DRIVES

Development and Research on Innovative Vocational Education Skills

U1 ARTIFICIAL INTELLIGENCE OVERVIEW

U1.E1 ARTIFICIAL INTELLIGENCE FUNDAMENTALS

Computer Vision Expert

May 2021, Version 1

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LEARNING OBJECTIVES

The student is able to

CVE.U1.E1.PC1	Understand the differences between data, information, knowledge, insight and wisdom.
CVE.U1.E1.PC2	Define artificial intelligence.
CVE.U1.E1.PC3	Understands the need, purpose and impacts of artificial intelligence.

WHAT IS ARTIFICIAL INTELLIGENCE?

IS THERE A SINGLE DEFINITION POSSIBLE?

“Branch of Computer Science that has to do with the automation of intelligent behaviors, proper of the human beings.”

(Luger&Stubblefield, 1998)

A wide-ranging branch of computer science concerned with the construction of intelligent machines that are able to perform tasks that typically require human intelligence.

“The ability to use memory, knowledge, experience, understanding, imagination and judgment to solve problems and adapt to new situations.”

(AllWords Dictionary, 2006)

Technology that seeks to simulate the human process of learning and decision making

AI FOCUSES ON THREE COGNITIVE SKILLS

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1

Learning

The learning process focuses on data acquisition and the creation of rules to transform data into useful information. The rules, called algorithms, provide computer equipment with step-by-step instructions on how to complete a specific task.

2

Reasoning

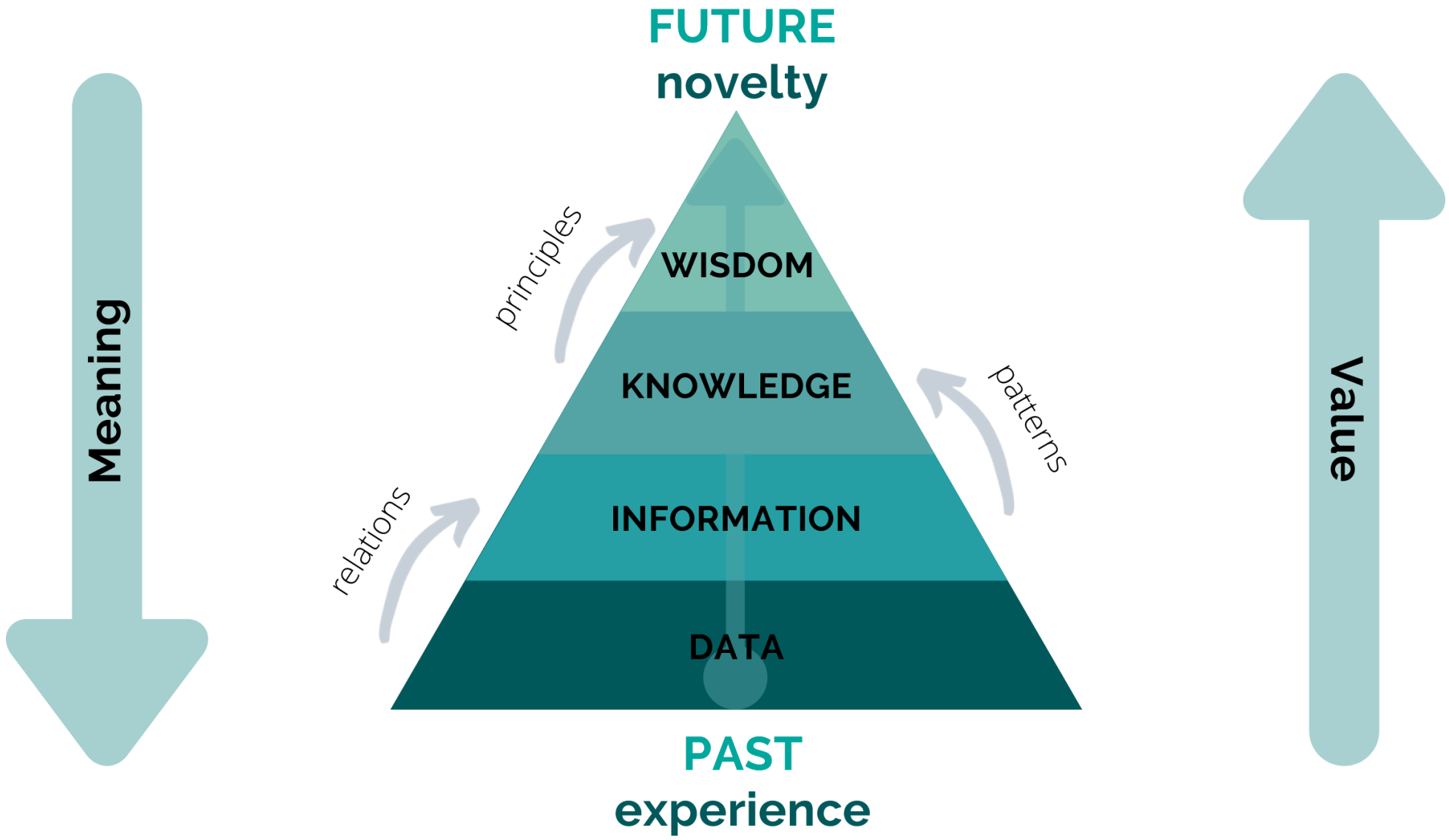
Reasoning focuses on choosing the right algorithm to achieve a desired result. Sometimes this cognitive ability decides the success of the whole process.

