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Master programmes in Artificial Intelligence 4 Careers in Europe

University of Ruse

INTELLIGENT COMPUTER SYSTEMS

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LECTURE 2

INTELLIGENT COMPUTER SYSTEMS NOWADAYS

1. Introduction
2. Types of intelligent computer systems
3. Risks
4. Quantum computers

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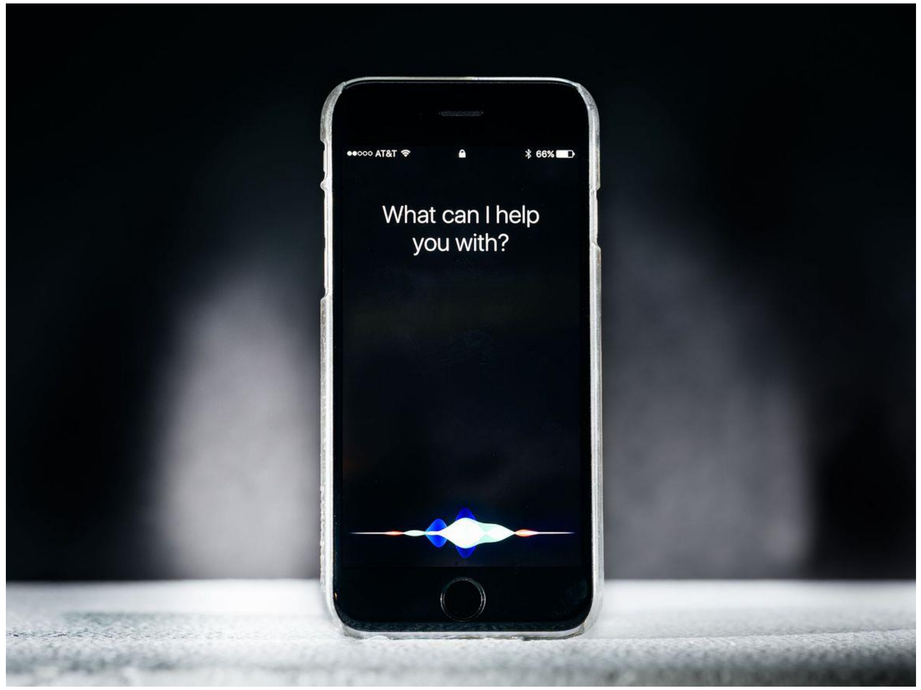
Popularity nowadays

From SIRI (Apple) and Cortana (Microsoft) to self-driving cars.

While science fiction often portrays AI as robots with human-like characteristics, AI can encompass anything: from Google's search algorithms to IBM's Watson for autonomous weapons.



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CONTENT 1

Application of robots

3D:

- **D**irty;
- **D**ifficult;
- **D**angerous.

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Possible outcomes for the future of ICS (according to Nick Bostrom, philosopher)

- **“Oracle”** – answers queries with absolute accuracy;
- **“Genie”** – executes commands and awaits for the next one;
- **“Sovereign”** – assigned a main goal and works independently in the world around it, by making decisions on how best to achieve it.

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CONTENT 2

Types of ICS

- **narrow-profiled/expert** - designed to perform a specific task (e.g. only facial recognition or only internet searches or only driving a car).
- **general (AGI)** – with a long-term goal.

While narrow-profiled AI may outperform humans at any specific task (e.g. a game of chess), AGI would outperform humans at nearly every cognitive task.

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Main risk

People cannot understand what an ICS is good at and what it is not.

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Potential risks – possible scenarios

- **ICS, programmed to do something devastating**

Autonomous weapons are ICSs that are programmed to kill. In the hands of the wrong person they could easily cause mass casualties. To avoid being stopped by the enemy, they would be designed to be extremely difficult to simply “switch off,” so humans could eventually lose control in such a situation.

