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Artificial Intelligence. Challenges and threats

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Abstract. The paper is concerned with the visions and threats of Artificial Intelligence. It characterizes and describes those that, according to experts and scientists, will have a huge impact on the shape, nature and functioning of societies in the next two to three decades. Undoubtedly, one of the significant challenges is the development and application of deep learning. Scientific research in Artificial Intelligence will be accompanied by intensive development of computer vision, convolutional networks and virtual, augmented and mixed reality. In the future, everything digital will be able to fall prey to counterfeiters. The essence and functioning of related Deepfake tools are explained and described in the paper. The development of Artificial Intelligence will result in a wide and versatile application of Biometrics. The paper describes the prospective areas of its use and draws attention to the problems associated with the construction of the oversized databases necessary for this purpose. In the era of a society characteristic of the development of the fourth industrial revolution, the way and means of automobile transportation and the necessary infrastructure will be radically transformed - autonomous vehicles will appear. The paper describes all levels of reference relating to the scope of control of an autonomous vehicle. Effective use of Artificial Intelligence solutions will not be possible without computers with enormous computing power. The

emergence of quantum computers will certainly solve this problem. The essence of quantum computer functioning is described in the next chapter. Artificial Intelligence can successfully perform many tasks better than humans. This will make Artificial Intelligence take on a huge economic value. Positions will be lost for both physical and mental workers. The question then becomes, where are we? Which professions can take over Artificial Intelligence and which ones will not move? What is the future of work done by humans? These issues are addressed in Chapter 9. The prospect of widespread and comprehensive use of Artificial Intelligence solutions will raise the following question, with respect to both humans and society. Can Artificial Intelligence optimize our happiness? The answer to such a question is not an easy one. The paper attempts to answer it. In the age of Robotics and Artificial Intelligence, we will be accompanied by, revolutionary changes in the way humans of entire societies function. There will be an urgent need to define a new economic model. Issues clarifying the nature and importance of the essential components of the said model are addressed in this work. Solutions and use of Artificial Intelligence are often accompanied by various kinds of failures. These can have many causes. The paper describes and explains, proposed by Yampolsky Roman, a kind of dysfunction pattern. The results of scientific research and practical experience that the list of Artificial Intelligence dangers is very extensive. A representative list of risks from Artificial, along with the characteristics of each of them, is presented in the last part of the paper.

Keywords: Artificial Intelligence, Deep Learning, Deepfake, Threats

1 Introduction

More than 40 years ago, Carnegie Mellon University computer science PhD student John McCarthy, coined the term "artificial intelligence". For many people, Artificial Intelligence is the quintessential technology of the twenty-first century, and the challenges, changes and threats it brings are global in nature, inherent in the fourth industrial revolution [1]. There are many interesting applications of Artificial Intelligence and directions for its development from which humanity will benefit immensely. As Artificial Intelligence experts predict, in the next few decades a great variety of aspects of our daily lives will change beyond recognition. Artificial Intelligence will generate unprecedented wealth, revolutionize medicine and education through human-machine symbiosis, create entirely new forms of communication and entertainment, challenge the existing social and economic order, relieve us of routine work and, unfortunately, will also bring very different and new threats, particularly in the form of autonomous weapons and smart technology [7].

Development of the practical application of Artificial Intelligence has progressed very slowly until recently, but for the past few years Artificial Intelligence technology has been evolving at a dizzying pace. The turning point for Artificial Intelligence has been the achievements mostly related to deep learning, a technology for autonomous learning from large data sets. The essence, conditions and risks of deep learning were presented in Chapter 2. Special attention was paid to the comprehensively useful nature of this technology. Reference was made to such an important issue as the differences between the abilities and skills of Artificial Intelligence and humans. The importance of sufficient and very large amounts of data necessary for the correct course and results of deep learning was emphasized. s and applications

are addressed in Chapter 3. Knowledge of how people see has contributed to the development of convolutional neural networks. This technology overcomes all previous solutions developed. Integral to Artificial Intelligence solutions and models is computer vision. Issues related to its capabilities for computer vision, the general architecture and operation of which are described in the chapter under discussion.

The content of the third chapter is the technical issues related to the implementation of Deepfakes. They are created through a technology called generative adversarial networks. It is also pointed out that in the not distant future deepfake protection software will become as common as antivirus software. The fourth chapter describes the actual and potential areas of use of Biometrics. It was emphasized that it is expected that in the near future Biometrics as a very significant element of Artificial Intelligence will completely take over the task of recognizing and verifying people.

Virtual reality, augmented and mixed will be a way of interacting with the world around us, especially with the Internet of Things, and retrieving information about physical objects to better understand their history, intended use and context. It will be a combination of the Internet world and the real world and will change all aspects of our lives and work. Chapter 6 deals with these issues.

Chapter 7 considers autonomous vehicles, that is, self-driving cars controlled by a computer that drive without a driver. It highlights such issues as navigation implemented by Artificial Intelligence and benchmarks in controlling an autonomous vehicle.

Quantum computers will significantly speed up Artificial Intelligence, and quantum data processing will lead to revolutionary changes in Artificial Intelligence models. Allowing it to solve problems that are currently impossible to solve. Chapter 8 highlights the above issue and describes the essence of quantum computer operation in a very synthetic way. The professions most vulnerable to automation through the application of Artificial Intelligence are those associated with routine work and entry-level positions. Artificial Intelligence, on the one hand, will incredibly improve labor productivity, and on the other hand, it will lead to deep structural difficulties in society - the complex dynamics of social processes will be infected. Thus, the following question is as relevant as possible: when it comes to labor, will artificial intelligence prove to be a blessing or a curse? The answers to some of the most relevant of these questions are the content of Chapter 9.

Chapter 10 addresses the issue of happiness in the age of Artificial Intelligence. An attempt was made to answer the question. Can Artificial Intelligence optimize our happiness? This is obviously an incredibly complex and difficult problem. I believe that despite many philosophical and design and programming problems, in the near future Artificial Intelligence will strive to increase our happiness.

