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The Impact of Artificial Intelligence and Space Transportation on Security

A mesterséges intelligencia és az űrszállítás hatásai a biztonságra

Absztrakt

A tanulmány célja, hogy két olyan területre hívja fel a figyelmet, melyek a jövőben jelentős hatást fognak gyakorolni a globális biztonságra. A mesterséges intelligencia és az ahhoz kapcsolódó technológiai újítások, illetve eszközök fejlesztése egyrészt kiemelkedő lehetőségeket, másrészt jelentős kihívásokat is jelentenek egyes források szerint a biztonságra nézve. Az űrszállítás privatizációja kereskedelmi célokkal a 2000-es évek közepétől kezdődően új kutatási lehetőségeket és programokat tett lehetővé, amely felgyorsította a fejlődést ezen a területen. Ugyanakkor veszélyes következményeket is magában hordoz. Elsősorban jelentős károsodást okoz környezeti szempontból, főként a Föld légkörében, másrészt megnöveli a kozmikus térben vagy onnan irányuló összecsapások lehetőségét.

Kulcsszavak: mesterséges intelligencia, űrszállítás, biztonság

Abstract

The aim of the study is to draw attention on two fields which will have a severe impact on global security in the future. Artificial intelligence and related technological innovations, development such tools will bring enormous opportunities in on hand, and according to some sources it also brings significant challenges on security on the other hand. The privatization of space transportation with commercial purposes from the mid-2000s brought new research opportunities and programs and created considerable improvement in this field. At the same time, it is carrying dangerous consequences in itself. First creates remarkable environmental damage mostly in the Earth's atmosphere, for second it increases the opportunity of a clash from or in the space.

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INTRODUCTION

This article examines how trending technologies create new chances and challenges for humanity. In many cases, they are developed to make everyday life easier, but there are also debates about how they can affect societal security if some of those intelligent machines get into wrong hands or start to make their own decisions. "Trending Technologies" are systems, vehicles, machines, and devices that are able to communicate, provide information, or act independently based on algorithms and collected data. This paper is limited to those observations that describe the social effects of technological development.

Artificial intelligence, augmented reality,[2] and virtual life are not questions of the future; they are a present topic. There are self-driving cars on the roads and weapon systems that act autonomously. In some cases, research and development (R&D) from defense industries was outsourced to private companies because the private sector is less regulated, more flexible, offers more funding for researchers, and provides access to markets as well. One of the best examples of outsourcing is the appearance of commercial space transportation, companies like SpaceX and Orbital ATK.[3] In the mid-2000s, these private companies launched their own rockets, built their own systems for space exploration, and proved they were able to transport cargo into space. Previously only a few states (e.g., Russia, China, the U.S.) could provide this capacity. On the one hand, this privatization diversifies space transportation and opens the way for broader space exploration. On the other hand, it makes it difficult to control who or what is in space, and to manage the impacts of space transportation on the atmosphere and environment.[4]

ARTIFICIAL INTELLIGENCE

There is no commonly accepted definition of artificial intelligence (AI), but it is, roughly, a computer system that can perform human-based tasks and provide solutions in many fields, such as healthcare, security and defense, or the civil service. The term "Artificial Intelligence" (AI) was coined in 1956 by John McCarthy, an American computer scientist. AI is, in short, the simulation of human intelligence by machines. The process is capable of learning, reasoning and self-correction. AI technologies can be robotic process automation, for example: tasks that need to be repeated by humans. Machine learning makes it possi-

[2] Impact of Augmented Reality http://www.augmented-reality-games.com/imact.php (Accessed 22. 11. 2017)
[3] NASA – Commercial Space Accomplishments https://www.nasa.gov/sites/default/files/files/NASA_Commercial_Space_Accomplishments.pdf (Accessed 22. 11.2 017)
[4] Nina Rastogi: „Dirty rockets." http://www.slate.com/articles/health_and_science/the_green_lantern/2009/11/dirty_rockets.html (Accessed 23. 11. 2017)

ble for computers to learn and act without programming. There are different algorithms, for example, for supervised learning, unsupervised learning, and reinforcement learning.

The first time artificial intelligence was mentioned in research papers was in the 1950s, and it had topics like problem-solving. Twenty years later, the U.S. Department of Defense started a program for computers that trained the system to mimic human reasoning. The street-mapping projects of the Defense Advanced Research Projects Agency (DARPA) in the 1970s, for example, or intelligent personal assistants in 2003 build on this technology.[5]

The technological development of computers started after World War II. The first Electronic Numerical Integrator and Calculator (ENIAC) machine was created seventy-two years ago, and its purpose was to calculate artillery firing tables for the U.S. Army. The inventors of ENIAC were J. Presper Eckert and John Mauchly, researchers at the University of Pennsylvania. It cost $500,000 and took up 1,800 square feet; the machine weighed 50 tons and contained 17,468 vacuum tubes and 15,000 relay switches.[6] Today there are some personal computers that fit into a single human hand. They are less expensive and far more effective than their predecessors.

