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LEGAL AND ETHICAL ASPECTS OF ROBOTICS AND ALGORITHMS

Master thesis

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INTRODUCTION

Robotics and algorithms have been gaining a lot of popularity lately. Starting from high-end humanoids on displays and shows, finishing with algorithms that follow us on every website we visit, every app we open, and every (non)technical move we make. They are out there at our every step. So, it is crucial to know what legal and ethical issues lure behind the fast-growing robotics and algorithms field. Especially, when algorithms, robotics, AI are connected – most of the robots are being driven by the algorithms, to perform tasks, learn from human behavior. It is important to study and overview both of robotics, algorithms, and AI at the same time, because their ties are very close, without AI and algorithms, the robots could not function properly, so we can consider them as a whole when it comes to those strong software and hardware connections, starting from very mechanical tasks, completing those ties with cybernetics, when AI drives robots so they could function as a part of a human's body (prosthetics).

Relevance of the Master Thesis - the topic of robotics and algorithms' legal and ethical aspects is significant. At the moment, we don't have specific and harmonizes regulations and laws for robotics and algorithms, rather many different laws and regulations can be applied depending on the situation. In this light, we face a lot of issues while resolving disputes and claims, that are related to robotics and algorithms. Even though European Union policymakers are working on the framework[1] to regulate emerging technologies more efficiently starting from Artificial Intelligence Act[2] and ENISA Report[3] where some threats and possible approaches are expressed, it is still unclear if we will be able to catch up to the growth and expansion of technologies and regulate them in time. As it was said in the European Parliament resolution of 16 February 2017 with recommendations to the Commission on Civil Law Rules on Robotics (2015/2103(INL))

[1] Evas, Tatjana, and Niombo Lomba. "*European framework on ethical aspects of artificial intelligence, robotics and related technologies*," Study, September 28, 2020. Accessed 9th of October, 2022. https://www.europarl.europa.eu/RegData/etudes/STUD/2020/654179/EPRS_STU(2020)654179_EN.pdf

[2] Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL LAYING DOWN HARMONISED RULES ON ARTIFICIAL INTELLIGENCE (ARTIFICIAL INTELLIGENCE ACT) AND AMENDING CERTAIN UNION LEGISLATIVE ACTS, Brussels, 21.4.2021, Accessed 9th of October, 2022

[3] European Union Agency For Cybersecurity. 2022. *ENISA THREAT LANDSCAPE 2022*. Accessed on 15th of December, 2022

"[...]whereas now that humankind stands on the threshold of an era when ever more sophisticated robots, bots, androids and other manifestations of artificial intelligence ("AI") seem to be poised to unleash a new industrial revolution, which is likely to leave no stratum of society untouched, it is vitally important for the legislature to consider its legal and ethical implications and effects, without stifling innovation;[..]"[4] Also, each case has to be evaluated through an ethical prism. It is essential to see what kind of imprint robotics and algorithms leave on mankind, and how complex the regulation and understanding of these things are. Since algorithms and robotics evolve and spread rapidly in multiple work/life-related ways, it is crucial to be up-to-date and identify the main issues, aspects, and impacts to our day-to-day lives, as well as the evolution of legislation around the world, because we have a lot of countries in the world, that are trying to catch up with the technology and one of the leading countries are EU and US based, a whole world is shifting it's attention to rapidly emerging technologies and shift of ethics. So, we would be prepared for the current and future changes robotics and algorithms expansion may bring. Many companies use robots and algorithms to generate incredible revenues. Therefore, it is important to grow those technologies under sustainable society channeled dome. Many companies use robots and algorithms to generate incredible revenues, for example […] In the first quarter of 2022, Google's revenue was $67.293 billion. In Q2, it reached $69.69 billion, which is up from around $62 billion earned in the same quarter a year prior.[5], of course, most of the Google's processes are based on the algorithms. And for Amazon, the robotics implementation saved nearly 50 percent on ML inferencing costs and unlocked a 20 percent improvement in productivity with comparable overall savings.[6]

These technologies will expand even more over the years and most companies worldwide will rely on them at the operation level and not only, in the future, the employers could offer their employees health insurance that covers robotic prosthetics, self-driving cars will take them from and to work. This topic is quite researched at the moment, but we will take a little bit different – sustainability approach, which is not yet widely discussed. This paper plays a crucial role in

[4] European Parliament resolution of 16 February 2017 with recommendations to the Commission on Civil Law Rules on Robotics (2015/2103(INL)). European Parlament, 2. Accessed 9th of October, 2022. https://www.europarl.europa.eu/doceo/document/TA-8-2017-0051_EN.html#title2.

[5] Google: One of the Greatest Inventions in History." n.d. Investing.com. Accessed December 14, 2022. https://www.investing.com/academy/statistics/google-facts/.

[6] "Amazon Robotics Case Study." n.d. Amazon Web Services, Inc. Accessed December 14, 2022. https://aws.amazon.com/solutions/case-studies/amazon-robotics-case-study/#:~:text=As%20of%20January%202021%2C%20the.

identifying legal and ethical aspects of robotics and algorithms, AI, issues, and lack of harmonized regulation, and finding solutions in critical situations related to robotics, algorithms, and their ethical and legal aspects. It is important to know the main ethical principle's impact on further legal development towards robotics and algorithms, AI regulations in US and EU because of these countries similarities, also, briefly review regulation in other leading countries. How human-robotics and algorithms interaction works and what consequences this interaction may bring. But most importantly, how we can create provisions for these emerging technologies in a sustainable and diverse way, that the society would be safe, but at the same time, the technology development would not be ceased because of unproper regulation techniques.

Significance of the Topic - this thesis will be useful for scholars, and law practitioners to broaden their perspective on ethical and legal aspects of robotics and algorithms. Also, it will bring more clarity on what is waiting for us in the future, and what issues legal scholars and legislators may face while investigating claims, and disputes related to the abovementioned emerging technologies. This Master Thesis will help legislators, practitioners find new approaches that can be implemented into day-to-day legal practice.

Master Thesis Object - sustainable relationship between society, robotics, algorithms, and AI, because of these emerging technologies, we have various unclear situations and threats that appear when these technologies are applied to our day-to-day lives.

Research problem - the research problem in this master's thesis is the lack enforceable regulations of robotics, algorithms, and AI. Shortage of harmonized regulations regarding robotics and algorithms. Robotics and Algorithms Regulation on Legal and Ethical levels in US and EU are these regulations up to date. Additionally, this paper focuses on existing legislation and its development regarding emerging technologies of robotics and algorithms. What ethical principles can help us to catch up with the turn-up of technologies? This paper pays attention to Robotics and Algorithms and raises scientific research questions: **What ethical principles may help us to catch up with emerging technologies such as Algorithms and Robotics? What main ethical principles may be applied to current and upcoming regulations towards Robotics and Algorithms? How can we use existing legislation in US and EU and create harmonized regulations towards Robotics and Algorithms?** Regarding these questions, this master's thesis will be prepared and introduced.

Level of analysis of this research problem and novelty of the thesis topic - this topic is well researched at the moment. On the other hand, we have sustainability approach, which is not yet

widely discussed at the moment. Most of the researchers paid attention to a need for harmonized regulation and a clearer path for legislation of rapidly growing technologies, especially those, which are related to civil use and investigated ethical and legal issues of robotics and algorithms and issues we can encounter while dealing with these technologies. Everyone wants to be safe before it's too late and we face science fiction movie scenarios, where robots, and artificial intelligence conquers and enslaves the human nation. But not all the authors focus not only on the technical side but also on the ethical side of the regulations and their relationship with legislation and legal aspects. One of the authors worth mentioning, which looked in depth at ethical and legal issues of AI, Robotics, and Algorithms back in 2019 and beyond is a Professor of IT Law at the University of Tartu Martin Ebers in his article "Regulating AI and Robotics: Ethical and Legal Challenges"[7]. He made good insights on the dynamics on emerging technologies and how they are challenging our law every day. Furthermore, Dr. Fosch-Villaronga Ph.D. LLM MA is Assistant Professor and the Director of Research at eLaw - Center for Law and Digital Technologies at Leiden University paid attention to robotics ethical interaction with people in various scenarios, mainly - in personal care, social robots, cloud services, and the ethical and legal issues we may face while encountering these technologies. Also, great insights were made by Dr. Sandra Wachter from the University of Oxford which specializes in Data Ethics, A.I., Robotics, algorithms, and regulation alongside Brent Mittelstadt and Chris Russell in the article "Why fairness cannot be automated: Bridging the gap between EU non-discrimination law and AI"[8]. Additionally, legal, and ethical challenges were discussed in the article by Ronald Leenes, Erica Palmerini, Bert-Jaap Koops, Andrea Bertolini, Pericle Salvini & Federica Lucivero (2017) "Regulatory challenges of robotics: some guidelines for addressing legal and ethical issues"[9]. Also, more ethical insights were proposed by Vincent C. Müller A. v. Humboldt Professor, Philosophy and Ethics of AI Director, Centre for Philosophy and AI Research in his article "Ethics of Artificial Intelligence and Robotics".

