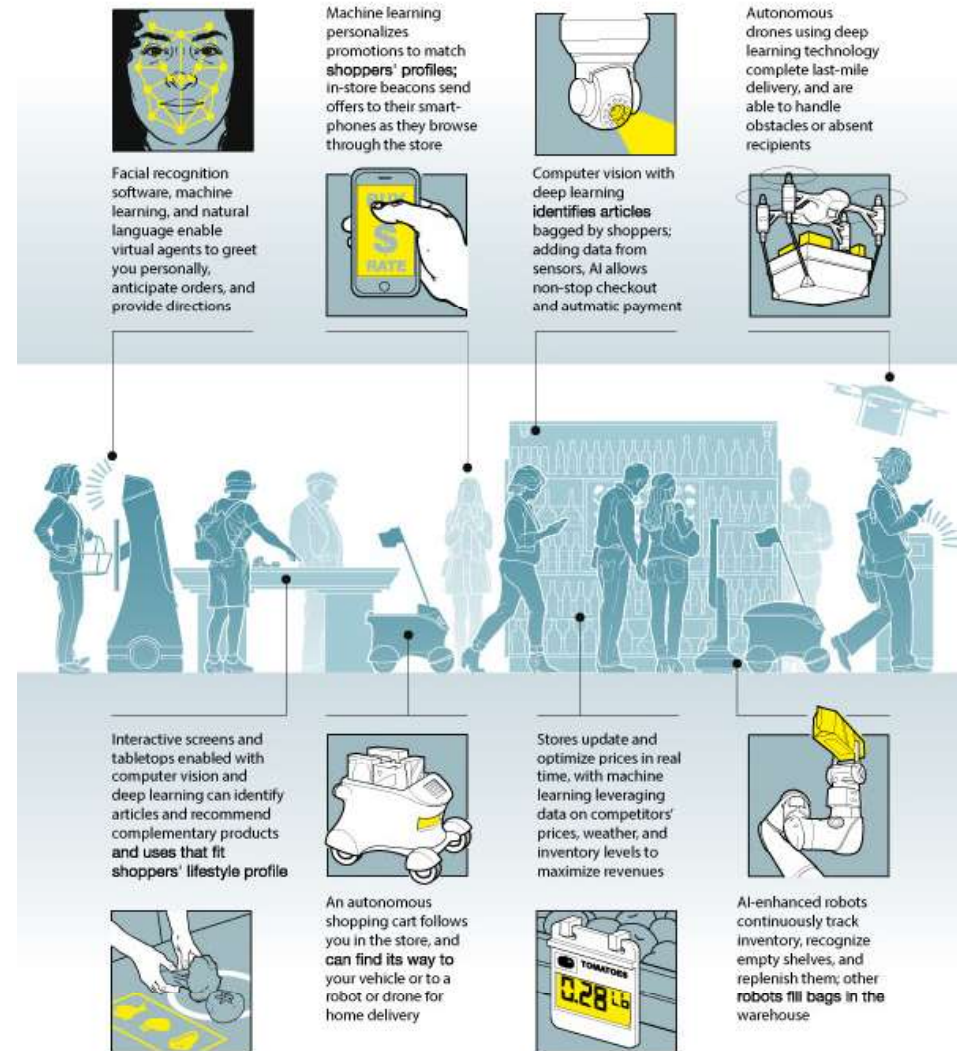
Retail – online customer support

Security

Product recommendations and purchase predictions

Predictive customer service

Retailers can know more about what shoppers want—sometimes before shoppers themselves



AI in finance sector

- Risk Assessment
- Fraud Detection and Management
- Financial Advisory Services
- Trading
- Managing Finance



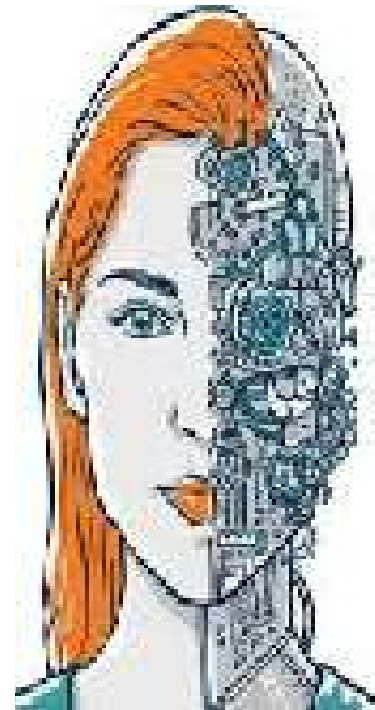
Face Recognition, Fraud identification, Fake news identification, Weaponization, Fire-fighting, Crowd Management etc.