AI can be classified in many ways. One differentiates between "weak AI," also known as "narrow AI", and "strong AI". Weak AI is designed for particular tasks, for example, Apple's SIRI, which simply responds to inputs using algorthims. Strong AI, or artificial general intelligence, mimics human cognitive abilities to find solutions in different situations.

Another classification, created by Arend Hintze, an assistant professor at Michigan State University, describes four types of AI: a reactive machine, able to identify the task and make predictions, but with no memory and therefore unable to use past experiences in calculations; limited memory machines, which can use past experiences to help in future decisions, like some of the autonomous vehicles currently in production; theory of mind intelligence, or machines that understand others' beliefs and intentions as humans make decisions (these do not exist yet); self-aware machines that act independently (these do not exist yet either).

Computing power–machine learning, neural networks, algorithms–has grown exponentially; it seems like AI is evolving from simple to self-aware machines. Different types of AI machines act in different ways. Some are able to react in real time, others work with past information and present pre-programmed representations of the world. There are also plans for self-aware robots that can predict human feelings and respond accordingly.[7]

Machine vision, or making computers "see," is already a reality. Using cameras, computers can capture and analyse visual information. They can see beyond walls, and are used in tasks from bomb disposal to medical image analysis to the identification of signa-

[5] Artificial Intelligence https://www.sas.com/en_us/insights/analytics/what-is-artificial-intelligence.html (Accessed 23. 11. 2017)
[6] ENIAC https://www.computerhope.com/jargon/e/eniac.htm (Accessed 24. 11. 2017)
[7] Type of AI from reactive to self-aware https://futurism.com/images/types-of-ai-from-reactive-to-self-aware-infographic/ (Accessed 24. 11. 2017)

tures. Such tools can make specific work like investigations, medicine, engineering, or everyday life easier for people who have a handicap.[8] They can make it safer for soldiers to operate, or possible for the elderly or blind to drive themselves and live independently.

Cameras replace the driver's eye in these autonomous vehicles, so the car can adapt to what is happening. The downside is that they require high -quality and -capacity processors that can collect and make sense of millions of pixels. These type of cars are also equipped with Light Detection and Ranging (Lidar) – probably the most expensive part of the system. It is using lasers and lights to measure distances from the vehicle up to 100 meters in all direction, thus it is creating a real-time 3D map. A large amount of information in every second makes necessary for autonomous vehicles to have powerful processors. It is also necessary to use radars because lidars and cameras are not able to see everything, but radio waves can help to determine distances of the surrounding objects, the speed they are moving with and the angle as well. It does not require line of sight as cameras and lidars do, but can be efficient in special circumstances as well, for example in poor weather conditions. In another way it also beneficial with much lower data processing than the previous sensors.[9]

AI thus has lots of positive attributes and beneficial applications, but no one knows how some of the algorithms and machines do what they do. In an MIT research paper, there was a case about an experimental self-driving car, developed by Nvidia, that did not follow the instructions of the engineers who constructed it but started to use algorithms it had learned from humans by sensing and adapting information.

It seems impossible that humans created something and then could not control and do not understand how it works. Yet the way the experimental car of Nvidia did this movement is still not clear to most of the scientists. Every bit of information collected by the sensors of this car was collected into a huge network of artificial neurons that sends the information further, into the “neural” systems of the car. The ability of image captioning, voice recognition, language translation can be practical in many ways, but it has still missing parts that can cause failures due to inscrutable processes.[10]

Deep Learning, a form of AI, is becoming more and more relevant in the future. Deep Learning is a system that uses both memory and reactive properties to form “neural networks” that “think” and “analyze” like humans, but much faster. A group of researchers at Mount Sinai Hospital in New York, for example, applied a deep learning program, “Deep Patient” to predicting disease of patients in 2015. The program successfully predicted not only cancer but psychiatric disorders like schizophrenia as well. The curiosity of the results

[8] What is A.I.? http://searchcio.techtarget.com/definition/AI (Accessed 23. 11. 2017)
[9] Richard Wilson: “CES Autonomous cars and the sensors to make them safer.” https://www.electronicsweekly.com/market-sectors/automotive-electronics/ces-autonomous-cars-sensors-make-safe-2017-01/ (Accessed 21. 11. 2017)
[10] Will Knight – The Dark Secret at the Heart of AI. 11 April 2017 - MIT Review https://www.technologyreview.com/s/604087/the-dark-secret-at-the-heart-of-ai/ (Accessed 21.11.2017)

is that professors still do not know how could Deep Patient discover schizophrenia which is hard to predict even for experts.