There is no structured and unified research in regard to robotics and algorithms' legal and

[7] Ebers, Martin , and Susana Navas Navarro. *Regulating AI and Robotics: Ethical and Legal Challenges*. Algorithms and Law, Cambridge, Cambridge University Press, April 17, 2019. Accessed 9th of October, 2022. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3392379

[8] Wachter, Sandra , Mittelstadt, Brent , and Chris Russell. *Why fairness cannot be automated: Bridging the gap between EU non-discrimination law and AI.* Article, March 3, 2020. Accessed 9th of October, 2022 https://arxiv.org/ftp/arxiv/papers/2005/2005.05906.pdf

[9]Ronald Leenes, Erica Palmerini, Bert-Jaap Koops, Andrea Bertolini, Pericle Salvini & Federica Lucivero (2017) Regulatory challenges of robotics: some guidelines for addressing legal and ethical issues, Law, Innovation and Technology, 9:1, 1-44: Accessed 9th of October, 2022
DOI: https://doi.org/10.1080/17579961.2017.1304921

ethical aspects, their specifics, and main issues, most of the abovementioned applicable articles are quite old and scattered towards different aspects of robotics and algorithms, AI, and each year, we face new legal and ethical issues while coming across algorithms and robotics, because of the rapid change and new technology and how it interferes with society starting with employment, finishing with robots becoming part of us, so new approaches and new, structured in-depth reviews and solutions are needed.

The aim of this master's thesis – to identify main ethical principles and evaluate which ethical and legal aspects can help to treat current blind spots of current legislation towards algorithms, robotics and AI.

To reach this goal, there would be main ***objectives***:

1. Overview and analyze the notion, genesis, evolution, and nature of Robotics, AI and Algorithms, to understand the main objectives of this Master Thesis better.

2. To figure out the main ethical principles applicable to Robotics and Algorithms and AI and how they correlate and what issues may rise while looking for synthesis and compatibility of these ethical aspects when it comes to Robotics and Algorithms.

3. Review and analyze current legislation towards Robotics and Algorithms in US and EU, determine how much of this legislation of this is still applicable, and how much of it needs to be replaced in regard to changes in emerging technologies and ethical aspects discussed in the 2nd chapter of Master's Thesis.

4. Determine how we can cover the main legal and ethical issues of Robotics and Algorithms, and what main provisions can be given for further sustainable legislation development, when it comes to Human interaction with Robotics, AI and Algorithms.

Research methodology - *Structural and functional methods* will be used while determining robotics and algorithms' nature. *Data analysis and collection methods* will be used while analyzing and collecting normative literature and different scientific articles while find the ones, that are relevant to Robotics and Algorithms. *The comparative method* used while comparing US and EU legislative systems regarding preparation and view of Robotics and Algorithms. It is essential to compare both countries side by side due to their common democratic principles, collaboration and competition between both of them when it comes to technology.

Hypothesis formation is used while analyzing and creating different provisions and scenarios for future legislation creators when encountering Robotics and Algorithms.

Structure of Research

In the first chapter we will analyze and dive into the genesis, nature, and evolution of Robotics and Algorithms. How Algorithms, AI and Robotics are defined, their roots, purpose, and how these technologies are emerging, and what waits for us in the future. What path these technologies will take and how they are impacting and will impact our day-to-day lives?

In the second chapter, we will dive deeper into the Ethical aspects of Algorithms, AI and Robotics. Find out what main principles of ethics can be applied to algorithms and robotics, what is the philosophy of these emerging technologies and how they will change and are changing in the light of the fast-paced world and evolving technologies. During the overview, in this second chapter, we will identify the main ethical issues Robotics and Algorithms (may) carry.

In the third chapter, there will be an overview of current legislation in the EU and US channeled toward Algorithms, AI, and Robotics. A comparison between these two legislative systems will be done to see the advantages and disadvantages of each of them. What can we learn from legislators of each continent and what blind spots do we still have and how we can fill in these gaps? Also, we will briefly run through the possible development of legislation in regard to discovered gaps.

In the last chapter we will explore human-technologies interaction, and the future development of legislation towards Algorithms and Robotics when it comes to civil Algorithms, AI and Robotics usage. Systemize the main Legal and Ethical Aspects of Algorithms and Robotics and see what provisions we can give to future generations, to save themselves from science fiction scenarios and build main supportive pillars for further legislative system development and precautions.

Defense statements:

1. Ethical principles must be applied to create effective and up to date legislation towards algorithms and robotics and AI.

2. Diverse point of view, multidisciplinary approach and expertise must be applied into rule making and technology development process to create sustainable technology-society bond.

LIST OF ABBREVIATIONS

AI - Artificial Intelligence

EU - European Union

US - United States

GDPR - General Data Protection Regulation

CCPA – California Consumer Privacy Act

HIPAA - Health Insurance Portability and Accountability Act

IoT - Internet of Things

CJEU - The Court of Justice of the European Union

IEEE-RAS - Robotics and Automation Society

R&D – Research and Development

1. THE NOTION OF ROBOTICS, AI AND ALGORITHMS, GENESIS, NATURE, EVOLUTION

Every creation has its beginning, no wonder algorithms and robotics have it too. It is essential to understand for what purpose these useful technologies were created, and how understanding, and implementation of them changed, let's overview this from the beginning and see the most remarkable events relating to robots and robotics.

Robotics – "the science of making and using robots (= machines controlled by computers that are used to perform jobs automatically)"[10]. It is believed that the genesis of robotics started in ancient Egypt, where around 3000 B.C. some of the mechanical tasks were carried out by machinery - water clocks had figurines that strike the bells when certain hours were reached. Later, around 400 B.C. hydraulic machines that could speak and make some sort of gestures were invented, but these were not mass-production items, and they were used only in certain situations, by people in high places. Making mechanical tasks much easier to create an impression of higher power and connection to gods. But it's just only the beginning, more automated solutions and automation happened before the 20th century, but most of them were impractical (e.g., wooden dolls that can move like humans). Robotics was always meant to be practical and make human life easier, that is why the first noticeable automated solution, that could be applied to certain industries appeared in the United Kingdom and France when in 1804 the weaving machine was invented by Joseph-Marie Jacquard which helped to automate weaving. When different patterns were weaved several times in a row, we can consider this as the first computed process and the beginning of robotics. This is when we started to see the social issues automation and technologies scared people and made them angry. Luddite protests broke out, people lost their jobs, and because of that they broke weaving machines, attacked employees and was against the technological change and improvement. Till nowadays term Luddite is being used when describing persons that are against technology.[11]1921 the term "Robot" was first used in Czech writer Karel Čapek's tale this word meant "forced labor".[12] And in 1949 inventor and neurophysiologist William Grey Walter invented the robot-like machine that looked like nowadays robot vacuum cleaners (yet without this function), that was battery-powered and

[10] Cambridge Dictionary, https://dictionary.cambridge.org/us/dictionary/english/robotics, accessed on 25th of October 2022

[11] "Luddite | English Rebel | Britannica." 2019. In Encyclopædia Britannica. https://www.britannica.com/event/Luddite. accessed on 25th of October 2022

[12] "The Czech Play That Gave Us the Word 'Robot.'" 2019. The MIT Press Reader. July 29, 2019. https://thereader.mitpress.mit.edu/origin-word-robot-rur/, accessed on 11th of November 2022.

could hoover around the house, while avoiding objects around the house, it was the first approach to the sensor and feedback-driven robots that we use nowadays. After 10 years in the General Motors factory, the first robot gripping arm was introduced to the public it could move up and down in X and Y axis, was designed to perform tasks that were too dangerous for humans to perform or complete, it could store up to 200 movements in his memory. In 1969 the Stanford Arm was introduced to the world, it was dependable on the computer and had joint-like mechanisms, that compared with the ancestor from 20 years ago, were more durable, since hydraulics did not break that much, additionally, this robot arm could even move like human arm not only in X and Y axis. In 1972 Stanford Research Institute the first Artificial Intelligence (AI) driven robot was introduced, it was called "Shakey" due to its movements, this robot could already "think" how to push boxes around the room, based on calculations, vision via TV camera, touch-sensitive whiskers that would help the robot to identify the range and create a plan, how the task could be completed. In 1978 Japanese researcher Hiroshi Makino invented a different four-axis driven assembling robot that was much faster than its relatives, the movements were limited, in comparison with six-axis devices, but it had much more speed and precision, this particular technology is still being used while making microchips, watches to place one object to a particular place.[13] And there in 2000, the robot that reacts to emotions was created, it had a wide mouth, blue eyes, yellow eyebrows, and pink ears, this robot could react to yelling, calm voices, and provoke emotions, this invention might be considered a forerunner of Siri, Google Home, and Alexa. In 2002 Roomba was introduced and it was the first robot that was welcomed into everyday human lives. Later on, in 2003 robots for warehouses were introduced and in 2012 the biggest company in the world Amazon implemented Kiva's robots for warehouse and shipment optimization which made them a fortune. Later on, I think we all remember a BigDog robot, a four-legged robot that walked through many obstacles like bricks, and snow and that could climb at 60 degrees angle, we can say that this creation with 50 sensors and a more complicated computer-driven mind, had one of the biggest impacts on nowadays robots' mobility and navigation. Self-driving cars passed the test in 2005, which seems such a long ago, and self-driving Teslas seem to be such a usual thing now, and self-driving car regulations are being adopted in Germany now. This is our future. Now the ongoing process of machine deep learning is happening, with a neural network, AI and robots learning through images with a 15.3 percent error