Artificial Intelligence and other technologies will bring about the fourth industrial revolution. Improved technologies for deriving and storing energy from sunlight and wind will make us face a reconstruction of the world's energy structure in the coming years. An indicator of the changes that are already taking place in the modern world is the so-called "dematerialization". Thanks to research at the molecular level, scientists will be able to artificially produce the food we know so well and propose entirely new food products. Robots and Artificial Intelligence will dominate the production, delivery, design and marketing of most goods. There will be a need to develop a new economic model, subservient to human needs rather than human greed. The transition to the age of affluence will require a major social remodeling - an improbable

transformation. The aforementioned problems are addressed in Chapter 11. Chapter 12 considers the failures of Artificial Intelligence. A thorough analysis of the literature on the subject justifies the conclusion that they can have very many causes. Currently, the most common ones are due to algorithmic errors, poor performance of computer systems or basic failures. Analyzing the possible failures of Artificial Intelligence, it is possible to develop a kind of pattern of dysfunctions. These failures can certainly be assigned to very different causes. This chapter describes the essence and nature of the most typical and common causes of Artificial Intelligence failures.

The results of scientific research and practical experience on both individual and social levels indicate that the list of risks associated with Artificial Intelligence is very extensive. The most typical risks and their expressions and impacts are described in Chapter 13, noting that many of the above risks are not new, but the sheer breadth and diversity of risk combinations and the many unforeseen interactions between the various risks are already of great concern.

2 Deep Learning

Deep learning is based on the tangled networks of neurons in our brains. Its essence is the creation of software layers in which artificial neural networks have levels of input and output data. During the process of deep learning, mathematical training takes place to maximize the objective function. The artificial neural network is prepared and trained to independently distinguish which features of the millions of images of the object under study are most helpful in distinguishing between these objects. According to experts and systems analysts, deep learning is a comprehensively useful technology. It can be applied in almost any field for recognition, prediction, classification, decision-making and synthesis. In doing so, however, it should be emphasized that the computing power of computers is the engine of Artificial Intelligence, and input data is its fuel [3] [6]. The creation of deep learning was related to research on the human brain, which, however, functions in a completely different way than Artificial Intelligence. After all, humans need much less data, but thanks to deep learning and computers, they are definitely better at performing a specific task, especially when it comes to quantitative optimization. Humans don't have a particularly divisible attention span, whereas a deep learning algorithm, trained on an overwhelming amount of data, will discover correlations between fuzzy features of the data, too vague or too complex for humans to understand or even perceive.

Deep learning is a powerful tool, but it does not solve all problems. Humans lack the AI's characteristic ability to analyze a huge number of data points simultaneously, but they have a unique ability to make decisions based on experience, abstract concepts and common sense. In contrast, deep learning functions efficiently when the following conditions exist: a large amount of adequate input data, a narrow domain and a specific objective function to optimize. If any of these factors do not occur, everything can fail. If there is not enough data. The algorithm will then run out of examples to establish meaningful correlations. If the optimization problem, will involve multiple domains. The deep learning algorithm will not find correlations between them and will not get enough data to discover all combinations. If the objective function will be too large. Without explicit guidance, the algorithm will not be able to optimize the output correctly [9].

It is very important to understand that deep learning functions very differently from the human brain. Deep learning needs a huge amount of data to learn, the human brain needs only a small amount of data. For deep learning, optimization, especially quantitative optimization and selecting one solution out of a million is very easy. For the human brain, it is an extremely difficult task. This is because there is, among other things, the related problem of individualization i.e. situation-dependence, e.g. showing each user a different product to maximize purchases, is extremely easily solved by deep learning algorithms. Humans deal with it with extreme difficulty. Abstract concepts, analytical reasoning, reaching conclusions, common sense, perspicacity are quite easy activities for the human brain. Deep learning has a very big problem with this. The same is with creativity.

What are the drawbacks of deep learning? At the heart of the matter is the simplicity of the objective function and the danger of focusing on optimizing a single objective function, which can lead to harmful, wide-ranging externalities. There can also be the danger of deep learning getting to know you better than you know yourself. Internet users who are manipulated in this way may adopt the point of view imposed on them, there may be polarization of societies and misrepresentation of the truth, which may ultimately affect people's happiness, mood and mental health. Deep learning problems require further research in the area of complex goal functions, as well as finding a way to quantify such concepts as "time well spent," "fairness" or "happiness".

3 Computer vision

Computer vision is an Artificial Intelligence issue related to teaching computers to see. Among our six senses, vision is the most important. So with regard to computer vision, as an essential element of Artificial Intelligence, it is not a matter of simply transmitting recordings or images, but of teaching computers to understand what they see. Computer vision includes the following skills, ordered from least to most complex [16]:

- Image capture and processing
- Image detection and segmentation
- Object detection and detail understanding
- Object tracking
- Gesture and motion recognition
- Scene understanding, both general and with detailed correlations

Technologies using computer vision are already in daily use. They can be utilized in real time, in a variety of fields. They find significant application in all kinds of photography and video recording. Thanks to them, you can:

- Edit photographs and video recordings
- Perform analysis of medical imaging
- Verify the message on the internet
- Select advertisements according to the content of the video being played
- Perform intelligent image search
- Create deepfake type mystifications naturally

Integral to deep learning and computer vision are convolutional neural networks. Knowledge of how people see has contributed to the development of convolutional neural networks. At the lowest level, such a network consists of a large number of filters that are repeatedly applied to a single image. During deep learning, image processing is optimized and each filter is assigned its learning field. The filters signal their confidence that they have noticed a particular feature that is assigned to them. Elements of the higher layer accept input received from lower levels and detect more complex features [19].

In improving deep learning, scientists decided to look to the human brain for inspiration. Our visual cortex uses many neurons assigned to numerous areas - known as receptive fields - through which the eyes see. Receptive fields identify basic features such as shapes, lines, colors or angles. The detectors are connected to the neocortex, the outer layer of the brain. The neocortex stores information in a hierarchical manner and processes the message from the receptive fields, allowing us to better understand the complexity of the recorded scene. Convolutional neural networks are a precise and improved deep learning architecture designed to handle computer vision, with separate versions for fixed images and video recordings. The tremendous increase in computer processing power and data volume has made this technology overcome all previous solutions developed for computer vision.