SPACE TRANSPORTATION

Another emerging trending technology is private space exploration and transportation. The leading companies in this field are Space Exploration Technologies (SpaceX), Virginia's Orbital Science, Lockheed Martin (developers of the Orion capsule), Boeing, Blue Origin, Bigelow Aerospace, SpaceDev/Sierra Nevada, and Virgin Galactic. These companies are racing to develop spaceships and rockets capable of transporting astronauts to the International Space Station or landing them on Mars or the moon.

The competition is also about who can provide commercial crew capabilities though.[11]

SpaceX, with its Dragon spacecraft and Falcon 9 rocket, launched and landed successfully in January 2017; no one else has or can yet re-use rockets in this way, which is a tremendous competitive advantage. The company also has put in orbit a communications satellite for Bulgaria, the BulgariaSat-1.[12] NASA has been cooperating closely with SpaceX since 2005, when they signed an agreement about human spaceflight development. It has created a framework for future missions and common work, especially in the field of R&D. [13]

There is speculation, however, that SpaceX and NASA will become competitors. SpaceX CEO Elon Musk announced in February 2017 that they have plans for the next year to carry private tourists around the moon. NASA has relied for such ventures on Russia since 2011, because it had ended its Space Shuttle Program; for the U.S.A., it is a matter of national interest to restore an independent capability to launch spacecraft and transport astronauts.[14]

Most of the new ideas regarding space transportation sound like science fiction, but this was true of much on the 1960s TV series "Star Trek", which featured, among other things, hand-held communications devices and computers that responded to voice inquiries. Books by H.G. Wells, H.P. Lovecraft, and others also contain "devices" dismissed at the time as "fantasy" but real today. People could not imagine flying, for instance, or traveling underwater, but those have been realities for many years. Today people have cell phones, laptops, and TVs that function through touchscreens, a technology unthinkable even a

[11] Stuart Fox: 6 Private Companies That Could Launch Human Into Space https://www.space.com/8541-6-private-companies-launch-humans-space.html (Accessed 23.11.2017)
[12] Sane O'Kane: SpaceX successfully launches and lands a used rocket for the second time https://www.theverge.com/2017/6/23/15861622/spacex-falcon-9-rocket-landing-success-buglariasat (Accessed 21. 11. 2017)
[13] SpaceX and NASA sign cooperative agreement on human spaceflight development http://www.spacex.com/press/2012/12/19/spacex-and-nasa-sign-cooperative-agreement-human-spaceflight-development (Accessed 14. 10. 2017)
[14] Could NASA and SpaceX cooperation turn into competition https://www.cbsnews.com/news/spacex-nasa-cooperation-could-become-competition/ (Accessed 14. 10. 2017)

decade ago. Yet today, when some scientists claim it is possible to move populations to Mars, people are doubtful.

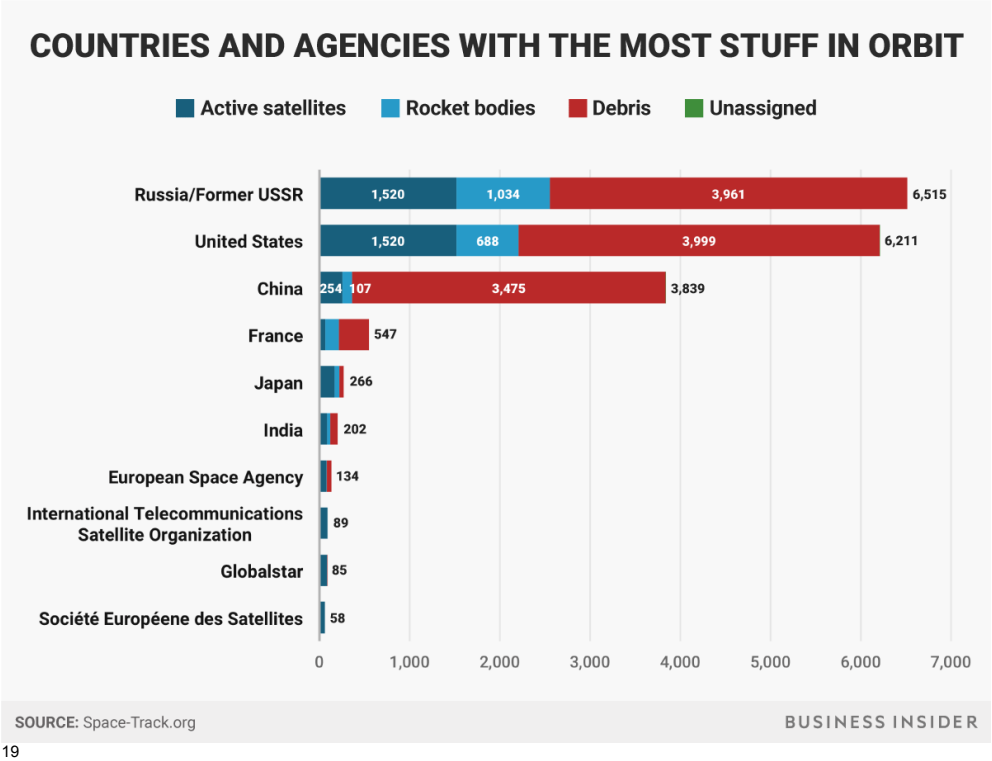
The tendencies of technological development, however, show that it is possible if both states and commercial actors are focused on the R&D of space transportation. According to Elon Musk, there are two ways for humanity in the future. One way is to stay on Earth where, sooner or later, humans will become extinct; the other is more enticing, because it says that there is the possibility for becoming a space-traveling civilization and to discover new solutions.[15]