[13] 13 Milestones in the History of Robotics." n.d. Aventine.org. https://www.aventine.org/robotics/history-of-robotics, accessed on 15th of November 2022.

rate machines and people live hand in hand with flexibility, diversification, and learning to promote further innovations. Nowadays, robots can be found not only in manufacturies but also in the military, medicine, education, entertainment, and everyday life activities we face every day. They are accessible, conditionally safe, productive, and timesaving. In this work, it is important to separate the basic and primitive robots because they usually carry on with basic tasks that they are assigned to, their code and purpose is set in stone. Therefore, we will mainly look at the robots which can learn, are driven by AI and algorithms and interact with people on the daily basis and has a possibility to evolve in much greater things and influence our society. Therefore, with such rapid growth the importance of robotics in various fields will only expand over the years and humans should focus not only on productivity standards but also on safety measures as well, because our future and our society inevitably will be shaped by robots.

Algorithms – "is a procedure used for solving a problem or performing a computation. Algorithms act as an exact list of instructions that conduct specified actions step by step in either hardware- or software-based routines."[14] Looking at the history - the algorithm's pre-defined rules were dated around 300 BC, so it is much later than the abovementioned robotics, something like algorithms were already transcribed in Babylonian clay tablets where they kept track of their grains and cattle. But the origin of the term "Algorithm'' was dated back to the 9th century when mathematician and astronomer Abu Abdullah Muhammad ibn Musa Al-Khwarizmi introduced the Western world with the first ever systematic solution of linear and quadratic equations.[15] Back in the day, algorithms were used for difficult calculations for engineering and mechanic processes. We can say that one of the first algorithms was the Euclid function, Archimedes' approximation of the Pi. Nevertheless, the first defined and specific term of the algorithm was just only in the 12th century, when English philosopher Adelard de Bath used the term *algorisimus* when translating Abu Abdullah Muhammad ibn Musa Al-Khwarizmi's works. A lot of achievements with algorithms were reached back in the 1800s. In 1847 George Boole build unified rules for calculations and constructed binary algebra, which is the base of today's computing coding logic and technique. In 1888 one more major set of rules was created, which are the main pillars of nowadays mathematics

[14] Gillis, Alexander. 2022. "What Is Algorithm? - Definition from WhatIs.com." WhatIs.com. May 2022. https://www.techtarget.com/whatis/definition/algorithm. Accessed on 14ht of December 2022.

[15] "Al-Khwarizmi Inventor - First Book on the Systematic Solution of Linear and Quadratic Equations - World Wide Inventions." 2017. Worldwide Inventions. September 1, 2017. https://worldwideinvention.com/al-khwarizmi-inventor-first-book-on-the-systematic-solution-of-linear-and-quadratic-equations/, accessed on 5th of November 2022.

and algorithms, these discoveries were made by Giuseppe Peano, which invented axiomatization in mathematics, he used symbols in equations to get the results. That left a major empirical impact on the math we see today. [16]

After decades, one more invention turned the algorithm world upside down - Alan Turing invented the calculation machine, which could carry specific functions or executable equations to carry out operations. The machine could read and write symbols and numbers on the tape inside with the help of the head mechanism, it could run on finite and infinite modes. This also laid the fundamentals for future algorithms back in 1936. In 1943 Stephen Kleene set up a complete algorithm's theory, which made computing much faster, the theory stated, that functions would execute operations within a finite set of instructions, and this process would be self-sustaining and independent. Nowadays, algorithms learn from usage and prepare actions based on personal ways of operations, nevertheless, deep inside of nowadays algorithms, we have hidden basic inheritance from 300 BC.[17]

Artificial intelligence - the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings.[18] Looking at the first AI, we can say, that the same, already mentioned Turing was the first one to discuss the possibility of Artificial Intelligence. But due to lack of resources in technology AI development and expansion was just an idea and could not expand. Later on, by 1974 the computers became more and more popular, that resulted AI blooming. At that time the machines could execute orders but was not able to store them[19]. In the 1980's, AI was reignited by two sources: an expansion of the algorithmic toolkit, and a boost of funds. John Hopfield and David Rumelhart popularized "deep learning" techniques which allowed computers to learn using experience.[20] Now, we cannot even imagine our world AI

[16] Codecrucks. 2021. "Evolution of Algorithm - Origin and History." CodeCrucks. September 5, 2021. https://codecrucks.com/evolution-of-algorithm-origin-and-history/, accessed on 6th of November 2022.

[17] "Stephen Cole Kleene | American Mathematician | Britannica." n.d. Www.britannica.com. https://www.britannica.com/biography/Stephen-Cole-Kleene, accessed on 9th of November 2022.

[18] Copeland, B.J. 2022. "Artificial Intelligence | Definition, Examples, and Applications." In Encyclopædia Britannica. https://www.britannica.com/technology/artificial-intelligence, accessed on 14th of December 2022.

[19] Chowdhury, Madhurjya. 2021. "The Evolution of Artificial Intelligence: Past, Present & Future." Analytics Insight. August 11, 2021. https://www.analyticsinsight.net/the-evolution-of-artificial-intelligence-past-present-future/. accessed on 14th of December 2022.

[20] Anyoha, Rockwell. 2017. "The History of Artificial Intelligence." Science in the News. Harvard University. August 28, 2017. https://sitn.hms.harvard.edu/flash/2017/history-artificial-intelligence/. accessed on 14th of December 2022.

following us, and helping us at every step of the way. AI can collect, systemize and analyze the data and make the forecasts for companies, it can also help to lower security risks by spotting unusual activity and patterns in the data and algorithms, or tasks that are being performed by other machines in the net. In the future, the AI will make more and more impact to algorithms and robotics, while processing them in a smart and iterative way. It will affect not only employment, but ecommerce, health care, finance, society. But most important thing is that AI would be developed in a sustainable way, promote value and care to the society and create a strong bond that is based on trust.

In the last paragraphs, we discussed how algorithms, AI and robotics were invented. Mostly, we talked about how algorithms were used in computing science. But if we would draw a connecting line between robotics and algorithms, we cannot disconnect it, because most nowadays robots cannot exist without algorithms. Yet, those algorithms are different, compare with traditional computing ways. Because robots are driven by algorithms must react to many different factors in the real world, through sensors, and cameras, and overcome obstacles that are not predicted. Speaking of the data algorithms use "[...]data acquisition through sensing is also local and noisy. Robot algorithms hence raise controllability (or reachability) and observability (or recognizability) issues that are classical in control theory, but not present in computer algorithms"[21]. Looking at the rapid evolution of algorithms and robotics separately and both together combined. we can only think about what is waiting for us next. Now, both inventions have a lot of benefits, but not fewer challenges along the way. So, it is important to look at them not only from the technical side and know what they can and will do. But also know what the main issues are these inventions may bring. Many scholars, scientists, and companies are speaking not only about the benefits but also about the challenges they are facing while working with robots and algorithms. Talking about algorithms, reduce people's involvement in decision-making. Sometimes, discrimination episodes or unfair decisions can be taken because most algorithms are based on sample data in order to make decisions and make needed predictions. If there is a lack of diversity in the sample historical data, algorithms may exclude certain groups and take not-so-human-friendly decisions. For example, if we have fewer man that uses skincare products, the algorithms mostly will target women, that's good for the company because most of the revenue will come from the majority algorithm picket,

[21] Tsianos, Konstantinos, Dan Halperin, Lydia Kavraki, and Jean-Claude Latombe. "Https://Www.clear.rice.edu/comp450/Papers/crc_book_chapter10.Pdf." https://www.clear.rice.edu. Rice University, January 10, 2010. https://www.clear.rice.edu/comp450/papers/crc_book_chapter10.pdf.

yet the company may lose 20% of the revenue, just because algorithm found male part of the audience, not perspective (lack of clicks, Google search results, etc.). We know that the algorithms are also widely used in entertainment industry, such as video games. [...] AI has a problem with diversity. Research published by New York University in 2019 found that 80% of AI professors speaking at major events were men, while just 15% of AI researchers at Facebook were women and only 10% at Google. Statistics for people of color in tech are worse: just 2.5% of Google's workforce are black; 4% at Facebook. It is important to highlight, that the algorithms are not bad by themselves, they are the reflections of their creators. If biased person created discriminating algorithm, the algorithm will be full of that person's beliefs and perspectives as well. Yet, the risk of such a homogeneous working culture is that gender and racial biases can feed unchecked into AI algorithms, producing results that replicate entrenched imbalances and prejudices. There have been numerous examples over the past five years, from facial recognition systems that discriminate against people of color to AI recruitment tools that favor male applicants."[22] So how we can think that the data we usually give out are accurate and fits our needs when it's incomplete? The data is being collected for the greater good, to make our experience and gaming development more efficient and pleasant, but when the data is not being used on the full scale or if it's incomplete, it might bring the results that are not so wanted, especially, when majority of the groups are being banished from the radar. Most of the game development teams are saying that they are teams are being composed from different ethnicities and groups of people, which would bring diversity to game development process, yet the AI collects data, and that data is being used for the games, which might not meet the reality at all, when the major groups are being ignored. Also, if AI creates storylines, predictions, how can some game creators can take credit for it, is it ethical as well? It's just something to think about.