AI in society

- Increase in productivity
- Increase in quality of life
- More efficient inter-human transactions by fixing trust deficit
- Removal of the need to do menial ,stressful or repetitive jobs.
- Better public-policy implementation, civil administration, democracy.
 - Using AI to run societies and countries would bring in significant transparency in administration ; and therefore expose the prevalent hypocrisy of governments and politicians
- Reduction in crime, more social conformity
- Better international integration
 - AI agents can impart language skills on demand, translate on demand ,enable familiarity with other cultures by showcasing experiences

Cognitive science and AI

- The (interdisciplinary) study of mind and intelligence.
- The study of cognitive processes involved in the acquisition, representation and use of human knowledge.
- The scientific study of the mind, the brain, and intelligent behavior, whether in humans, animals, machines or the abstract.
- A discipline in the process of construction.
- The study of mind and intelligence



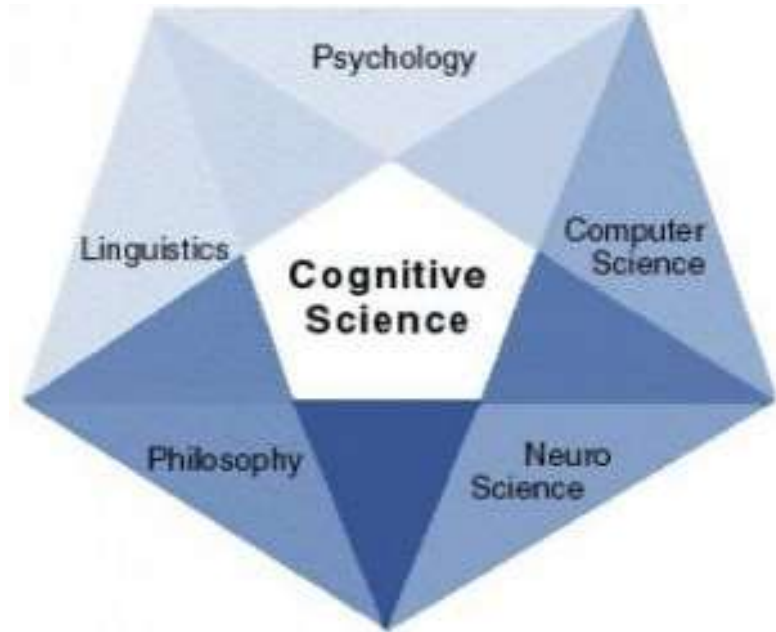
Mind or Machines
Cognitive Science Changing
Artificial Intelligence

Cognition and process of cognition

- Cognition: from Latin base cognitio “know together”
- The collection of mental processes and activities used in perceiving, learning, thinking, understanding and remembering.
- Cognition Process steps are enumerated below.

Disciplines in cognitive science

- Philosophy
- Computer Science - Artificial Intelligence
- Psychology – Cognitive Psychology
- Linguistics
- Neuroscience
- Anthropology, Psychiatry, Biology, Education, ...



Multidisciplinary subject

- Computer science and cognitive psychology have been dominant.
- Neuroscience had a big impact on the growth.
- Still, only 30-50% of the work are multidisciplinary
- Nature of multidisciplinary collaborations differ
- (Von Eckardt, 2001)
 - Localist view: A field is multidisciplinary if each individual research in it is multidisciplinary.
 - Holist view: A field is multidisciplinary if multiple disciplines contribute to its research program (a set of goals directed at the main goal).