3

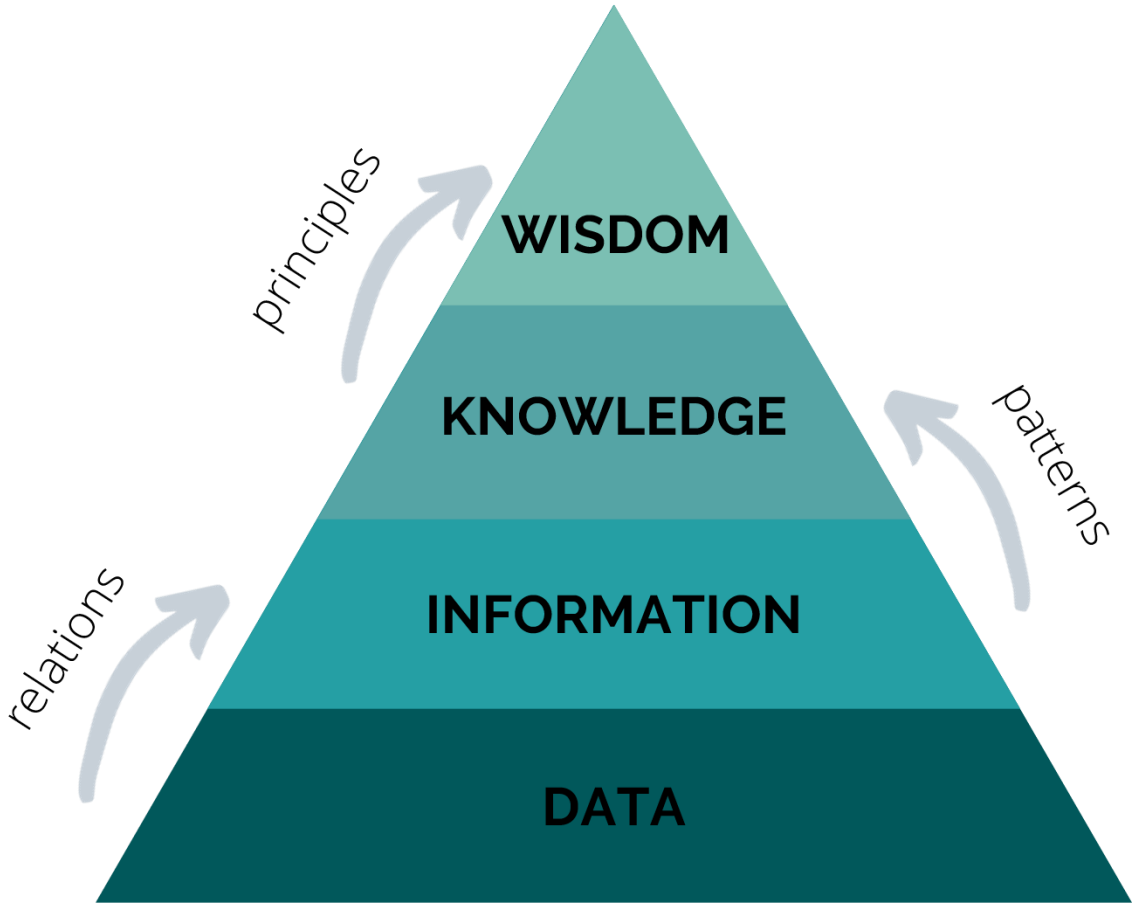
Self-Correction

This process is designed to continuously refine the algorithms and to ensure that they provide the most accurate results possible.

DIKW (DATA, INFORMATION, KNOWLEDGE, WISDOM) HIERARCHY



DIKW (DATA, INFORMATION, KNOWLEDGE, WISDOM) HIERARCHY



APPLIED I better stop the car!

CONTEXT The traffic light I'm driving towards has turned red

MEANING South facing traffic light on corner of Pitt and George Streets has turned red

RAW Red, 192.234.235.245.678, v2.0

DIKW (DATA, INFORMATION, KNOWLEDGE, WISDOM) HIERARCHY

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Data

Data is raw, it simply exists as a representation of objective facts. It is the starting point for reaching a meaningful end result. Logging, records, measurements, etc. are all data. Data is a fact that alone is not meaningful, as it doesn't relate to other data. Data may answer a very basic What question.

Information

Then, Data is processed into Information. During this process, relationships in the data are revealed, and analysis is done to find an answer to Who, What, Where and When questions. Hence, Information is data that has been given meaning by way of relational connection. This "meaning" can be useful, but does not have to be.