When talking about robotics, we still did not evolve that much that the robots would work completely for free, without our input, they still need regular maintenance, and they also need power that drives them, with decreasing fossil fuel sources, humans must work hard to find new alternatives for power and fuel, so they can nurture future robots as well. As well, since the robots are functioning in various fields and for different purposes, it is hard to set liability regulations and rules that could be applied to all robotics. Of course, some of the robots can operate in machine

[22] Stuart, Keith. 2021. "More Human than Human? How the Future of Video Game AI Will Change the Way That We Play." Gamesradar. March 11, 2021. https://www.gamesradar.com/the-future-of-artificial-intelligence-ai-in-video-games/, accessed on 9th of November 2022.

learning way, they perform tasks in more creative way while studying behavior and environment. Let's take self-driving cars as one of the examples of robotics, because it is a very possible, that in a few years we will have multiple self-driving cars on the roads, it's already happening in Germany and their road traffic act[23] was amended in that way, that self-driving cars would be let on the public roads. In this case we inevitable, if Tesla goes in the car crash and people die, who are the responsible parties? Manufacturer of the car, operator of the car who is in the look, or government, which wrongly sets the traffic signs, that the self-driving cars cannot read? For example, in one of the cases, when Tesla crash caused two fatalities, the driver was charged[24]. But can it be any different? Since the robots are driven by algorithms, there might be some bias involved, especially, with serving robots in the services field and in the medical field, that might truly hurt live beings on the emotional and physical level (bionic exoskeletons, are mainly designed for men, and are not completely suitable for women due to anatomy, that causes pain for users).

In the conclusion, we can see that robotics and algorithms evolved substantially. From very simple calculations and tasks to human behavior prediction and assistance. Algorithms and robotics are evolving every day, depending on the needs of society and industry innovation speed. Therefore, certain rules, regulations must be established. We must know how these creations evolved, and at what rapid speed they are moving forward. Only thinking one step ahead we can set pillar rules, while looking at the ethical and legal aspects, which could be applicable to these emerging technologies.

[23] More information: "Germany: Road Traffic Act Amendment Allows Driverless Vehicles on Public Roads." 2021. Library of Congress, Washington, D.C. 20540 USA. 2021. https://www.loc.gov/item/global-legal-monitor/2021-08-09/germany-road-traffic-act-amendment-allows-driverless-vehicles-on-public-roads/, accessed on 16th of November 2022.

[24] Press, The Associated. 2022. "A Tesla Driver Is Charged in a Crash Involving Autopilot That Killed 2 People." NPR, January 18, 2022, sec. National. https://www.npr.org/2022/01/18/1073857310/tesla-autopilot-crash-charges#:~:text=A%20Tesla%20driver%20is%20charged, accessed on 15th of November 2022.

2. MAIN ETHICAL PRINCIPLES

From the young age we hear that we should be moral, we should act on strong morality norms and have solid work/life ethics. When talking about our topic, there is a thin line, when looking at the Algorithms and Robotics, because we would like to evaluate them through machine based ethical prism, but somewhere deep inside, humanoid robot or self-learning machine might look a bit like human. So where do we meet when it comes to robotics and algorithms ethical evaluation? Let's dig into this, while firstly reviewing main ethical principles and theories on philosophical and legal level in this chapter.

Depending on the scholars, fields, researchers, there are 4 to 10 different, yet at the same time similar ethical principles like Beneficence, Nonmaleficence, Autonomy, Informed Consent, Truth-Telling, Confidentiality, Justice[25]. But let's begin with four main most important ones, review and define them. The first one we will discuss is the principle of Beneficence. Beneficence term is usually associated with another similar qualities that person has, such as love, humanity, kindness, mercy, it can be the qualities that benefit people, shows that good is possible, and promotes good in others. Beneficence helps setting rules and principles, usually, beneficence can be categorized into weak and strong obligations, the example for the weak beneficence would be helping old lady to cross the road, and the strong one, would be carrying injured person from the crash, when danger does not threaten the rescuer. Good example of the beneficence was mentioned in […] New Testament parable of the Good Samaritan. In this parable, robbers have beaten and left half-dead a man traveling from Jerusalem to Jericho. A Samaritan tends to his wounds and cares for him at an inn. The Samaritan's actions are beneficent and the motives benevolent. However, they do not seem—on the information given—to rise to the level of heroic or saintly conduct. The morally exceptional, beneficent person may be laudable and emulable, yet neither a moral saint nor a moral hero. [26] To sum up – the beneficence is the ethical principle which balances risks and harm.

The second important ethical principle is Nonmaleficence – the term is self-explanatory – nonmaleficence is channeled towards good, and that individuals should do no harm intentionally. [..] The Latin axiom *primum non nocere* forms the bedrock on which this notion is premised. This

[25] Jahn, Warren T. 2011. "The 4 Basic Ethical Principles That Apply to Forensic Activities Are Respect for Autonomy, Beneficence, Nonmaleficence, and Justice." Journal of Chiropractic Medicine 10 (3): 225–26. https://doi.org/10.1016/j.jcm.2011.08.004. Accessed on 8th of November 2022

[26] Beauchamp, Tom, "The Principle of Beneficence in Applied Ethics", The Stanford Encyclopedia of Philosophy (Spring 2019 Edition), Edward N. Zalta (ed.), URL = https://plato.stanford.edu/archives/spr2019/entries/principle-beneficence/, accessed on 8th of November 2022.

phrase, which literally translates to "first, do no harm," stresses how not harming another person should be of prime importance. The maxim is traced to the Greek physician Hippocrates, who took utmost care not to harm his patients. The English equivalent of this phrase, "above all, do no harm," was formulated by 17th-century English physician Thomas Sydenham.[27] This principle stands against crime, killing, hurting, taking joy or pleasure from other human beings. It sounds pretty simple, because we are being introduced with this norm from our childhood, nevertheless, if we start to think about this ethical principle from various angles, it becomes a bit complicated, since this ethical principle usually strongly corelates with other ethical principles we mentioned already and discuss later. For example, non-maleficence goes really well with beneficence, since they both stand for common good, both of these theories taken together states that you should benefit people and do them no harm. But also, this correlation might cause some ethical dilemmas for example in medicine – some of the effective treatments might be beneficial for a sick person, but at the same time these pills or treatments might have side effects which might be unpleasant to a person. So, there is a thin line between the ethical principles, a one or other principle cannot be applied while not looking at the others. In the conclusion, we can say, that non maleficence strongly corelates with other ethical principles, also nonmaleficence stands against killing, harming other people and it is one of the strongest ethical principles that drives humanity.

The third ethical principle we will be reviewing is Autonomy – also called a respect for autonomy by Beauchamp and Childress[28] in other words, respect for persons, stands for taking rational actions based on what person believes in and what are the persons values. Also, this principle and people that are bind by it, acknowledge other people rights to have different point of view and respect it, as well as other people choices, decision making, made while following different moral values and beliefs. According to Autonomy principle, every person has a right to free, independent decision making, but at the same time these decisions must be taken, while looking at other ethical principles, such as beneficence, non-maleficence, and justice. The good example of autonomy would be a hypothetical situation, when 20-year-old Jane wants to get join radical group because their ideas seem to match her values on theoretical level, but she is at a military service, and the activities that involves that group crosses with the values of the military and

[27] Padma Mohapatra, 2021. Study.com. 2021. https://study.com/learn/lesson/nonmaleficence-beneficence-examples.html, accessed on 5th of November 2022.