4 Deepfake

In the future, anything digital will be able to become a victim of forgeries - videos uploaded to the web, recorded speeches, surveillance camera footage and courtroom videos. Significant in this regard, will be the development of 3D technology, which involves creating a model of a person purely through the computational operations of a computer. In computer graphics, everything can be modeled. So programmers need to create realistic mathematical models of hair, wind, light, shadow and so on. 3D solutions give the creator much more leeway: he can create completely arbitrary environments or generate characters, and then manipulate them at will. Modern computers cannot create images that take full advantage of the potential of computer vision and can fool the human eye, and it is for this that people in animated films still do not look realistic enough.

Deepfake was created with a technology called generative adversarial networks. It is a pair of deep learning neural networks "competing" against each other. The first network, called the generator network, aims to generate something that looks realistic and is based on millions of images. The second network, which is a discriminator network, compares the image generated by the generator network with real images and determines whether it is dealing with an authentic or a fake [8] [7].

The generator network uses the findings of the discriminator network to re-train itself before trying to fool it once more. Thus, it adjusts its operations to minimize the difference between the generated and real images. The discriminator network is then trained again, with the goal of detecting forgeries by maximizing the "loss function". These two processes are repeated up to millions of times, with the generator and discriminator honing their skills until they reach a level of equilibrium. Effective detectors are already in use today. However, an important limitation is the computing power of modern computers. This is especially true when users of a website upload millions of materials per day.

In the long run, however, the biggest problem will be the built-in mechanism for "perfecting" the generator network in a generative adversarial network. Suppose we have trained a generator network, and then someone develops a new detector algorithm to detect our deep-fakes. In this situation, we re-train our generator network to fool the detector algorithm. This leads to a situation in which one of the [1].

In the near future, deepfake protection software will become as common as antivirus software. The presence of fakes on government, news and other sites whose credibility is crucial is unthinkable - so they will be equipped with high-end deepfake detectors. Such detectors will catch any manipulated, high-resolution material created by large generative adversarial networks trained on very powerful computers.

Is flawless exposing of deepfakes realistic in the not distant future? According to scientists and researchers of this problem, we can expect such solutions. However, this will be possible when a completely different approach is used, i.e. every photo and every recording taken by any camera or cell phone using blockchain technology must be authenticated. This will guarantee that the original has not been modified in any way, already at the time of capturing this data. All material uploaded to the Internet will have to confirm blockchain authentication. With this procedure it will be possible to identify and eliminate any deepfake.

Analyzing the research results and the results of implementation work related to generative adversarial networks, it should be said with certainty that their useful applications will be more numerous than the harmful ones.

5 Biometrics

Biometrics is the science of using a person's physical characteristics to verify their identity. Generative adversarial networks verify people through a combination of specific characteristics - facial recognition, the way they walk, speech, superficial vein pattern, gestures, and hand and finger geometry. Biometrics is usually used in conjunction with appropriate measuring devices and does not rely purely on recognizing physical features from video recordings. Unique characteristics of a specific object, such as human irises and fingerprints, are ideal for biometric identification. The world's largest government biometric identification database is held by the Indian government. The project, called Aadhaar (meaning "base"), is an ambitious attempt to catalog the fingerprints, photos and iris scans of all citizens, of which the country has as many as 1.2 billion. More than 500 million citizens have already received identification numbers in the Aadhaar system, having first placed their detailed biometric data in a national database. Some countries are already using such super huge databases, and many others are in the process of building them. Gartner estimates that as many as 30% of companies currently identify their employees using biometric techniques, and as many as 3.4 billion smartphone users unlock their devices using either their fingerprints, facial and eye image or voice [3] [18].

Intense advances in the fields of deep learning and generative adversarial networks have made biometrics develop rapidly. The capabilities of Artificial Intelligence already surpass human capabilities in identity verification and recognition. It is to be expected that in the near future Artificial Intelligence will completely take over the task of recognizing and verifying humans. It is also expected that in the near future, intelligent biometrics will find wide application in forensic investigations and forensic research.

6 Virtual, augmented and mixed reality

Virtual reality refers to a completely artificially generated virtual environment in which the user is immersed. The virtual reality world is independent of the one in which the user is physically located. Augmented reality, on the other hand, refers to the world in which the user is physically located - a second layer is applied to a recording of a specific space, and augmented reality algorithms supplement the image with three-dimensional objects, text, video images and similar.

Augmented reality provides a live look at the physical, real world through a computer screen, on which additional information is superimposed on the image of the environment - photos, sounds, video recordings or GPS coordinates of observed objects. Unlike virtual reality, which replaces the real world with its digital image or creates a completely fictional world, augmented reality enriches the perception of the environment by superimposing useful data on objects observed in the real world. Being a combination of the Internet world and the real world and it will have major impact on all aspects both of our lives and work [12]. It is predicted that in the coming years we will download and install 2.5 billion augmented reality applications on our devices.

In recent years, another technology has emerged, called mixed reality, which is a modernized form of augmented reality. Mixed reality is the combination of the virtual and real worlds in such a way that a hybrid world is created. Mixed reality synthesizes environments not in the form of a simple sum of the real and the virtual, but by creating complex spaces created by completely decomposing and transforming the surrounding scenery, in order to allow the user to interact with objects placed in this reality. Mixed reality is still in its infancy. I assume that the technology will develop the ability to integrate new virtual objects with the environment in which they appear and will present them as if they were subject to the laws of physics, making them seem more natural.

Virtual reality, that meets the eye, is the most natural output, so the most natural way to transmit input must be the brain-computer interface [3]. Research carried out in this direction will certainly result in technical solutions that will make it possible to download data from the brain and transmit information to it, so that we will remember and recreate memories by computer, transfer them to other people's minds or store them for all time. There will be breakthroughs in the area of virtual reality. While artificial intelligence will turn data into intelligence, virtual reality will collect higher quality data - it will obtain it from our eyes, ears, limbs and even brains. Artificial intelligence and virtual reality will make it possible in the future to better understand humans and expand the scope of human experience [15].