DIKW (DATA, INFORMATION, KNOWLEDGE, WISDOM) HIERARCHY

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Knowledge

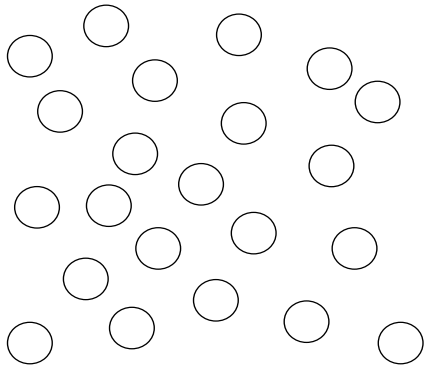
Knowledge is the appropriate application of Information in order to be useful. The transformation of Information into Knowledge aims to answer the How question. Knowledge is linked to doing and implies know-how and understanding. Specific measures are identified and the information gained in the previous step is used to answer questions based on these measures.

Wisdom

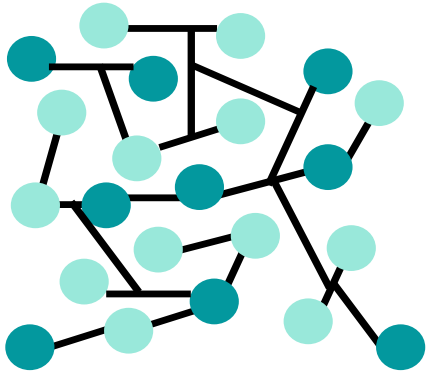
Unlike the previous levels, this stage asks questions to which there is no easily-achievable answer. Wisdom is the top level of the DIKW hierarchy and answers the Why question. It uncovers why the derived knowledge is applied by individuals in a specific way. i.e., finds the reason behind any decision-making (moral, ethical codes, etc.). Wisdom is the process by which it is possible to discern or judge between right and wrong, good and bad.