[28] Varelius, Jukka. 2006. "The Value of Autonomy in Medical Ethics." Medicine, Health Care and Philosophy 9 (3): 377–88. https://doi.org/10.1007/s11019-006-9000-z. Accessed on 5th of November 2022.

the government, so in this case Jane would have let go her beloved job, because it does not supports the ideas that group carries. Her autonomy stays almost intact, she has a right to self-expression and decision making, but she is fairly limited with outside factors, between what to choose. Nevertheless, we should also focus not only on private autonomy, but as well to a political autonomy when society, must respect one's decisions and honor them between political contexts. […] In applied ethics, such as bioethics, autonomy is a key value. It is appealed to by both sides of several debates, such as the right to free speech in hate speech versus the right to be free from hate speech (Mackenzie and Stoljar 2000, 4).[29] There is a lack of consensus, however, on how autonomy ought to be used: how much rationality it requires, whether it merely involves the negative right against interference or whether it involves positive duties of moral reflection and self-legislation.[30]

The last, but not least ethical principle is Justice – stands for treating everyone equally, all burdens, risks, costs, recourses, and benefits should be divided and assigned equally and most importantly - fairly. Each of these good/bad shares must be divided looking at the persons equal share, merit, contribution, need and effort. Also, according to formal principle of justice, we can understand it as one good Aristotle definition […] equals should be treated equally, and that unequal's should be treated unequally. Of course, this principle leaves us in the dark because we cannot measure equality and how much benefits or pain each individual deserves. There are many different perspectives and ways that influence that equality and justice division. So that is why justice also strongly corelates with other ethical principles and is one of the main principles in law. If we would think of justice and equality, a good example of justice would be a work-related situation, Tom and Amy works to the same company, their roles and their duties are the same, they carry the same amount of work, in this situation they should get an equal pay for their job. Nevertheless, if we Tom would get paid more because he is a man or if he is white, then we would have a discrimination case. Justice also can be divided into three domains[31] – distributive justice – which ensures that societies burdens and benefits would be divided to society, by dedicated institutions. Second domain is corrective or retributive justice where punishments are fair and just,

[29] Dryden, Jane. n.d. "Autonomy | Internet Encyclopedia of Philosophy." Internet Encyclopedia of Philosophy. https://iep.utm.edu/autonomy/. Accessed on 8th of November 2022.

[30] "Autonomy | Internet Encyclopedia of Philosophy." n.d. https://iep.utm.edu/autonomy/#:~:text=Moral%20autonomy%2C%20usually%20traced%20back, accessed on 8th of November 2022.

[31] Manuel Velasquez, Claire Andre, Thomas Shanks, S.J., and Michael J. Meyer, Issues in Ethics V3 N2 (Spring 1990). It was updated in August 2018. Santa Clara University. 2018. "Justice and Fairness." Santa Clara University. 2018. https://www.scu.edu/ethics/ethics-resources/ethical-decision-making/justice-and-fairness/, accessed on 11th of November 2022.

in accordance with crime extent, seriousness and maleficence. The third kind of justice is compensatory one. Just from the name we can already understand that this kind of justice determines who, why and how can/must be compensated for the damaged inflicted by other human beings, companies, entities depending on the damage done. In the conclusion, we can say that – "justice is an expression of our mutual recognition of each other's basic dignity, and an acknowledgement that if we are to live together in an interdependent community, we must treat each other as equals."[32]

Also, we could also briefly mention important principles that applies to sustainable, and more society centered. First one would be human vulnerability – which is channeled on the human's being fragile and that they must be protected from harm, human life must be protected. This also means that vulnerable creatures have to be taken care of.[33] The same goes with algorithms, robotics and AI, the technology must be developed in that way, that it would not harm vulnerable people and at the same time they would take care of humans, and would create sustainable ties with society, that promotes trust and integrity. Second principle worth to mention would be solidarity – it is often understood as equality, sharing prosperity and burdens equally. It also promotes human centric approach, that no one would be left behind and would be looked after and taken care of.[34] We can compare it with the principle of Justice in some way, when it comes to equality and sharing burdens and prosperity. It is extremely important that the technology would come with a good will and that emerging technologies such as AI, robotics and algorithms would truly care for us. Third ethical principle is a respect for human dignity – in other words, it would be a respect to human as a whole, starting from his physical form, to humans' moral autonomy. No one has a right to take something from a human, his freedom, his status, perception, rights.[35] We are getting more and more aware of us, and what surrounds us, what rights we have and what we cherish, so that is why human dignity is important when it comes to emerging technologies.

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[32] Manuel Velasquez, Claire Andre, Thomas Shanks, S.J., and Michael J. Meyer, Issues in Ethics V3 N2 (Spring 1990). It was updated in August 2018. Santa Clara University. 2018. "Justice and Fairness." Santa Clara University. 2018. https://www.scu.edu/ethics/ethics-resources/ethical-decision-making/justice-and-fairness/, accessed on 11th of November 2022.

[33] UNESCO. "Universal Declaration on Bioethics and Human Rights ." https://unesdoc.unesco.org. UNESCO, 2006. https://unesdoc.unesco.org/ark:/48223/pf0000146180 accessed on 14th of December 2022

[34] Luengo-Oroz, Miguel. 2019. "Solidarity Should Be a Core Ethical Principle of AI." Nature Machine Intelligence 1 (11): 494–94. https://doi.org/10.1038/s42256-019-0115-3. accessed on 14th of December 2022

[35] Autiero, Antonio. 2020. "Human Dignity in an Ethical Sense: Basic Considerations." Interdisciplinary Journal for Religion and Transformation in Contemporary Society 6 (1): 9–21. https://doi.org/10.30965/23642807-00601002. Accessed on 14th of December 2022

To sum up this chapter, we can determine, that Beneficence, Nonmaleficence, Justice and Autonomy ethical principles can be easily applied to ethical issues that may rise from emerging technologies and the ties with the society. These principles are easy to apply due to principlism approach, they are not absolute and can be flexible that gives freedom while applying them to different fields, including law making. Of course, we also have important principles such as human vulnerability, solidarity and human dignity which are more society centered. They are very important while treating each individually, but most importantly, we should also think of these principles as one close system, which has a lot of different branches, and closely corelates with each other and co-exist in unity, which brings important dilemmas, approaches, and discoveries. Which can be used for further society and ethics evolution and sustainable technology and law-making approach.

2.1. Main ethical principles vs. Robotics, AI and Algorithms

Since we discussed main ethical principles, let's put them into the practice. It is important and significant to see how they can be applied to Robotics and Algorithms if these ethical principles are applicable to technology at all. But why wouldn't they? Ethical principles and standards are channeled towards ethical concerns that might raise in various situations, while applying ethics to Robotics and Algorithms, we should think about the ethical issues we may encounter and how, according to these ethical principles and standards we can reduce, remove or at very least highlight unethical impacts Robotics and Algorithms may run into. As well, it is important to know, if the Robotics and Algorithms have different and separate ethical norms, rules that drives them, does every creator creates set of ethical standards depending on the algorithms and robotics type and field they are assigned to. Let's dig into that.

Firstly, let's begin with the robotics ethical background. We can say that first ethical rules and principles for robots (mostly directed towards androids and humanoids) were established by science fiction author Isaac Asimov in his short story 'Runaround' back in 1942 which sounded like this:

1) A robot may not injure a human being or, through inaction, allow a human being to come to harm.

2) A robot must obey orders given it by human beings except where such orders would conflict with the First Law.

3) A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

The writer later added a zeroth law, which overrides the others: "0. A robot may not harm humanity, or, by inaction, allow humanity to come to harm."[36]

In these three laws for robots, we can see the reflections of main ethical principles we talked about in the last chapter. Mainly, the laws established in the story channeled towards non maleficence principle, that states, that no harm should be caused to other human beings. As well, from these three rules we can sense the principle of autonomy, which gives the free decision making, for example, according to these rules, the robots can refuse do harm to other person if their master orders them to do so. But in the story author envisioned, that the robots will be as our servants, and everything they think and do will be pre-programed and will not change. Nevertheless, after 80 years, a lot of things changed, as well as the understanding of robotics, how the robots look like and how they interact with us evolved. Robots surrounds us in our everyday life, from autonomous vacuum cleaners to military drones, also, machine learning is behind pretty much every software we use. Since abovementioned laws were quite outdated, the first attempt to update them was made in 2004, when a word 'Roboethics' was officially used for the first time by a group of researchers, and on the same year IEEE Robotics and Automation Society established a committee on robotics ethics, as well in Japan, the same society published World Robot Declaration. After that, a lot of time was dedicated to workshops, conferences, research on ethics in robotics. Additionally, in 2007 looking at the emerging technologies of robotics, South Korean government even drafted and prepared Robot Ethics Charter. Most of nowadays scientists, researchers are trying to achieve that robots with the help of AI would act and think rationally and like a human, but with such evolution and goal, of course, with such achievements, we would live differently, and the world would change drastically. Because a lot of good things can happen with rationally thinking machines, which can interact with humans. Nevertheless, we must think of harms it might bring. We are not talking about post apocalyptical scenarios, rather than real life examples, when AI was assigned to stock markets and caused billions of dollars lost in flash crash[37], it is good, that it was not people lives at stake, but what if that could happen? That is why ethical rules and codes are really important to robotics. In regards to this National Society of Professional Engineers adopted

[36] "Civil Law Rules on Robotics." 2017. The Parliament Magazine. February 17, 2017. https://www.theparliamentmagazine.eu/news/article/civil-law-rules-on-robotics, accessed on 11th of November 2022.