7 Autonomous vehicles

An autonomous vehicle, or self-driving car, is a computer-controlled vehicle that drives without a driver. Driven by Artificial Intelligence, an autonomous vehicle uses neural networks instead of brains and mechanical parts instead of arms and legs. The Artificial Intelligence's navigation plans a route, associating all points along the way with points a high-resolution digital map. Artificial intelligence inference involves using algorithms to predict the intentions of other cars or pedestrians. Artificial Intelligence decision-making and planning occurs

through the use of specialized rules or statistical estimates when obstacles, both moving and stationary, are detected.

Autonomous vehicles will initially only assist humans, but will eventually completely replace the driver. The process of controlling an autonomous vehicle is described in points referred to as reference levels, from zero to five. Level 0 - the human takes care of everything related to driving the car, while the artificial intelligence watches the road and alerts the driver as needed needs. Level 5 - human intervention is not needed on any of the roads or in any environment [5].

According to the assessments of many experts, Level 5 vehicles will not reach widespread use in the next twenty years. A major obstacle to reaching Level 5 is the problem of Artificial Intelligence, which will have to be trained on very large amounts of data representative of real-world driving situations. The multitude of such potential scenarios is incredibly large, and their level of variation correspondingly high, so for the time being there is no viable way to collect all permutations of the possible behavior of each object on the road, moving in all directions, under varying weather conditions [7] [4].

If we challenge one important assumption, that Level 5 must function in cities and on roads as they currently exist, there is an opportunity to accelerate the process. The development of 6G technology and augmented reality systems will have a significant impact on progress in this regard.

When Level 5 autonomous vehicles appear, there will be a real revolution in transportation. As part of route optimization, artificial intelligence will reduce users' waiting times to the bare minimum, as well as reduce empty trips. The reduction in expenses will clearly reduce transportation prices and encourage people to stop buying cars. Level 5 vehicles are expected to drive more safely than humans.

8 Quantum computers

Quantum computers will significantly speed up Artificial Intelligence, and quantum data processing will lead to a revolution in machine learning, solving problems that are currently impossible to solve. A quantum computer is based on a new architecture that uses quantum mechanics to perform certain types of calculations much more efficiently than a traditional computer. Quantum computers do not use ordinary bits, but quantum bits, or qubits, which are usually subatomic particles, such as electrons or photons. Cubits are subject to the principles of quantum mechanics, and as a result, they exhibit certain unusual properties on which their extraordinary data processing power depends.

The first such property is superposition, which is the ability of each qubit to assume many different states at any time. This makes multiple cubits in superposition to process a huge number of outcomes simultaneously. If an Artificial Intelligence on a classical computer is given the task of winning a game, it will try different moves and undo them in its "head" until it finds a path to victory. In contrast, an Artificial Intelligence built on quantum computing will try out all the moves in an incredibly efficient way, keeping all doubts about possible moves in its "mind", resulting in a drastic reduction in complexity.

The second property is entanglement, which means that two qubits remain connected in the sense that an effect on one simultaneously affects the other, even if a large distance

separates them. Through entanglement, each qubit added to a quantum machine dramatically increases its data processing power [7].

These amazing properties come at a price. The quantum computing system is very sensitive to disturbances, both in the computer and in the environment. In order to build a functional and expandable quantum computer, scientists must create special vacuum chambers, superconductors and high-efficiency cooling systems from scratch. Because of these challenges, scientists are gradually increasing the number of qubits in quantum computers - from two in 1998 to 65 in 2020 - but this is still too few to be able to perform, some particularly complex computational tasks despite the fact that quantum computers are more than a million times faster than traditional ones. Scientists estimate that a quantum computer will require a million or more physical cubits to achieve data processing power on the level of four thousand logical cubits.

Quantum computers will manage to model many complex natural phenomena that traditional computers cannot handle. They will not only discover cures, but also hint at combating climate change, predicting the risk of epidemics, creating new materials, exploring space, modeling the human brain and understanding quantum physics [13] [10].

The impact of quantum computers on Artificial Intelligence will not just come down to accelerating the pace of deep learning. Programming a quantum computer involves giving it all the potential solutions, expressed in cubits, and working out each of them. The quantum computer then aims to find the best solution to the problem in a very short time. Such a system will revolutionize machine learning and unravel issues previously considered unsolvable.

9 Artificial Intelligence and the elimination of jobs

Artificial Intelligence can successfully perform many tasks better than humans, And on top of that it does it practically for free. This will make Artificial Intelligence take on enormous economic value. This will happen, of course, at the price of unprecedented extensive job losses. Both blue-collar and white-collar workers will lose their positions. The question then becomes, where are we? Which professions can Artificial Intelligence take over, and which ones will not move? What is the future of human jobs?

In a particular way, the professions most vulnerable to automation through the application of Artificial Intelligence are those associated with routine work and entry-level positions. Artificial Intelligence, on the one hand, will incredibly improve labor productivity, but on the other hand, it will lead to deep structural difficulties in society. So, as much as possible, there is another question: in terms of labor, will Artificial Intelligence prove to be a blessing or a curse? The World Economic Forum estimates that 85 million jobs could disappear by 2025 as a result of automation, digitalization and the development of Artificial Intelligence. At the same time, the demand for 97 million new jobs is projected to emerge, requiring completely different skills and competencies.

Artificial Intelligence's advantage over humans is its ability to detect incredibly subtle patterns in large amounts of data. For example, a human loan processor takes into account only a few factors on the basis of which he decides whether to approve a loan application - he analyzes the assets the applicant owns, his income, the value of his house, his job and so on. An Artificial Intelligence algorithm, on the other hand, can examine thousands of variables in

milliseconds - publicly available information about the customer in question, his purchases, his record of medical services, the applications and digital tools he uses - and provide a much more precise assessment of the application. This raises the question. Would people be willing to let Artificial Intelligence give an opinion on their creditworthiness, and offer more favorable installments in exchange for agreeing to insights into their personal data? I believe that many people would go for it.