DIKW (DATA, INFORMATION, KNOWLEDGE, WISDOM) HIERARCHY

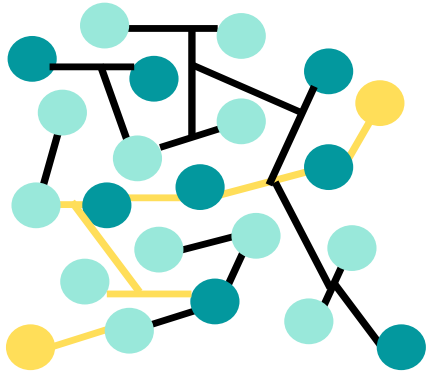
Data



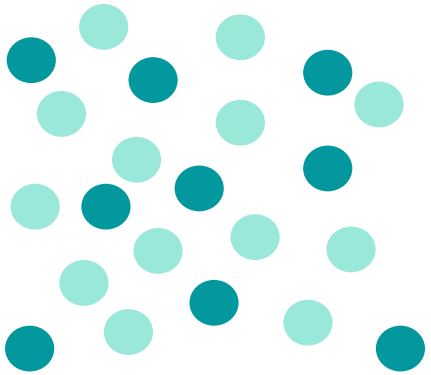
Knowledge



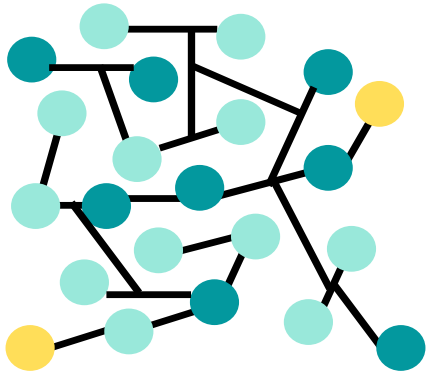
Wisdom



Information

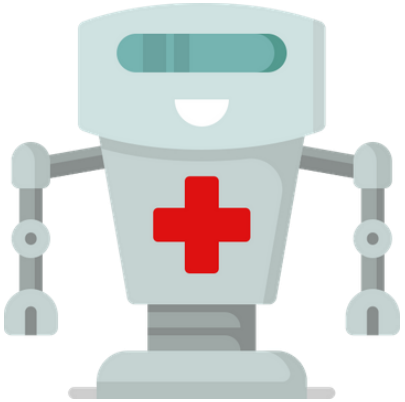


Insight

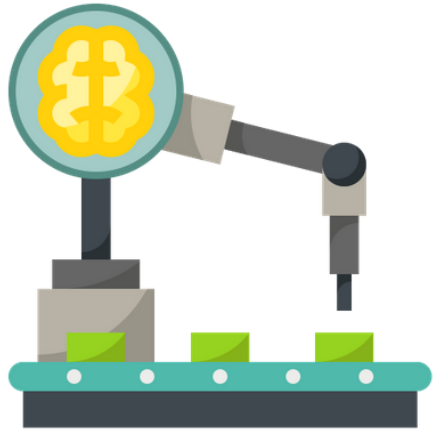


HOW ARTIFICIAL INTELLIGENCE INFLUENCES OUR WORLD?

SMART PERSONAL ASSISTANCE



SURGICAL ROBOTS



AUTOMATION

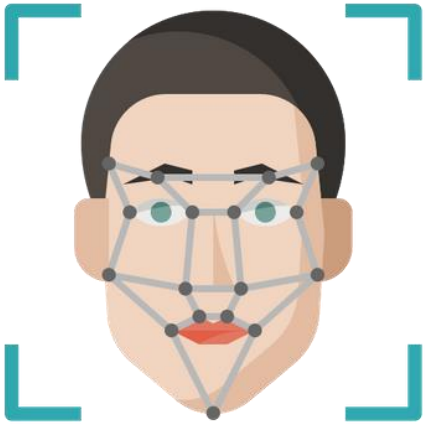
HOW ARTIFICIAL INTELLIGENCE INFLUENCES OUR WORLD?