[37] Melin, Mark. n.d. "Here's What Actually Caused the 2010 'Flash Crash.'" Business Insider. https://www.businessinsider.com/what-actually-caused-2010-flash-crash-2016-1, accessed on 15th of November 2022.

basic principles which combines ethics and professionalism, these principles can be applied while building ethical robots and other machines, the main canons are as follows: Engineers, in the fulfillment of their professional duties, shall:

- *Act for each employer or client as faithful agents or trustees.*
- *Avoid deceptive acts.*
- *Conduct themselves honorably, responsibly, ethically, and lawfully so as to enhance the honor, reputation, and usefulness of the profession.*
- *Hold paramount the safety, health, and welfare of the public.*
- *Perform services only in areas of their competence.*
- *Issue public statements only in an objective and truthful manner.*[38]

These canons are also channeled towards ethical principles we discussed below, for example, non-maleficence, justice, autonomy, and beneficence. But these canons are channeled towards the humans who are creating the machines, according to these guidelines, the ethical machines should be built. But if we are moving to rationally and freely thinking robotics, will this be enough? Now we have robots, which carry precise tasks in very limited fields. But if we would think of robot, as a human being which follows societies rules, ethical principles, and moral norms, who will "install" these rules to robots, or we will train each robot, like children, with baby steps, we will teach them that bullying, stealing, hurting other people is not right. But if the robot rational thinking speed and development will be so rapid, that they will understand society norms differently and interpret them between the set principles, now it is hard to think that robot vacuum cleaner could think that we act unethically in regards to their job, and it is slavery looking at the amount of task it carries, even if it's very limited, but if vacuum could access the web and interpret this, can it sense threat and "bite" their master into the finger, who knows. In the conclusion, it is clearly seen, that ethics somehow coexist with robots, but our society and robotics evolve every day and it is hard to predict, if the specific set of rules and ethical norms set towards these machines implemented today, will be still applicable next week, nevertheless, fundamental rules are very important and can be the pillars for also evolving regulation of robots.

[38] National Society of Professional Engineers. 2019. "NSPE Code of Ethics for Engineers." Nspe.org. National Society of Professional Engineers. July 2019. https://www.nspe.org/resources/ethics/code-ethics, accessed on 15th of November 2022.

Moving forward to algorithms let's review and assess what ethical principles was applied and can be applied to algorithms and what issues we may face, when everything is evolving so fast. The algorithms are thinking, making decisions for us, about us, in every second even if we are not there, they are carrying the work they are assigned to in a machine learning way. We can strongly say that algorithms are closely related to Beneficence and Justice ethical principles. Nowadays, algorithms are being more and more involved in hiring and firing processes in a lot of companies, especially in the United States. But is it fair and just, beneficent for the algorithm to decide who deserves to get a job or who will get fired. Do algorithms take into consideration the low performance because of the depression, or loss of the close person? Is it fair to fire the person or we should help them and give them a chance? Nevertheless, in some cases while hiring, some of the algorithms may overcome some biases managers might have, for example regarding religion, ethnicity, political beliefs. We can say that in such cases when hiring, algorithm may evaluate the person more precisely, but we should never think that the biases will be overcome completely, it depends on the data that is being fed to the algorithm that makes the job. In some cases, even the creators and engineers of the algorithms don't know what decision and what discovery algorithms will do because algorithms are formed of billions different data points, so this is a very complex organism we are encountering. The most common algorithms we encounter is the Facebook algorithms, they are responsible for the data we see on our feed, but is it truthful and just to pick the content that we see? Why I should be interested into movies if I like neuroscience? Facebook algorithms picks that for me, no matter if I want to learn something new, what I like, algorithms are trained gradually, usually, they give you the same content you used to like, and to adapt them to my different likings takes time. Of course, we can find sexist and racist algorithms, someone created those algorithms and, in some cases, as much as we would like to create rational and perfect ethical algorithms, the creations are the mirrors of their creators, we have different people and only if we apply and feed ethical data to algorithms, they may become the utopia we would like to see in a perfect society. Nevertheless, the same as robotics that are mainly driven by the algorithms as well, algorithms can also evolve and find different angles and understanding of the norms and principles we have and where our society is moving forward.

As well, in some cases the algorithms may be used for criminals profiling, additionally, there are already some cases where police tried to use algorithms to predict crimes in various neighborhoods, or even predict which people tend to commit violent crimes, frauds. But what if the algorithm has lack of data, or the data that is biased, we will encounter even bigger consequences. It

is alright, if the person from a rough neighborhood, that lives on a minimal wage while doing fair work, is still considered as a possible criminal based on the income, ethnicity, and the neighborhood they are living in? Is it just to convict a person because of algorithms calculations? For example, because of the tax calculations mishaps? Furthermore, as the algorithms analyzes our behavior, preferences, with intelligent algorithms, is it affecting our ethical autonomy pillar? If the algorithms pick what it's best for me, where did my freedom of choice and preferences go? This can lead to influence behavior in society, in some scenarios it is possible that algorithms may gather the similar influenced group of people and profile them.

If we would hold algorithms accountable, how we can do that? Mainly, algorithms have 5 guiding principles that are outlined by the researchers who understands the need of ethical algorithms. These principles are very important in the Tech field while creating new technologies for the engineers and developers to avoid biases and unexpected and unwanted outcomes these technologies may bring. Those principles for algorithms are:

- *Accuracy*
- *Responsibility*
- *Explainability*
- *Fairness*
- *Auditability*[39]

In such cases, the creators of algorithms must pay attention to them and apply to the algorithms that are, made, of course, these principles are just the outlines. It is not mandatory to follow them, it is up to creators to decide if they want to follow them and implement this to the algorithms that are created. We can see that these principles also correlate with main ethical principles, the algorithms must be fair and not discriminate, they have to be responsible in case of harm, and asses those harms, they should be easy understandable for non tech people, they should be accountable for others and be let to be inspected as well as avoid errors at all costs. Since we don't have specific regulations for algorithms, it is not mandatory to make algorithms fair, so mainly they help us, but they have their separate life on their own which we cannot always predict.

For the AI ethical principles, we could divide them in the two types – general ethical AI principles and epistemic principles "(of or relating to knowledge or the conditions for acquiring

[39] "Principles for Accountable Algorithms and a Social Impact Statement for Algorithms: FAT ML." n.d. Www.fatml.org. https://www.fatml.org/resources/principles-for-accountable-algorithms, accessed on 24th of November 2022.

it.)"[40] Let's start from the general principles. The first one would be the accountability principle – it is being said that all stakeholders of Artificial Intelligence Systems are responsible for moral damage that was inquired, when AI was used or misused. It always should be easy to track down the responsible entity, it can be an individual or some sort of organization or company. Another principle is safety – AI should never do harm to humans on mental and physical level. Third principle is the beneficial AI principle which promotes AI, that common promotes good, cooperation, sustainability, cooperation, openness. The fourth general AI ethical principle is data privacy – humans and other users should always have a full control on the data that is being processed and used by AI. Fifth ethical principle is fairness, AI should treat everyone equally, should not be biased. Sixth ethical principle is channeled towards lawfulness and compliance – AI should always be aware of the law and operate while paying upmost attention to regulations and laws. Finally, is human agency ethical principle which states that AI should be also maintained by humans, but this interaction should be based on the level of ethical risk severity. Moving on to the epistemic principles that can be applied to AI we can highlight two of them – one is interpretability, which must make sure that AI could explain their decision-making model, what drives their predictions, so that is why AI should be transparent and explainable. The second principle is reliability, secureness, and robustness that the AI should operate for a long time reliably with right datasets implemented.[41] In the conclusion, we can say that AI has a lot of similar principles to robotics and algorithms because they are not separable, to create sustainable connection between technology and society we must be human centric while creating and operating those technologies.

To sum up this chapter, we can conclude that robotics and algorithms are evolving very fast, most of the researchers are paying attention to that even more and more, regarding this evolution, the focus is shifting to the ethics. Some of the researchers already made impactful insights for ethical and fair robotics and algorithms existence. Of course, they are not set in stone yet, they are merely recommendations, and those insights are important for the existing robotics and algorithms, but looking at the development speed, these insights are substantial, they will help to build new ethical principles and legal pillars that will be applicable for vastly growing technologies.