Experts believe that increased productivity through new technology almost always results in economic benefits, and that growth and prosperity is a guaranteed job gain. The problem is that Artificial Intelligence and robotic process automation is different from other technologies. However, it has a kind of universal appeal that could see it transform hundreds of industries and millions of jobs simultaneously, both cognitively and physically. While most technologies have created jobs and eliminated them at the same time, Artificial Intelligence's clear goal is to take on the duties of humans and thereby decimate jobs. In the not distant future, Artificial Intelligence and robotic process automation will be able to take over about forty percent of occupations.

They have in mind the enormous capabilities of Artificial Intelligence, the question arises how to help people experiencing professional turmoil because of it. First of all, we need to understand what skills Artificial Intelligence does not have and what tasks it will not perform. Only then will we accelerate the creation of decommissioning-proof jobs and undertake large-scale training and education efforts. Here are three features, which Artificial Intelligence can't handle [7]:

- **Creativity** – Artificial Intelligence can't create, work conceptually or plan strategically. It is excellent at optimizing data to achieve a narrowed goal, but it cannot determine its own intentions or think creatively. It does not reason interdisciplinarily or use common sense.
- **Empathy** – Artificial Intelligence does not have or understand feelings such as empathy or compassion. It will not manage to make humans feel understood and cared for.
- **Agility** – Artificial Intelligence can't do complex physical work that requires dexterity and eye-hand coordination. It can't deal with unfamiliar and unstructured spaces, especially those it hasn't explored before.

Of course, there are many professions that Artificial Intelligence will not manage to master for a long time to come. However, the wave of labor market changes associated with its introduction will sooner or later engulf all professions in which people routinely work. In the future, we should expect to see a blurring of the line between "contrived work", "practical training" and "real work" and the use of virtual reality technology to implement these three scenarios. There is also no doubt that the education system will need to be reformed so that school and university graduates are creative, socially oriented and versatile.

10 Artificial Intelligence and happiness

Can Artificial Intelligence optimize our happiness? This is an incredibly complex and difficult problem. I believe that in the near future Artificial Intelligence will strive to increase our happiness level. There will be the first prototypes of devices and software to try to increase

people's life satisfaction. Nevertheless, the problem situation related to this is still extremely intricate. It may be necessary to take another look at the definition of happiness, which is bound to become even more complex. It is not out of the question that a new look will be required for Maslow's Hierarchy of Needs.

It is reasonable to think that, thanks to Artificial Intelligence, society will develop to the point where the standard of living for most people will rise to a high level of comfort. However, the challenge still remains the problem of measuring happiness, which is an abstract, subjective and individual concept. If we could define it in units of measurement, how would Artificial Intelligence direct our lives to make us happy? Using the technologies available today, this can be done, not always perfectly, in three ways.

First method is incredibly simple - just ask people. It is the most reliable measurement, but it can't be used all the time, other ways must be used as well.

Second method measuring happiness will rely on the use of Internet of Things technology - cameras, motion detectors, temperature and humidity sensors and others, to observe human behavior, facial expressions and voice. It will be thanks to IT that human facial expressions can be detected, reflecting their emotions. Also useful in assessing human emotions are the skin tone of various parts of the face, caused by uneven blood flow, as well as the pitch of the voice, its volume, speaking rate, accent and balance in sound. The state of mind is also described on the basis of hand tremor, pupil dilation, eye refraction, blink frequency, skin moisture and body temperature changes. With so many elements analyzed, Artificial Intelligence has been able to determine human emotions - happiness, sadness, disgust, anger and fear. Over time, the recognition of feelings will become more reliable as more people come under Artificial Intelligence's observation.

The third way of measuring the happiness is to constantly check hormones linked to certain sensations and feelings. For example, serotonin is correlated with well-being and confidence, dopamine with pleasure and motivation, oxytocin with love and trust, endorphins are linked to feelings of bliss and relaxation, and adrenaline with energy.

The state of our mind depends on unknown combinations of various forms of bioelectrical activity - brain waves, structural elements - brain structure, and chemical elements - hormones, which work closely together. Thus, the creation of a scientifically validated information engine to optimize happiness will require researchers to find solutions in each of the aforementioned areas of knowledge. It is reasonable to believe that in the not-too-distant future, scientists will tackle the challenges they face and successfully develop such a model of Artificial Intelligence that can efficiently read human emotions, clearly outperforming humans themselves in this regard. There will also be prototypes of Artificial Intelligence that will attempt to raise human happiness to higher levels [20].

The data needed to create a powerful Artificial Intelligence that will give us happiness will also be an incredibly important issue. Protection and security of this data will also be an important issue. Concern for data privacy has become a cause for discussion in many countries around the world, especially among leaders in information technology. Its results unquestionably indicate that solutions in the nature of a "trusted Artificial Intelligence" to which we would entrust all our data for storage, hiding or transfer will be a necessity. Once the "trusted Artificial Intelligence" knows all that information about us and the broader environment in which we operate, we will be able to have it fulfill our data processing requests. I believe that over the next few years, thanks to increasingly insightful research into

data issues, there will be significant advances in the use of private data processing technology to protect personal information. Regardless of what, or who, this trusted institution will be - an enlightened ruler, the open source community or a distributed blockchain system, there is a contemporary unprecedented opportunity to make good use of the powerful Artificial Intelligence [21].

11 Artificial Intelligence and new economic models

Artificial Intelligence and other technologies will bring about the fourth industrial revolution. Not only a revolution in Artificial Intelligence awaits us. Improved technologies for extracting and storing energy from sunlight and wind will mean that the world's energy infrastructure is set to be overhauled in the coming years. Energy, material and manufacturing costs will fall at historically record rates. An era of affluence is to be expected. The energy and materials revolution will provide fuel and raw materials for Artificial Intelligence-led, automated production, making a time of prosperity inevitable. In the very near term, most of the developed world and parts of the developing world will be powered primarily by sunlight and wind. Sunlight and wind are currently the cheapest sources of electricity. In the last decade, the cost of obtaining solar energy has dropped by 80% and wind energy by 50%. The cost of energy storage has also dropped significantly. The drop in the cost of producing electricity will reduce the cost of water, materials, manufacturing, the use of computers, and make it possible to create applications and inventions that were previously too expensive to develop. Energy based on the sun and wind will be 100% clean, and thus by far will have the greatest impact on the desired climate change.