SMART HOME DEVICES

SELF DRIVING VEHICLES

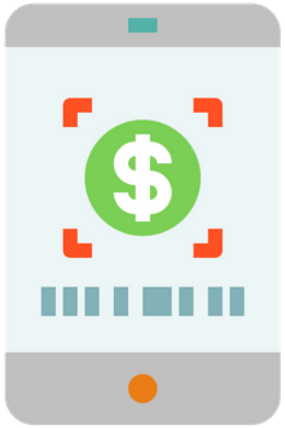
VIRTUAL REALITY

HOW ARTIFICIAL INTELLIGENCE INFLUENCES OUR WORLD?



CYBER SECURITY

CONSUMER BASKET ANALYSIS



SMART PAYMENT

ADVANTAGES OF ARTIFICIAL INTELLIGENCE

01 Reduction of errors that occur in tasks done by the machines when compared to human performance

02 Significant improvement in information analysis

03 Replacement of human beings in repetitive and boring tasks

ADVANTAGES OF ARTIFICIAL INTELLIGENCE

04 In video games, AI can predict and read the player's behavior to increase the complexity if it is at an easy level

05 Allows the simulation of real situations, preparing human beings to act correctly in emergency circumstances

06 Machines are not affected by emotions or human problems such as lack of sleep or hunger

DISADVANTAGES OF ARTIFICIAL INTELLIGENCE

01 High production and repair costs

02 Data storage is very expensive, which increases the price of developing and maintaining these systems

03 Its operation is limited to scheduled tasks, does not have self learning

DISADVANTAGES OF ARTIFICIAL INTELLIGENCE

04 Machines have not yet been created with the ability to understand common sense and ethical thinking

05 The risk of machines being created and used for destruction purposes, such as war machines, is high

06 The risk of facing high unemployment

ARTIFICIAL INTELLIGENCE TIMELINE

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First Neural Network Model

Warren McCullough and Walter Pitts proposed the first mathematic model for building a neural network.

Turing Test

Allan Turing proposes a test for machine intelligence.

Robotics Laws

Isaac Asimov publishes the "Three Laws of Robotics."

Hebbian Learning

Donald Hebb proposes the theory that neural pathways are created from experience.

SNARC

Marvin Minsky and Dean Edmonds build the first neural network computer.

ARTIFICIAL INTELLIGENCE TIMELINE

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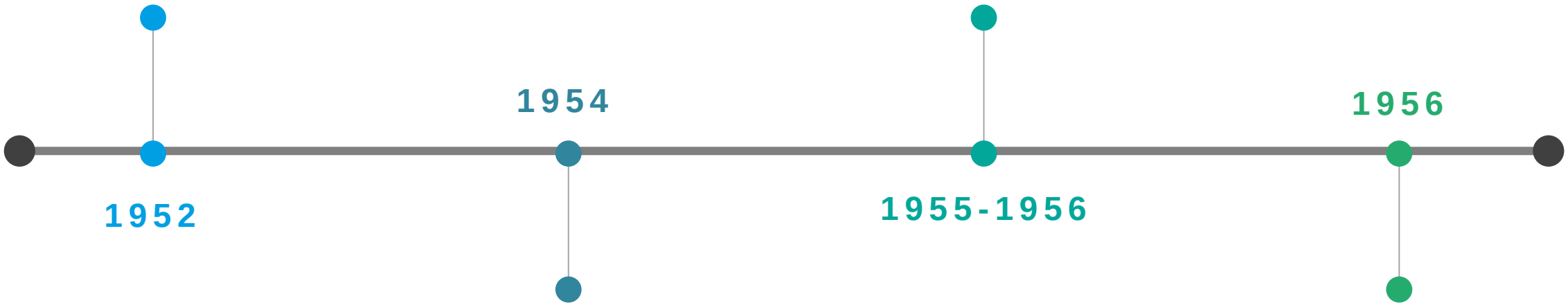
Samuel's Checkers Player

Arthur Samuel develops his first self-learning program to play checkers for the IBM 701.

Logic Theorist

Allen Newell, Herbert A. Simon and Cliff Shaw developed the first reasoning program.



Georgetown–IBM Experiment

A machine translation experiment that automatically translates sixty Russian sentences into English.