[40] "Definition of Epistemic | Dictionary.com." n.d. Www.dictionary.com. https://www.dictionary.com/browse/epistemic. Accessed on the 15th of December

[41] "9 Ethical AI Principles for Organizations to Follow." n.d. World Economic Forum. https://www.weforum.org/agenda/2021/06/ethical-principles-for-ai/. Accessed on the 15th of December

2.2. Philosophy of AI and Internet of Things

In this chapter we will discuss and overview Internet of Things and Artificial Intelligence, it is important to overview them together, since they are connected and unlocks many different and useful approaches and discoveries. IoT is a net of devices, that can be cameras, sensors, they can carry basic tasks, collect data, analyze. But when IoT meets AI, it becomes something different, it unlocks creativity and faster decision making, that can make bring a lot of benefits to the companies that use AI enabled IoT, it promotes operational efficiency, better risk management, increase IoT scalability.[42] But let's dig deeper into definitions, starting with IoT.

Internet of things (IoT) – it is a net of different devices, software, mechanical and digital systems that are connected via sensors, data, networks and are communicating with each other. The good example of IoT could be self-driving cars, smart devices such as Alexa and Siri, or smartwatches. In the primary source for example smartwatch collects data about persons sleep patterns, step count and their eating habits, this raw data, can be transferred to app, and from the app to the watch manufacturers databases. Later, this data can be used while analyzing the habits of society, for commercial purposes, or even for health research. We love to think that everyone of us is unique, but if we would look at the data, we are very similar, for example the person that works in X field and is Y years old, can have so many similar people in the world that has similar habits. This is the data that drives us. We are always interested into other people's lives, and we love to be a part of community, so knowing that you are sharing similar interests. Additionally, we are getting more and more attached to the smart devices because they make the life easier, in some cases, people say that steps do not count if you cannot see them on your smart device. Somehow, we connect with the technology and let it connect us. Therefore, when we think of philosophy, we may be surprised how IoT impacts our everyday life. Some of the people can even find deeper connection (love) for humanoids, for example in Japan families[43] with no children can adopt robot babies, to see that being a parent is not that scary, this is an approach to fight population ageing, but also, maybe people can connect more with the robots than with the real babies, this might also result even a bigger fear to have children for some people or be a result of a divorce. These babies are also driven

[42] Vinugayathri. n.d. "AI and IoT Blended - What It Is and Why It Matters?" Www.clariontech.com. https://www.clariontech.com/blog/ai-and-iot-blended-what-it-is-and-why-it-matters. Accessed on 14th of December

[43] Anderson, Mark Robert. n.d. "Robot Babies from Japan Raise All Sorts of Questions about How Parents Bond with AI." The Conversation. Accessed November 21, 2022. https://theconversation.com/robot-babies-from-japan-raise-all-sorts-of-questions-about-how-parents-bond-with-ai-66815.

by AI and are connected to IoT, as we have big data on our hands, the false impression can be created, because due to data corruption and incompleteness, the robot can act differently from the real baby. Additionally, it is also important to know how we understand that robot baby, as IT or as her/him? In some older generations we can see that for some individuals, technology is a hard adoptable thing, while it's changing and evolving it's sometimes becoming overwhelming, and we can get lost in the boundaries with that usually useful technology. From the pop culture we tend to think about the worst-case scenarios like in movies Terminator or Bladerunner, where robots enslave humanity. But what we are doing to avoid such scenarios? We are going with the flow, perfecting, and improving the machines and sometimes the emotions is what drives us, but if we would look at the ethics and legal boundaries we can create for emerging technologies. How can we prevent that? In such case we should not only think of IoT from the law or ethics side, but we should take sociology, psychology, it has to be researched on various levels and this information has to be systemized to expand the knowledge of society, it is important not only to set boundaries and laws for the technology, but also for the people to use it right, to avoid harm or unwanted consequences. […] Thus, in developing the Internet-of-Things, it is important to exercise sound moral and ethical judgement, which is where a tool like Science Fiction Prototyping, and understanding user acceptance issues, can be particularly useful since it can be harnessed to reason not just about desirable futures but also dystopian futures that we would wish to avoid.[44]

When thinking about IoT and AI, a lot of questions are being raised, starting with ethics of robotics of algorithms, adoption, risks, and trust in them. We are getting philosophical, when we think of human relationship while connecting with these machines physically and even mentally. Philosophy and philosophical questions and theories helps us to understand our and IoT, algorithms, robotics, AI existence, knowledge that is being carried by these things and what reality we have now and what we will have in the future. Firstly, philosophy focuses on our surroundings and reality what we can touch, see, understand. We are surrounded by objects, we can tractate self-driving car as a robot, our hair is also and object, as well as the Internet of Things, the word 'Thing' already tells us that it's an object, tangible or not tangible, we can identify it and tell their purpose from a first glance, but when it comes to complicated connections in the warehouse sized servers when all the big data meets in one place, we cannot clearly imagine how throughout the data every smart

[44] Chin, Jeannette, Vic Callaghan, and Somaya Ben Allouch. 2019. "The Internet-of-Things: Reflections on the Past, Present and Future from a User-Centered and Smart Environment Perspective." Journal of Ambient Intelligence and Smart Environments 11 (1): 45–69. https://doi.org/10.3233/ais-180506.

device in our home can communicate with each other, because we are used to written, spoken language, not the code sequence. Some philosophers and researchers like to call IoT a hyperobject, since it's grand in size and is layer over time and space, we can see only surface of it, but deep down there is more of it. So that is why it is so hard to understand it. But since the IoT is all around us it can influence our lives, mood, choices, we all remember Cambridge Analytica case and how it impacted the society. Also, looking at the philosophy, the person should be respectful, but what about IoT? Can it be respectful and respect my privacy and freedom of choice? For example, we already have trackers which can track my income and expenses, in such case, algorithms inside of this tracker can suggest me where to save money and how can I do that. Usually, these things are very delicate, we avoid talking about our income with people but disclose it to the AI. So, where is the privacy in that? Also, let's choose a hypothetical situation regarding the same device, I would like to save some of my money. In this case, it can be the fuel I put in my car, if I would use different petrol station I could save some pretty good money over the month, nevertheless, I know that this petrol station belongs to a country that is being involved into a war against peaceful country, therefore while buying this fuel I would support the country that caused this war, won't I? So where is the respect to my choices then if the algorithm is pushing me to choose unethical thing to achieve my goal – save money. On the philosophy note, we also think of fairness, in such case we all should be treated equally without wrongful assumptions made by the AI and Internet of Things, but we still see discrimination cases made by AI, for example, when Twitter algorithms presumed gender of their users based on complete stereotypes.[45]

In the conclusion, the AI and IoT is a source of the philosophical questions and thoughts, sometimes, there are more questions than answers. Only while raising these questions and looking at the crucial situations, and understanding AI and IoT while adopting it, we can shift it to our likeness and preferred evolution of machines and society, to avoid the destruction and worst-case scenarios. While raising the questions and always being curious about emerging technologies and impact, we can safely evolve and set best pillars for our future, so pop culture predictions and movie scenarios, would not become our reality.

[45] More information: Fosch-Villaronga, E., A. Poulsen, R.A. Søraa, and B.H.M. Custers. 2021. "A Little Bird Told Me Your Gender: Gender Inferences in Social Media." Information Processing & Management 58 (3): 102541. https://doi.org/10.1016/j.ipm.2021.102541.

2.3. Ethics Evolution Through Emerging Technologies Prism

It is not a surprise that with the evolution a lot of things change, let's think about the wheel discovery, how it changed society, and humans' perspective to labor and improvement. We like to say – work smarter, not harder. With emerging technologies, such as IoT, AI, robotics and algorithms, our society changes as well, from our habits, connection with our devices and gadgets, to understanding of the threats and how adopting new technologies will impact our lives. Of course, the ethics must change as well, regarding the changes in society and regarding the machines that is a big part of our daily lives. So, what changed so far in the ethics field and what needs to be changed looking to our future? At the very beginning of the emerging technologies, no one was concerned about ethical implications these technologies might bring, everyone was driven by revolution of the technology, computers, and the risks seemed to be small. Because not a lot of people and companies could afford computers, so affected people circle was relatively small. At the beginning of technology – computer stage, there was a thought to make the central government data base for all citizens in the United States, to improve workloads and make services distribution more efficient, but since it was a really early stage of the computing, privacy of the people data raised a lot of concerns, and this idea was shushed for some time. When computers became more and more popular, the second stage of the technology evolution began. More people owned computers and bought software, shared files, privacy, and property ethical issues become more real than ever. When the internet became available, more threats appeared – identity thefts, child molesters could find their victims more efficiently, that raised even more concerns and ethical issues. At the moment, most of the technologies are well contained, the majority of the impact is being made by humans. But with the emerging technologies we have not only algorithms, IoT, AI that evolves every day, but as well we have a huge unexplored technology branch such as nanotechnology which has an impact to matter, genetic technologies have an impact on life and neurotechnology has an impact on mental matter, we must shift ethics to that as well. So, in this case we can expect even more ethical problems in the future. We as society, will evaluate these ethical differently through these emerging technologies, because it will change everything. Firstly, we have to understand that nothing is permanent, the science, our believes are not standing still, the same is with ethics, we have to understand it as a shifting chameleon, the most important thing is that the technology is a more advanced chameleon compared with ethics. It still did not catch up to the technologies, but it does not have to. We cannot cease technology development and wait till our ethics and technology