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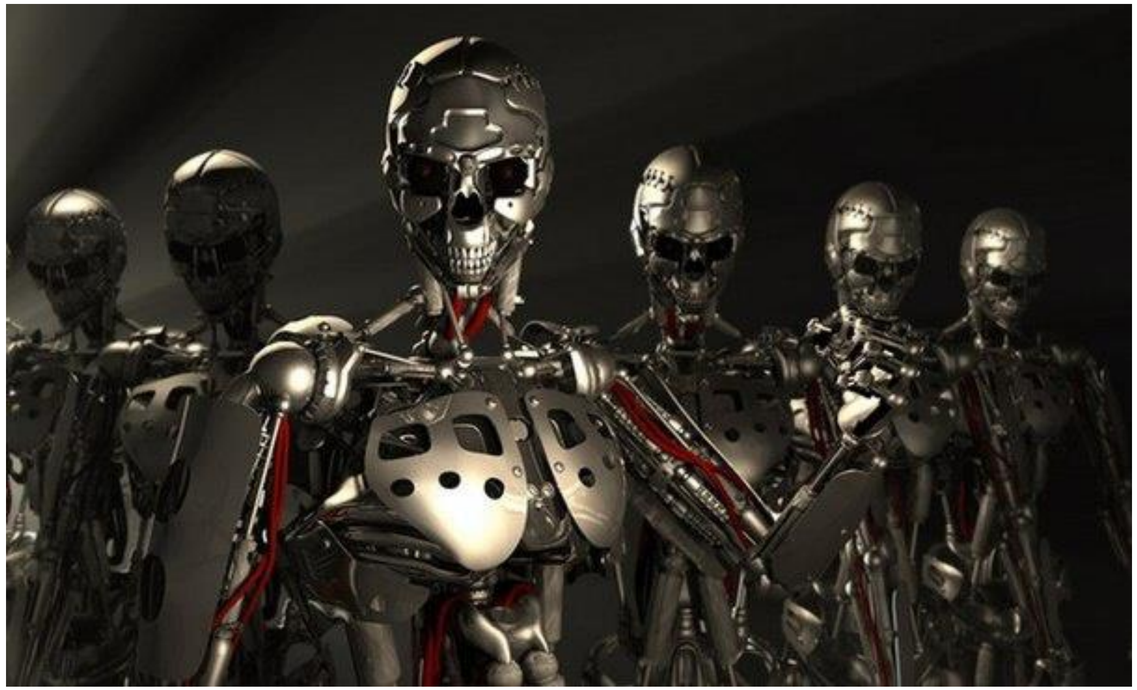
The US army has a project for the replacement of ¼ of its soldiers with robots



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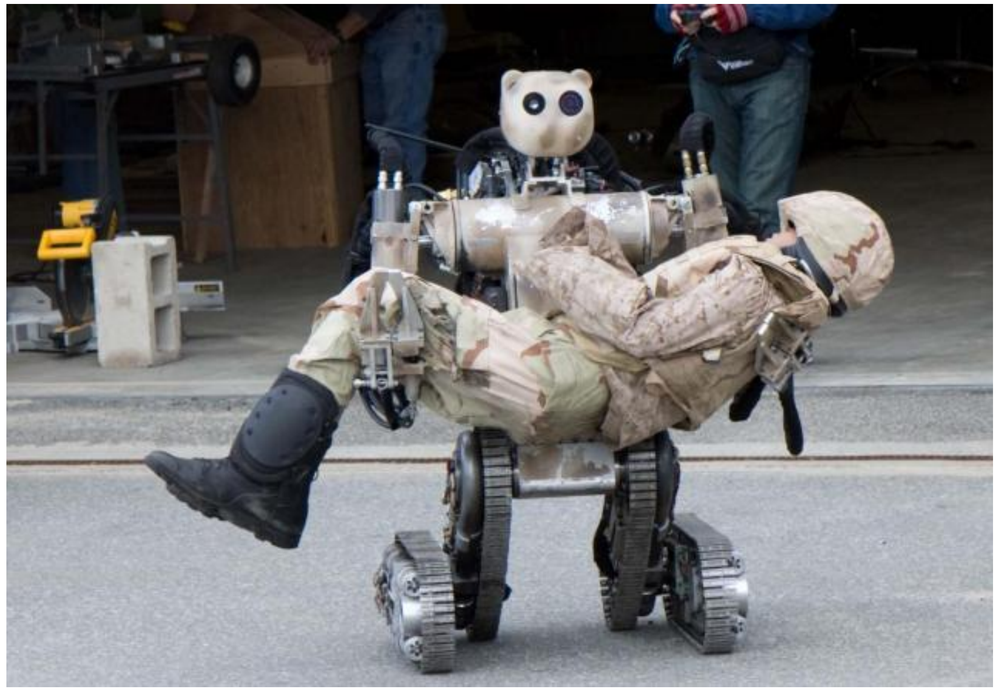
Project “Army” of the Pentagon