The ideal planet, as Musk describes it, would be Mars. It is not as hot as Mercury or Venus, and it is closer than the moons of Jupiter and Saturn. Earth's moon, which may seem the logical choice, is too small, has no atmosphere, and its days are 28 hours long. But Mars has 24,5 hours per a day, thus approximating Earth time, and it is probably possible to warm the planet and create a thin atmosphere, which makes chances of establishing a self-sustaining civilization better.[16] The current need though, is spacecraft that can transport humans to another planet affordably.

Thanks to the common R&D of commercial and public sectors, there are already more than 4,600 satellites orbiting the Earth. The different type of satellites are beneficial in many ways. They can be used for making maps not only about the Earth, but also about the stars; they can be used to study phenomena like black holes and quasars. There also satellites for communications (radio, telephone), for navigation (calculating distances and positions), remote-sensing satellites for reconnaissance (radio and radar transmissions), for search-and-rescue missions, and for weather forecasting.[17]

All of them have a specific mission, but eventually, or in some cases soon after their launch, they become "space junk". There are literally thousands of man-made objects floating around in space that are no longer useful. To save the environment and prevent accidents caused by the falling objects, the future of space exploration and transportation is recycled rockets. The Falcon 9 is not only environmentally friendly, it is less expensive; companies can save around $18 million per launch.[18]

[15] Elon Musk: „Making Humans a Multy-Planetary Species". In: New Space, Mary Ann Liebert INC. Vol. 5., No. 2, 2017. 49 p.
[16] Musk: „Making Humans" 49 p.
[17] Uses of Satellites www.cyberphysics.co.uk/topics/space/Satellite/satellites_uses.htm (Accessed 28. 11. 2017)
[18] Sarah Marquart: SpaceX's historic launch proves recycled rockets are the Future of Space Exploration https://futurism.com/spacex-just-made-history-with-the-first-launch-and-landing-of-a-previously-used-falcon-9-booster/ (Accessed 10. 11. 2017)



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CONCLUSION

Today there are many "pseudo-AI" technologies based on human interaction with machines. Some companies, like Tesla, Apple, and Facebook, are pushing updates and making changes in how to interact with these devices; nonetheless, they all still require some human interaction. These applications, or "apps", collect information about people's habits and everyday schedules, and then use it to project their behavior. Google search engines provide information targeted to an individual on this basis, predicting, for instance, which goods a person might wish to purchase based upon past searches.

Intelligent systems like this that learn, adapt, and create new information autonomously and independent from humans could create a battleground for technologies. Virtual Personal Assistance (VPAs) are making everyday tasks easier, they will be infused with AI

[19] Dave Mosher and Andy Kiersz: These are the countries on Earth with the most junk in space http://www.businessinsider.com/space-debris-garbage-statistics-country-list-2017-10 (Accessed 28. 11. 2017)

using: advanced analytics, AI powered autonomous business processes and AI interfaces, with that improve costumer's experiences. The military sector especially is interested in developing such machines. AI would improve cybersecurity, increase the precision of weapons systems, and reduce the danger to humans in general.

The increasing autonomy of these systems creates concern, because no one knows for certain how these autonomous systems make decisions or in which direction they will develop; it is possible they may develop beyond human control. If an AI is becoming smarter than humans, there are no guarantees that they will not overrule their human-produced instructions. Researchers like Stephen Hawking, Elon Musk, and Bill Gates have all issued warnings, at various times, that AI brings risks to both itself and to humanity.

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