AI Birth

John McCarthy coins the term AI, which he defined as "the science and engineering of making intelligent machines“.

ARTIFICIAL INTELLIGENCE TIMELINE

Lisp

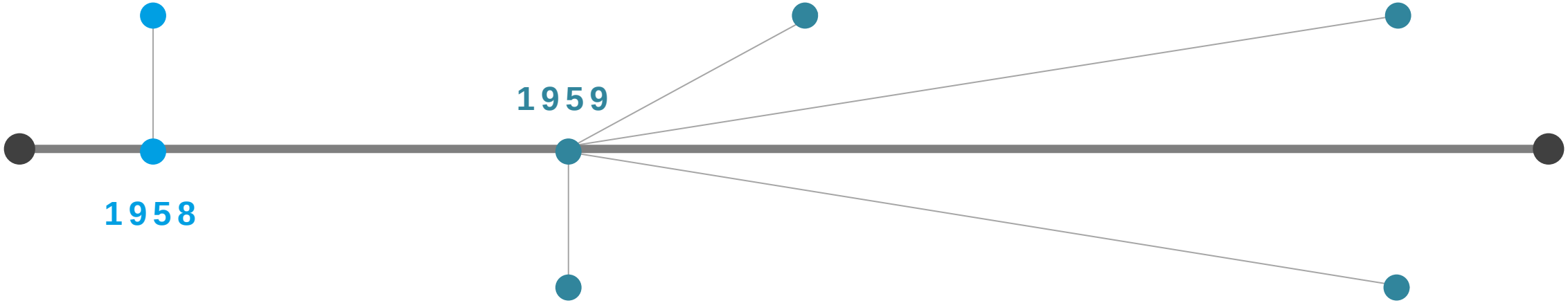
John McCarthy develops the computer programming language Lisp.

Geometry Theorem Prover

Herbert Gelernter build the first advanced AI program.

Machine Learning

Arthur Samuel coins the term machine learning while at IBM.



General Problem Solver (GPS)

Allen Newell, Herbert Simon and J.C. Shaw develop GPS, a program designed to imitate human problem-solving.

MIT AI Project

John McCarthy and Marvin Minsky found the MIT Artificial Intelligence Project.

ARTIFICIAL INTELLIGENCE TIMELINE

Lisp

John McCarthy develops the computer programming language Lisp.

Unimate

The first industrial robot, Unimate, developed by George Devol, is granted.

AI Laboratory

John McCarthy starts the AI Lab at Stanford.

Eliza

Joseph Weizenbaum creates Eliza, an early natural language processing computer program.

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1966

ALPAC

The ALPAC committee is established by the U.S. government to evaluate the progress in machine translations research.

1972

PROLOG

The logic programming language PROLOG is created.

1973

Lighthill Report

The British government details the disappointments in AI research that led to severe cuts in funding.

1974-1980

First AI Winter

Artificial intelligence funding is limited, and research stagnates.

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End of the first AI Winter

Digital Equipment Corporations develops R1, also known as XCON, the first successful commercial expert system.

Strategic Computing Initiative

The U.S. government launches the initiative to provide DARPA funded research in advanced computing and AI.

Fifth Generation Computer Systems

Japan launches the FGCS project with the aim of developing supercomputer-like performance and a platform for AI development.

LISP collapse

As cheaper alternatives emerged, the market for Lisp machines collapsed.

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End of FGCS

Japan puts an end to the FGCS project, failing to reach the ambitious objectives outlined.

1992

1993

End of Strategic Computing Initiative

DARPA puts an end to the Strategic Computing Initiative, which falls far short of expectations.

Second AI Winter

At the time, expert systems were too expensive to maintain and update, eventually falling out of use.

1987-1993

1997

Deep Blue

IBM's Deep Blue beats world chess champion Gary Kasparov.

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AiBO

Sony launches first consumer robot pet dog AiBO.

STANLEY

A self-driving car, wins the DARPA Grand Challenge.

Roomba

Mass production of the first commercially successful autonomous robotic vacuum cleaner.