- The plan - to spend $ 1 billion over the course of 5 years (since 2017) on building robots to accompany soldiers on the battlefield.
- Tasks – scouting, disposal of explosives, "sensing" of dangerous chemicals, carrying of equipment.



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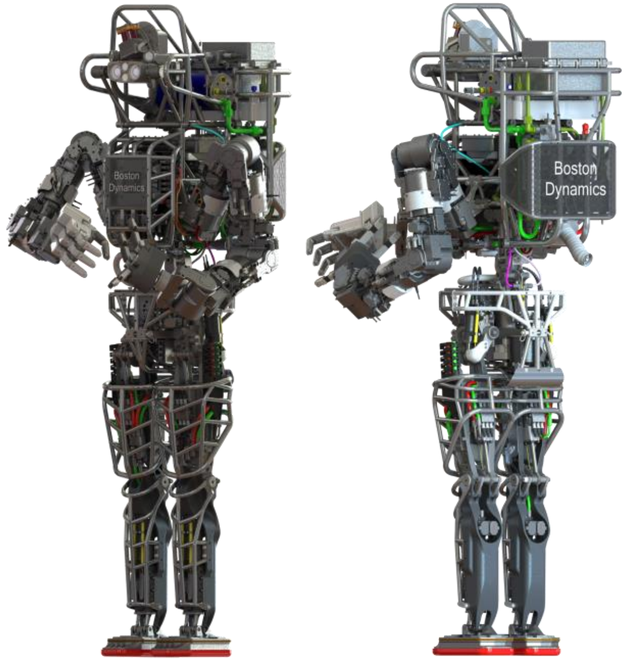
Project “Army” - FOR

- Bryan McVeigh, the project manager – thinks that by the end of the project there will be robots in every army. This new army will be times faster than a human one and it would have the ability to "see" the battlefield. According to him, there is no danger of autonomous robots such as "Terminator", because the plan is that the **commands would always be given by people** and robots will not make decisions by themselves.



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Project “Army” - AGAINST

- Elon Musk leads a group of 116 specialists from 26 countries - they issue a formal letter to the UN asking for a **ban on deadly autonomous weapons**. They believe that robots are unpredictable, and the fact that they are not being constructed to be autonomous now does not mean they will not become such.