An indicator of the changes that are taking place in the modern world is the so-called "dematerialization". It defines an era in which many physical products are becoming scarce, as their role is being taken over by computer programs and platform-like products such as cell phones. Dematerialization is proceeding at an ever-increasing pace, and as a result, products that until recently were expensive are becoming free.

Thanks to research at the molecular level, scientists will be able to artificially produce the foods we know so well, as well as propose entirely new food products. Biology will revolutionize many industries, as a result of which they will become ecologically harmless, and the overall cost of their production will drop significantly. Artificial Intelligence will also soon be used to accelerate the pace of innovation in materials science. Giant databases will be created that will enable the creation of entirely new materials. Products will certainly be created that will be much lighter compared to their traditional counterparts. Robots and Artificial Intelligence will dominate the production, delivery, design and marketing of most goods. They will bring the cost of most manufactured goods down to a level that barely exceeds the cost of the materials from which they are made. We will enter an era of affluence thanks to nearly free energy, inexpensive materials and production automated by Artificial Intelligence. The era of affluence will come when virtually nothing will be in short supply, production will be almost cost-free - everything will become available for free or semi-free to everyone. These free products will primarily concern necessities - food, water, clothing, shelter and energy. We are also seeing evident signs of the "era of affluence" today. In 2020, \$218 billion worth of food was thrown away in the United States, and the cost of eradicating hunger in that country is

estimated at a modest \$5 billion a year. In addition, there are five times as many empty houses as there are homeless people. In the future, if the assumption of scarcity loses its *raison d'être*, all related theories will be obsolete - this will be particularly true of the works of Adam Smith, Karl Marx and John Maynard Keynes. When scarcity disappears, all mechanisms like selling, buying or exchanging will be unnecessary. Perhaps money will turn out to be unnecessary. When the models of the economy are no longer based on notions of scarcity and money, it will be time to create them anew in such a way as to elevate human needs to a higher level, including desire, love and belonging, recognition, as well as self-realization.

The transition to the era of affluence will require a major social remodeling - an unbelievable transformation. The occasion of the transition to the era of affluence will involve an exceptionally difficult test for human beings. There will be a need to develop an economic model subordinate to human needs, not human greed [2] [11].

Rapidly developing technologies will lead to the emergence of superintelligence. If we want it to emerge in the future, we absolutely need a breakthrough in science. We need to know how to effectively model scientific creativity, how to create models of reasoning and strategic thinking. How to shape Artificial Intelligence into consciousness and its accompanying needs, desires and emotions. How to instill in Artificial Intelligence what compassion, empathy and trust in another human being is. Are such breakthroughs realistic. In the future they certainly are, but they won't be achieved easily or quickly, and without all this Artificial Intelligence will not manage to become more humanized.

However, it should be remembered that Artificial Intelligence will be accompanied by many challenges and threats. The source of these dangers, however, will not be AI itself, but people who, decide to use it thoughtlessly for evil purposes. If we believe that with the development of Artificial Intelligence capabilities, many social groups will be rendered useless, then we will have squandered all chances to define and build a new model of the 'society of the future'.

However, if we welcome with satisfaction and satisfaction the liberation from routine work, and the end of living in fear of hunger and poverty, if we believe that the symbiosis of humans and Artificial Intelligence is much more valuable than the simple sum of our skills and skills of Artificial Intelligence. Then we will manage to create a perfect complement to ourselves in the form of Artificial Intelligence, and together we will go where no human has gone before. Together with Artificial Intelligence, we will build a new society, but more importantly, however, we will discover ourselves.

12 Failures of Artificial Intelligence

Artificial Intelligence failures can have many causes. Currently, the most common ones are due to algorithmic errors, poor performance of computer systems or fundamental failures. By analyzing the possible failures of Artificial Intelligence, a kind of pattern of dysfunctions can be developed. They can certainly be attributed to very different causes. Undoubtedly, one of the most important is the faulty data that feeds the Artificial Intelligence engine. Not insignificant are also the cultural differences of different communities, which can affect the misjudgment of the input data and the results of Artificial Intelligence. One of the common reasons for Artificial Intelligence failure is also the implementation of inferior solutions, which results in limited functionality of the developed systems.

With regard to deep learning algorithms, one of the causes of dysfunction will be unrepresentative input data. The discrepancy between learning and test data is not insignificant for the proper evaluation of the performance of AI algorithms. When modeling the behavior of specific individuals, Artificial Intelligence uses very general rules and statistics that describe different populations. However, these do not always correlate with the specifics of a person's personality. This can result in low reliability of human behavior modeling results. Designers of Artificial Intelligence models and algorithms do not always deal with information noise or statistical outliers. Such a situation makes the proposed solutions only suboptimal. Such engineering activities are often accompanied by a lack of testing of the executed Artificial Intelligence engine under rare and extreme conditions, which significantly limits the functionality of the proposed solution. Not insignificant to the success of using various Artificial Intelligence solutions is often the lack of alternative solutions. This can result in a lack of confidence in whether the modeled process is adequate to reality.

Agreeing that the users of the Artificial Intelligence tools used can control the data and the learning process is also a debatable issue. Their interference may interfere with the correctness of the modeled process. The question here is that while the short-term impact of Artificial Intelligence on our lives depends on who controls it, its long-term impact depends on whether it can be controlled at all.

Certainly, a very important reason for the dysfunction of very many Artificial Intelligence solutions is usually the lack of security mechanisms to prevent adversary interference. The scale and consequences of a very wide variety of threats of this type, are described in the next chapter. Artificial Intelligence also finds it very difficult to replicate human common sense and cultural competence. The solutions it proposes are judged to be naive and lacking in common sense for this reason.