Speech Recognition

Google introduces a speech recognition feature in the Apple iPhone.

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ImageNet

A free database of 14 million images, labeled by thousands of Amazon workers, used to train neural networks with the lowest error rate possible.

Man vs Machine

IBM’s Watson supercomputer took on the human brain on the US quiz show Jeopardy! beating two former champions.

Dance Bots

Enabled by neural networks, 20 humanoid NAO robots danced in perfect harmony for eight minutes at Shanghai's 2010 World Expo.

Siri

Apple introduced an intelligent virtual assistant with a voice interface on iPhone 4S.

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Cat Faces

Andrew Ng feeds a neural network with 10 million unlabeled YouTube videos and the neural network learned to recognize cats.

Driverless cars

Google makes first self-driving car to pass a state driving test.

Eugene

Sixty-four years after the Turing Test was published, the Eugene chatbot passed the test.

Tay

Microsoft's chatbot goes rogue on twitter making racist remarks and inflammatory political statements.

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Sophia

A realistic humanoid robot that displays humanlike expressions and interacts with human beings.

Libratus

Carnegie Mellon researchers developed a computer program that defeated the top four human poker players in no-limit Texas Hold‘em poker.

Google DeepMind Challenge Match

Google's AlphaGo defeated Lee Sedol, the world champion Go player at the time.

Alibaba’s AI model

Alibaba build an AI model that scored better than humans in a Stanford University reading and comprehension test.

ARTIFICIAL INTELLIGENCE TIMELINE

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2018

Bixby

Samsung’s virtual assistant includes several functions, such as voice commands, reminders, object recognition and control of home intelligent devices.

2019

Google’s first African AI lab

Google opened an AI lab in Ghana with the aim of providing solutions to health and agricultural issues.

2019

Google’s AlphaStar

The AI agent defeated pro StarCraft II players.

2020

Covid-19

Covid-19 accelerates investment in AI and researchers dive into technology for a wide range of applications.

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ARTIFICIAL INTELLIGENCE IS QUITE OLD BUT IT GOT POPULARITY RECENTLY. **WHY?**

PAST

- only a very small amount of data was available to make accurate predictions

PRESENT

- data are generated every minute (IoT)
- huge data size (big data)
- more advanced algorithms
- high power and storage
- high performance computing
- more accurate predictions

HISTORY OF INDUSTRIAL REVOLUTION

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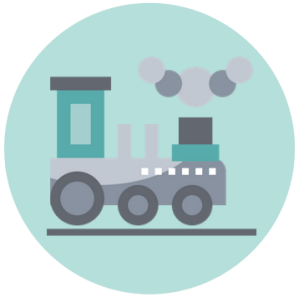
INDUSTRY 1.0



MECANIZATION

steam and water power

1780

INDUSTRY 2.0

MASS PRODUCTION

electricity and oil-based power

1900

INDUSTRY 3.0

AUTOMATED PRODUCTION

electronics and IT systems

1970

INDUSTRY 4.0

CYBER PHYSICAL SISTEMS

IoT, Big Data, Cloud, AI

2000

INDUSTRY 5.0

MASS COSTUMIZATION

industrial blockchain, drones, 5G and beyond

2020

INDUSTRY 4.0 vs INDUSTRY 5.0

INDUSTRY 4.0	INDUSTRY 5.0
Focus on Connecting Machines	Focus on Delivering Costumer Experience
Mass Customization	Hyper Customization
Intelligent Supply Chain	Responsive & Distributed Supply Chain
Smart Products	Experience Activated/Interactive Products
Manpower Distanced from Factories	Return of Manpower to Factories

UNEMPLOYMENT

WHAT HAPPENS AFTER THE END OF JOBS?

The work hierarchy is mainly concerned with automation. By inventing ways to automate jobs, we could create space for people to take on more complex roles, moving from physical work that dominated the pre-industrial world to cognitive work such as strategic and administrative work.

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INEQUALITY

HOW DO WE DISTRIBUTE THE WEALTH CREATED BY MACHINES?