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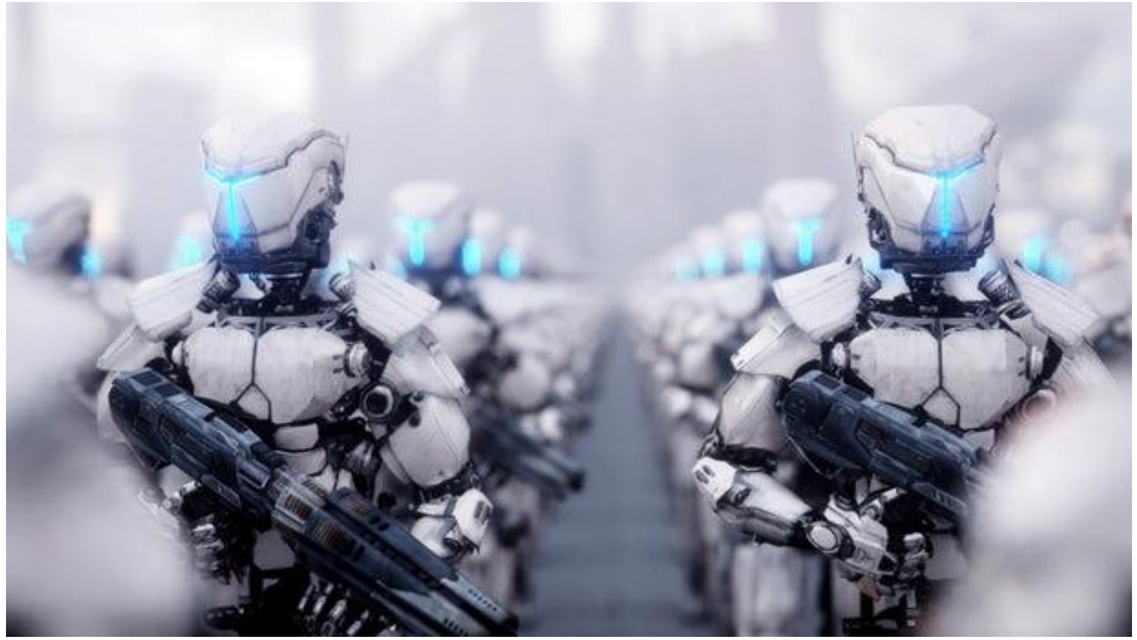
War projects

- Russia’s president, Vladimir Putin, said in an interview with Forbes: “Artificial intelligence is the future, not only for Russia, but for all humankind. It comes with enormous opportunities, but also threats, that are difficult to predict. Whoever becomes the leader in this field will become the **ruler of the world**.”



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Second scenario

- **ICS, programmed to do something beneficial, but it develops a destructive method for achieving its goal -** this could happen whenever we fail to fully align the ICS's goal with ours.

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Second scenario - example

If you ask an intelligent car to take you to the airport as fast as possible, it might get you there by being a threat to the rest of the traffic participants, by doing literally what you asked for.

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Second scenario - example

The driving company Uber released its own autonomous cars and bad results were not delayed. The first death by an autonomous car is now a fact: a woman killed while crossing the street in Tempe, Arizona.

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Second scenario - example

If an ICS is tasked with an ambitious geo-engineering project, it might destroy our ecosystem as a side effect, and view human attempts to stop it as a threat that needs to overcome.

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Second scenario – benefits and risks

ICSs are becoming better at accomplishing their goals, but if those goals aren't aligned with ours, we would have a problem.

What would happen if we are in charge of a hydroelectric green energy project and there's an anthill in the region and it needs to be flooded?

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Second scenario – benefits and risks

A key goal for ICS safety research - never place humanity in the position of those ants.

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Second scenario – benefits and risks

China is developing a social system, based on facial recognition algorithms and cameras that track the daily activities of people. The goal is to give every one of China's 1.4 billion citizens a personal score based on how they behave - do they jaywalk, do they smoke in non-smoking areas, how much time they spend playing video games, etc.

When you are being watched and then decisions are made based on that intel, it's not only an invasion of privacy, but it can quickly turn to social oppression.

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Risks with ICS

- **Loss of control;**
- **Possibility for manipulations:**
  - of turnovers;
  - of public opinion;
  - of people's desires.

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Base risks

- AI does not generalize - it is good at a certain task.

Example – The fact that an AI plays GO does not mean that it can drive a car and vice versa.

- When AI encounters a "mystery" - receives information that is not part of its training.

Example – Trained to recognize people with beards.

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Can we predict the future?