The environment in which the process of designing and using AI solutions takes place has limited access to the necessary information and various types of sensors. The result of such a state of affairs is the limited usability of highly advanced solutions. Not insignificant for the mentioned usability are mistakes made during the design work and the lack of extensive testing.

The process of designing algorithms, models and advanced super intelligence solutions involves teams consisting of high-level specialists, from a wide variety of fields of knowledge and scientific disciplines. They usually use a language that is not always understood by representatives of other professional and scientific specialties, the result of which will be a lack of full readability, so important in explaining the essence, modeled processes and results of the application of solutions.

An important handicap of the solutions proposed by Artificial Intelligence is the inability to adapt to changes in the environment. For Artificial Intelligence users operating in a social space with high dynamics of change, this is a significant limitation.

The errors described are the most common current cause of Artificial Intelligence dysfunction. Most of the research currently being carried out to prevent such failures is being done in the area of practical knowledge and scientific activity under the name "Artificial Intelligence Security" [22] [23].

13 Threats from Artificial Intelligence

Artificial Intelligence will be involved in virtually every human activity. The results of scientific research and practical experience on both individual and team levels indicate that the list of Artificial Intelligence risks is very extensive. A representative list of threats from Artificial Intelligence includes such as: [23]

- **Loss of human autonomy** – Dependence on Artificial Intelligence can move people away from actual decision-making. It will accelerate the withdrawal of people from practical knowledge and work. This phenomenon is evident in many developed countries.
- **Concentration of power** – Very different growth rates among individuals, groups, companies, nations, as well as between humans and Artificial Intelligence will cause concentration of economic, political, social, cultural power etc.
- **Loss of freedom and control over our social goals** – Artificial Intelligence will be able to accurately monitor and even predict the actions of individual humans. It or someone behind it will be able to use its ability to restrict our freedoms and directly or indirectly manipulate our communities and individual decisions. Overwhelming people with irrelevant data can be a very effective method of manipulation. Even the benevolent use of Artificial Intelligence can cause undesirable social effects.
- **Loss of individuality** - People who are strongly connected to Artificial Intelligence will likely begin to lose their individuality as their minds are expanded beyond their brains and as they become increasingly susceptible to "group think".
- **Immortality of Artificial Intelligence** – There will be the possibility of loss of renewal resulting from the death of Artificial Intelligence. This may weaken future generations and create possible intergenerational conflicts. The immortality of Artificial Intelligence may create a "Artificial Intelligence to human" relationship similar to the "God to mortal" relationship. These threats will create a temporary imbalance in social potential.
- **Unlimited growth of Artificial Intelligence** - Artificial Intelligence is evolving much faster than humans, constantly increasing the existing gap.
- **Loss of character** – Genetic engineering and the merging of man and machine may force us to redesign the human body and mind. This could have unexpected side effects - disabilities in the human species and new forms of racism.
- **Direct harm from Artificial Intelligence** - Artificial Intelligence can construct scenarios in which harm can come from a hostile, apathetic, benevolent, wild, criminal, capricious or incompetent "personality" of its own. It can cause us harm deliberately for pragmatic or frivolous reasons , apathetically while pursuing its own goals, or by mistake.
- **Loss of stability** – It refers to any deviation from the desired state of existence, whether economic, social, existential, caused by Artificial Intelligence, resulting in a loss of control over our own destiny and the ability of societies to cope peacefully with change.
- **Psychological harm and loss of purpose and fulfillment** – Currently, it is difficult to assess the impact of the psychological, widespread damage that any threat from Artificial Intelligence may cause on our spiritual well-being and motivation systems.
- **The possibility of new types of warfare** – Facilitating, enabling or abetting the conflicts characteristic of super intelligent societies.

Many of the above risks are not new, but the sheer breadth and variety of risk combinations and the many unforeseen interactions between the various risks are already worrisome. First and foremost, one would think, attention should be paid to the first two risks. This is related to the issue of concentration of potential, which may consequently prevent us from implementing appropriate Artificial Intelligence controls, which would have the effect of increasing all the other risks. An analysis of the above threats such as direct harm, loss of autonomy, status or freedom, and concentration of potential, shows that many of them are fundamentally related to the concept of power or its imbalance. For this reason, controlling Artificial Intelligence threats is largely a political problem. It should be noted, however, that there are also threats that are to some extent purely technical. That is, they neither involve power nor reflect desires, intentions and even thinking, such as loss of stability due to rapid change. Stopping these threats is about preventing unacceptable deviations from the desired state. The scale of these threats is also illustrated by the fact that the cost of global cybersecurity insecurity is steadily rising, and companies spent more than \$100 billion on its programmatic and technical security in 2017 [17] [22].

14 Conclusion

In the next twenty to thirty years, Artificial Intelligence will fully fill all the activities and actions of every person and entire societies. Each of us will face a unique challenge in practical, intellectual and mental terms. The changes that will accompany us will be revolutionary. In order to meet the challenges of the Artificial Intelligence era, we must be perfectly and comprehensively prepared for this, and, above all, understanding and resistant to their temporary negative effects. The decisive factor for success in this regard, of course, will be the knowledge of societies about the essence of the immense possibilities and how to use Artificial Intelligence solutions. The paper describes only those challenges and threats from Artificial Intelligence and those solutions and applications that experts believe will dominate and determine the content and functioning of societies in the near future.

It certainly applies to deep learning. Deep learning is a powerful tool, but it does not solve all problems. Deep learning works efficiently when the following conditions exist: a large amount of relevant data, a narrow domain and a specific goal function to optimize, which can support humans in optimizing the decision-making process. In contrast, humans lack the AI's characteristic ability to analyze a huge number of data points simultaneously, but have a unique ability to make decisions based on experience, abstract concepts and common sense.