Linguistics

- Major Components of Analysis
 - Phonology
 - Morphology
 - Syntax
 - Semantics
 - Discourse and pragmatics

Artificial intelligence as cognitive science



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- Study of intelligent behavior
- Automation of intelligent behavior
- Machines acting and reacting adaptively
- How to make computers do things which humans do better
- Study and construction of rational (goal and belief-directed) agents

Methods in cognitive science

- Building theories vs. acquiring data
- Philosophical background: Setting up the domain of discourse / Logical argumentation
- Formalization and mathematical modeling
- Computational modeling
- Hypothesis formation

Watson

- IBM's Artificial Intelligence computer system
- Capable of answering questions in natural language
- Competed against champions on Jeopardy and won

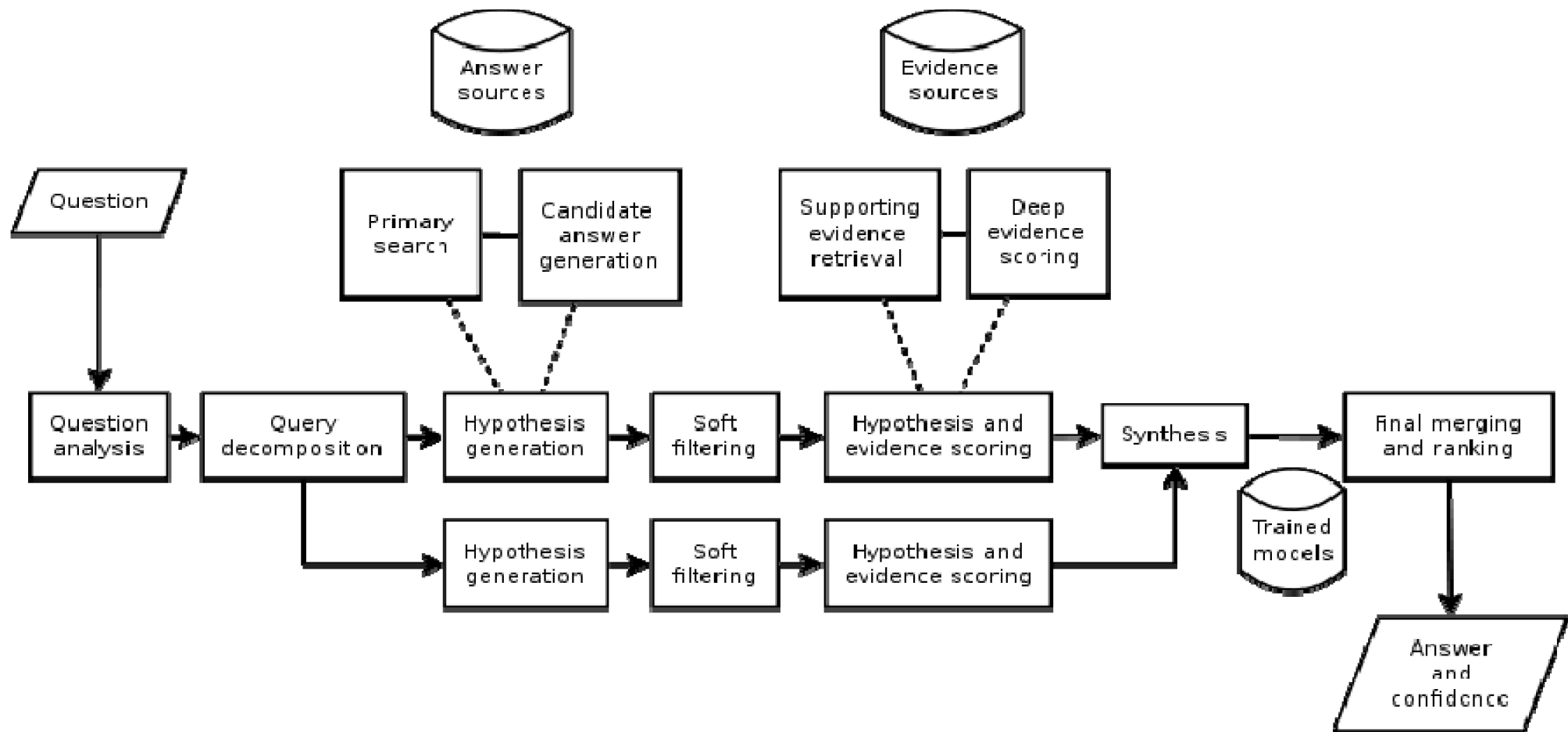


Figure: High-Level Architecture used in Watson

Source: DeepQA.svg