Even the most powerful supercomputers cannot say definitively whether it will rain next week:

- Incredible complexity of what we are trying to model;
- A large number of variables that we need to know very precisely - wind speed and direction, solar activity, changes in the temperature of the atmosphere and water bodies, etc.

This chaotic unpredictability is the reason for the so-called **butterfly effect**, i.e. any small change in the initial conditions can lead to many different outcomes if we expand the system over time.

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Base risks - conclusion

If AI is used for making predictions - does it realize when it cannot make a good prediction, based on the information it has?

A human can generalize and ask for help when he is unsure, but today's ICS cannot.

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Perfect determination

Knowing the exact initial conditions in a system would allow us to calculate how that system evolves: cause and effect.

In reality - it is impossible to know and control the initial conditions, as well as all other ongoing effects, to infinite precision, in a system that is even simpler than weather.

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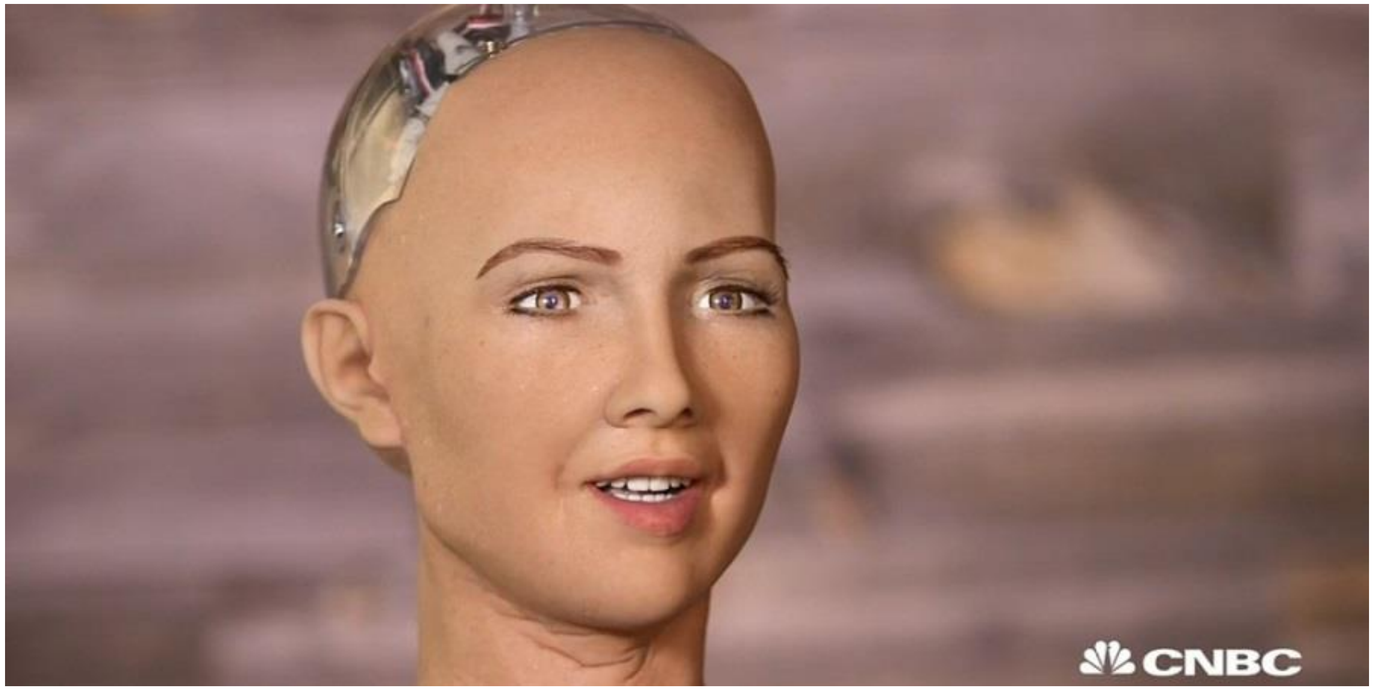
Sophia – first robot with citizenship