The economic system is based on remuneration for the contribution to the economy, often assessed on the basis of hourly wages. Most companies still rely on hourly product and service work. But by using artificial intelligence, a company can dramatically reduce its dependence on human labor, which means that revenues will be directed to fewer people. As a result, individuals who own AI-oriented businesses will be more likely to make more money.

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HUMANITY

HOW DO MACHINES AFFECT OUR BEHAVIOUR AND INTERACTION?

Although many of us are unaware of this, we are already witnessing how machines can trigger reward centers in the human brain. Just take a look at click bait titles and video games. These headlines are usually optimized with forms of algorithmic content optimization that capture our attention to make various video games and mobile devices addictive. Technology addiction is the new frontier of human dependence.

EVIL GENIES

HOW DO WE PROTECT AGAINST UNINTENDED CONSEQUENCES?

What if artificial intelligence turned against us? This doesn't mean transforming "evil" the way a human being can, or the way ai disasters are portrayed in movies and books. Instead, we can conceive an advanced AI system as a "genius in a bottle“ that can satisfy desires, but with terrible unforeseen consequences.

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SINGULARITY

HOW DO WE STAY IN CONTROL OF A COMPLEX INTELLIGENT SYSTEM?

The reason why humans are at the top of the food chain is not due to sharp teeth or strong muscles. Human domination is almost entirely due to our ingenuity and intelligence. We can get the best out of larger, faster, and stronger animals, because we can create and use tools to control them such as physical tools (cages and weapons), and cognitive tools (training and conditioning).

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ROBOT RIGHTS

HOW DO WE DEFINE THE HUMANE TREATMENT OF ARTIFICIAL INTELLIGENCE?

Since we consider machines to be entities that can perceive, feel and act, it is not a great leap to reflect on their legal status. Should they be treated as comparable intelligence animals? Some ethical questions are about alleviating suffering, others are about risking negative outcomes. While we consider these risks, we should also bear in mind that, in, in general, this technological advance means a better life for all. Artificial intelligence has great potential, and its responsible implementation depends on us.

ARTIFICIAL STUPIDITY

HOW CAN WE SAFEGUARD AGAINST MISTAKES?

Intelligence comes from learning, whether you are a human being or a machine. Systems usually have a training phase in which they "learn" to detect the right patterns and to act upon their information. Once the system is fully trained, it can enter the test phase, where more examples are found. The training phase can not cover all the possible examples that the system can deal with in the real world. So, these systems are easier to fool in ways that humans cannot be.

RACIST ROBOTS

HOW DO WE ELIMINATE ARTIFICIAL INTELLIGENCE BIAS?

People should not forget that AI systems are created by human beings who can be biased and judgmental. Once again, if it is used correctly, or if it is used by those who seek social progress, artificial intelligence can become a catalyst for positive change.

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SECURITY

HOW DO WE KEEP ARTIFICIAL INTELLIGENCE SAFE FROM ADVERSARIES?

The more powerful a technology becomes, the more it can be used for malicious and good reasons. This applies not only to robots produced to replace human soldiers or autonomous weapons, but to AI systems in general that can cause damage if they are used for evil purposes. In this sense, cyber security is going to become even more important. After all, we are dealing with a system that is faster and more capable than we are in orders of magnitude.

- Artificial Intelligence is a branch of Computer Science that seeks to simulate the human process of learning and making decisions;

- Artificial Intelligence focuses on three cognitive skills, namely, learning, reasoning, and self-correction;

- Artificial Intelligence already has huge impacts in modern society, but its role is expected to grow in the future due to the massive data (big data) that is being generated every minute (IoT), more advanced algorithms and high-performance computing and storage;

- However, it is extremely important not to neglect the dangers of artificial intelligence, especially ethical considerations.

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Thank you for your attention

DRIVES project is project under **The Blueprint for Sectoral Cooperation on Skills in Automotive Sector**, as part of New Skills Agenda.

The aim of the Blueprint is **to support an overall sectoral strategy and to develop concrete actions to address short and medium term skills needs.**

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