An obvious, somehow natural part of human life will be Artificial Intelligence solutions related to computer vision. They will accompany us in a great many daily activities, in particular, such as image capture and processing, image detection and segmentation, object detection and understanding of details, object tracking, and gesture and motion recognition. In the age of the information society, Deepfake-type threats will function in increasing scale and intensity. The results of current design and development work allow us to conclude that not far in the future deepfake protection software will become as common as antivirus software. After all, it is inconceivable that deepfakes are present on government, news and other sites whose credibility is crucial. Detectors will catch any manipulated, high-resolution material created by large generative adversarial networks trained on very powerful computers.

One of Artificial Intelligence's significant challenges will be the solution and use of biometrics. This will require the development of oversized databases describing a great many external characteristics and personalities of humans. Some countries are already using such databases, and many others are in the process of building them. It is to be expected that in the near future Artificial Intelligence will completely take over the task of recognizing and verifying people.

The next Artificial Intelligence challenge, regarding the solutions and use of virtual, augmented and mixed reality, will have a huge impact on our lives and the functioning of society. There will be disruptive changes in the field of virtual reality. While Artificial Intelligence will turn data into intelligence, virtual reality will collect higher quality data - it will obtain it from our eyes, ears, limbs and even brains. Artificial Intelligence and virtual reality will make it possible in the future to better understand humans and expand the scope of human experience.

Research work related to Artificial Intelligence is also accompanied by research on autonomous vehicles. It is expected that solutions practically in this area will revolutionize automobile transportation. The infrastructure necessary for its operation and use will change radically. Comprehensive changes will be made to the related behavior and functioning of humans and businesses of all kinds. When autonomous vehicles appear, i.e. those in which Artificial Intelligence will observe the road and alert the driver as needed, and human intervention will not be needed on any road or in any environment, there will be a real revolution in transportation. As part of route optimization, Artificial Intelligence will reduce users' waiting times to the minimum necessary, and reduce empty trips. The reduction in expenses will clearly reduce transportation prices and encourage people to stop buying cars. It is expected that vehicles with this level of application of Artificial Intelligence solutions will drive more safely than humans.

Effective use of Artificial Intelligence solutions will require super-efficient computers. Such requirements can be met by quantum computers. It should be expected that in not a long time there will be practically useful solutions in this area. This will bring about revolutionary changes in the processes of communication and data processing, as well as the functioning of computer systems. Quantum computers will manage to model many complex natural phenomena, which traditional computers cannot cope with. They will not only discover cures, but also hint at combating climate change, predicting the risk of epidemics, creating new materials, exploring space, modeling the human brain and understanding quantum physics. Research and work on quantum computer, is accompanied by initiatives of various bodies, such as the European Open Quantum Initiatives, in which a huge research and technical space in this field is defined.

A debatable and very controversial issue is the problem of Artificial Intelligence vs. job losses. First of all, we need to understand what skills Artificial Intelligence does not have and what tasks it will not perform. Here are three qualities that Artificial Intelligence can't handle - creativity, empathy and dexterity. Artificial Intelligence's primary advantage over humans is its ability to detect incredibly subtle patterns in large amounts of data. The jobs most vulnerable to automation through the application of Artificial Intelligence are those associated with routine work and entry-level positions. Artificial Intelligence will, on the one hand, incredibly improve labor productivity, but on the other hand, it will lead to deep

structural difficulties in society. So, as much as possible, the question is valid: when it comes to labor, will Artificial Intelligence prove to be a blessing or a curse?

There is an intense debate in the scientific world whether Artificial Intelligence can optimize our happiness? It is estimated that this is an incredibly complex and difficult problem. We may need to revisit the definition of happiness, which is bound to become even more complex. I believe that in the near future Artificial Intelligence will strive to increase our happiness level. It is predicted that with Artificial Intelligence, society will develop to the point where the standard of living for most people will rise to a high level of comfort. However, the challenge still remains the problem of measuring happiness, which is an abstract, subjective and individual concept. If we could define it in units of measurement, how would Artificial Intelligence direct our lives to make us happy? The state of our mind depends on unknown combinations of various forms of bioelectrical activity - brain waves, structural elements - brain structure, and chemical elements - hormones, which work closely together. In order to create a scientifically validated robust information engine to optimize happiness, researchers will have to face serious problems that will have to be solved in each of the mentioned areas of knowledge.

Artificial Intelligence will create the need to define a new economic model for the modern world. The energy and materials revolution that awaits us will provide fuel and raw materials for Artificial Intelligence-led, automated production, making a time of prosperity inevitable. The cost of energy storage will drop significantly, the cost of producing electricity will make it cheaper to use water, materials, manufacturing, use computers, and enable applications and inventions that were previously too expensive to develop. Energy based on the sun and wind will be 100% clean, and thus will have by far the greatest impact on desired climate change. A common phenomenon will be so-called "dematerialization," which will make physical products scarce as their role is taken over by computer programs and platform-like products such as cell phones. Robots and Artificial Intelligence will dominate the production, delivery, design and marketing of most goods. We will enter an era of abundance, experts predict, thanks to nearly free energy, inexpensive materials and production automated by Artificial Intelligence.

It should be strongly emphasized that it will sometimes happen that some of the Artificial Intelligence solutions will have a flawed character. There may be many reasons for this. Starting with the most common of them resulting from algorithmic errors, poor performance of computer systems or basic failures, through misprepared data, implementation of worse performing solutions, unrepresentative input data, discrepancy between learning and test data, use of very general rules and statistics modeling human behavior and personality, difficulties of Artificial Intelligence model and algorithm designers in dealing with information noise or statistical outliers. Such a situation makes the solutions proposed by Artificial Intelligence not infrequently only suboptimal in nature. The challenges of Artificial Intelligence are also bound to be accompanied by various risks. The list of risks associated with Artificial Intelligence is very extensive. The most important, in a sense representative, concern the loss of human autonomy, the concentration of power, the loss of freedom and control over our social goals, the loss of individuality, the immortality of Artificial Intelligence, the unlimited growth of Artificial Intelligence, the loss of character, direct harm from Artificial Intelligence, the loss of stability, psychological harm and the loss of meaning and fulfillment or the possibility of new types of warfare. Whether they are political or purely technical in nature, the breadth and

variety of their combinations and the many unforeseen interactions between them are already worrisome.

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