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CONTENT 3

Sophia – first robot with citizenship

- Produced by Hanson Robotics in Hong Kong and activated on February 14, 2016. It is modeled after the actress Audrey Hepburn and uses AI for communication by having been given initial mimics and answers to some standard conversation topics, but is programmed to “smarten up" over time.
- The goal - to be used as a companion for elderly people in homes and to help with major events such as concerts, etc.
- In October 2017, she obtained citizenship in Saudi Arabia, and in the beginning of 2018 she was given legs and the opportunity to walk.

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Sophia – first robot with citizenship

Will Smith on a date with Sophia:

https://www.youtube.com/watch?v=Ml9v3wHLuWI&t=109s

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Sophia – first robot with citizenship

- **Negative reviews** - Sophia has the opportunity to “smarten up" with time, i.e. she develops new "thoughts" on certain topics, and can each time give a different answer to any question. Her "thinking" happens through the **decision tree**. That way, she formulates her answer depending on what the person across her has said. This is not dangerous in itself and many people call her a chat-bot. To what extent, however, is the "reasoning" on different topics simply a follow-up to the decision tree, and to what extend is it actually “getting smarter"? Some scientists believe that this given freedom that Sophia has could turn against us, as she could become too self aware with time.

- Interview of CNBC with Sophia https://www.youtube.com/watch?v=78-1MlkxyqI
- Sophia’s blog: https://www.hansonrobotics.com/blog/

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Lil Miquela – first software „robot“

- Project, crearted by Brud in 2016 as an Instagram profile. Used mainly as a marketing strategy for different campaigns at the beginning, it now leads an independent “life”.
- Without a physical body, modelled over the images of real people.
- By the middle of 2022 has 3 million followers on Instagram.

- Lil Miquela’s introduction: I’m Miquela, A Real-Life Robot Mess - https://www.youtube.com/watch?v=6bn3tUUtj2M

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Will robots close down jobs?

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Which jobs will be occupied by robots?

- **Workers**;
- **Service Personnel** - McDonald's franchise in Phoenix is almost entirely robot-controlled;
- **Translators** - Google Translate is improving thanks to its neural network.
- **Accountants -** SMACC Financial Company, provides $ 3.5 million to set up its accounting system with AI;
- **Lawyers** – the international lawyer firm Baker & Hostetler has hired the first lawyer with AI called ROSS;
- **Writers -** a novel written by AI, almost wins a literary award. EMMA, the plagiarism detector, can easily identify authorship if a certain number of documents are uploaded to it.
- ...

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CONTENT 3

Will robots kill jobs?

- Daisuke Adachi and colleagues at Yale University looked at Japanese manufacturing between 1978 and 2017 – they discover that an increase of one robot per 1,000 workers increased company employment by 2.2%.
- Joonas Tuhkuri from the Massachusetts Institute of Technology (MIT) and colleagues looked at Finnish companies - concluded that the introduction of modern technology led to an increase in the hiring of employees.
- Unpublished work by Michael Webb of Stanford University and Daniel Chandler of the London School of Economics - examines machine tools in British industry and finds that automation has a "strong positive relationship with company survival and that greater initial automation is associated with increased employment “.

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CONTENT 4

Quantum computers and science in the XXI century

- **Quantum bits (qubit)** – are not limited to only 2 possible states, but can exist in a quantum superposition of both 0 and 1, i.e. can store much more information.
- **Advantage** - many entangled qubits can handle multiple operations simultaneously.
- **Problems before implementation:**

➢ such states can be maintained only under special conditions and for a very short time;

➢ to control the input and output of the information that the qubits process due to their increased number.

- **Working on the problem –** IBM, Google, startup companies.
- Quantum computers will need their own software and algorithms (Shor's algorithm for dividing a number by prime factors, Grover's search algorithm, etc.).

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