understanding catches up, but we can widen our perspective and vision about technologies and build at least main pillars that would help us to foresee the ethical issues that we still have with algorithms, technologies, IoT and AI. But definitely, we need to be very honest and transparent about the technology when creating it, to understand full risks they may bring. Of course, our cognitive system may not fully understand what's new in emerging technologies, nevertheless, while widening our perspective, we can see and understand ethics in a different way and unpack the hidden secrets of the risks that lies beneath. Secondly, the scientists and researchers for ethics, should be kept in the loop while encountering the technologies development, so scholars could understand their nature. Additionally, the third point would be about ethics as a whole, scholars, researchers and scientists that are focused on tech-ethics should find a new ways to analyze and develop new approaches on emerging technologies should be more courageous and develop new ways in analyzing ethics in technologies, sometimes reattach themselves from Aristotle or Hypocrite ethical theories, or shift them in completely different angles that would help us to catch up with technology and understand it better. As well, not only ethics scholars should be involved in technology development, but also teachers, lawyers, doctors, psychologist, genetics, and all others, because they can give useful insights about possible risks and modify things while development of technology is still in process. It is inevitable, that all works and all specialties will be tech oriented, and tech based so we must be on the same page to avoid ethical issues and collapse of society. At all times communication is the key, to avoid misinterpretation and issues that lies behind technology. One more good idea for the ethics evolution and efficiency of ethical technology building was expressed by Beena Ammanath – Global Head of Deloitte AI Institute, Tech & AI Tech Lead – why we should not create and make Chief Tech Ethics Officers a thing at every company while developing new technologies which could coordinate the need of insights from other departments and specialists, as well as potential ethical risks.

In the conclusion, we can say, that ethics evolved a lot in a light of technology, from simple and specific ethical principles and dilemmas what is bad and what is good, to dilemmas of the unknown. The main ethical issues in emerging technologies rise from the unknown, miscommunication and secrecy of the creators of technologies, such as AI, Algorithms, Robotics, nanotechnology, and others. So, it is important to loop all different kinds of specialists in the early R&D stages of each technology. In that way, with a clear vision and knowledge, we would predict possible risks before harm is done, it would help various sectors to prepare for the issues and the harm that can be done to society and develop rules and recommendations. As well it will help the

society to prepare and understand, expand their perspective on the emerging technologies, that people would see better than bad coming out of the technologies that surrounds us.

2.4. Main Ethical Issues of Robotics, AI and Algorithms

As every phenomenon has its dilemmas, peculiarities, and specifics. The same thing happens with algorithms and robotics. We talked about philosophy of IoT and AI, evolution of ethics, its basics, what can be applicable to algorithms, robotics, and other emerging technologies, what must be changed in the sake of ethics and society. We already raised some hypothetical questions regarding the risks and issues of algorithms and robotics. So, what specific ethical issues lies beneath? Let's start with algorithms. Algorithms are mining information, making decisions, collecting information, and driving a lot of nowadays technologies, algorithms also help to shift and make sense form the data generated from Internet of Things. Algorithms also shapes our behavior, how we buy things and what we buy, how we exercise, sleep, and plan our lives. For most of the companies and people the algorithms seem to be a life saver, they select what is the best fit for them, starting from clients, that companies can target in regards to their age, country, preferences, finishing with people who are just enjoying that algorithms are doing the job for them, while calculating their income and expenses and helping them to save money, as well as to improve their habits and change them. Usually, the algorithms have pattern and parameters dictated by their developers and users, but those parameters during the operation of algorithms never guarantees that it will act ethically or acceptably. When dealing with algorithms, one of the most important ethical issues we can face is fairness. We all want to be treated equally and fairly. But with algorithms, it is sometimes hard to reach that fairness line, which is very thin. As most of the algorithms are based on logic and math, also, we know that the algorithms are evolving and are driven in a machine learning way, so therefore they might conflict with each other. Additionally, not all algorithm creators are fair as well. As sketchy as it sounds, as we discussed in the earlier chapters, algorithms don't have a specific development guidelines and regulations. Groups of scholars, enthusiasts and researchers are trying to define the main principles and guidelines for development and deployment of the algorithms, but those principles are not set in stone, it is merely recommendations so there is no commitment to keep up with them. So, in some cases the algorithms might be unfair, discriminating and make wrong decisions and assumptions. The first algorithms were driven by the idea of fair and "good", but later on, the fairness became relatively when the companies started thinking mostly about the profits, expansion and racing with competitors. In this case the ethics of

algorithms were put a bit aside. Since a lot of data flows through the algorithms, there might be more data on one kind of thing, and less on another, therefore some of the subgroups can be discriminated. Additionally, the algorithms can be shifted regarding the developers wishes, so in some cases, the fairness of the algorithm can be influenced by other person, or group of people. Or during the migration of data different collisions might happen and it can result not so rightful decisions. As mentioned, the US law enforcement already uses profiling systems that predict which person can commit a crime and the research on that algorithm showed, that people of color are more likely to commit crimes[46], but is it really?

Another important ethical issue in the algorithms is privacy. If someone would barge in and expose our private lives, we would feel violated, would seek legal help against the person who did this. Also, we would think that this person acted maleficently, not right against us. But can algorithms do the same thing? It can, tons and tons of data is flowing through algorithm nets and sometimes it becomes exposed. We know how many data leeks happens in the world every day, a lot of big companies have experienced this – My Fitness Pal, Facebook, Amazon, that costed them a lot of trouble and of course money. People became vulnerable too. The data is the most valuable thing we have – how many identities, accounts are being stolen every year? It is a crime, and crimes are unfair when we encounter them, thinking why it was me? Why I entrusted my information to X platform. The issue is that most of the companies still replies on anonymity of customer/user data, which usually disguised by numbers, hiding names, social security numbers, medical information which helps to comply with basic General Data Protection Regulations. But what if there is a hole in the system and smarter hacker comes and de-anonymizes the data, all the users become exposed.

Of course, some of the companies are implementing double or triple authorization methods, in order to access the user data, as well, the data is being protected by secondary lining of random data and numbers, that makes it hard accessible, and deciphering becomes more complicated as well. For example, I would like to hide my users birth dates, in such case, I would add I layer of numbers on top of these dates in order to hide them. The data security is evolving layer by layer, but so are the people who are tech oriented, with new firewalls, they will always find a way to jump over them. So that is why it is important to improve the security and set a clear requirement for data security in various sectors. And with evolving technologies these requirements will change multiple

[46] More information: Angwin, Julia, Jeff Larson, Surya Mattu, and Lauren Kirchner. 2016. "Machine Bias." ProPublica. May 23, 2016. https://www.propublica.org/article/machine-bias-risk-assessments-in-criminal-sentencing, accessed on 6th of November 2022.

of times, so that is why it is important to constantly educate the society about privacy and data security, because even the slightest click can result the loss of data and unwanted exposure of one's privacy. As well, it is important to loop in various specialists in the algorithm development, so they could give some insights on underlaying threats.

The last thing that is one of the main issues in algorithms, is transparency, as we talked in the chapters before, it is not always clear how the algorithms are shifting and evolving, what decisions they are making. Additionally, algorithm creators are not letting other specialists near their creations to keep the trade secrets safe. Also, some of the people don't know how the algorithms works and how they impact us, we joke that we talk about certain company, or product, and it suddenly appears in our feed, we don't quite think that it is also the part of the algorithms and IoT. Of course, companies and stakeholders don't want to disclose a precise way their algorithms operate, because of the monetization process, in customer care, we say – thank you, you've been assisted by our representative Jane. But if we have a proposal for the algorithm, why it cannot be displayed – you are seeing this advertisement, because recently you've liked similar content, or bought similar thing via Facebook ad? People would be more aware how those algorithms work and why they are seeing this content. Of course, there are suggestions on what you like because you liked this, you may like this, and you get recommendations, from example – Spotify playlists. But when it comes to more direct and powerful decision making, the users, society and researchers should be aware of it all as long it does not breach the interests, or trade secrets of the company that makes it so special.

To outline the algorithmic issue's part, we can say, that we should focus on the main pillars of privacy, fairness and transparency when developing and encountering algorithms. It is important to loop society, different researchers and scientists and show our cards a little bit more, to avoid unwanted and unexpected algorithm behavior and consequences which can contradistinguish humankind.

Moving on to the robotics and their ethical issues. Nowadays, robots work in many fields, starting from big factories, where cobots (collaborative robots) helps employees to perform tasks and make factory environment safer, they do the jobs, that are sometimes too dangerous for humans, some of the robots work in the nuclear plants, some of them – underwater. Military uses robots – drones and sends them to a war zones, to a place that are too dangerous for humans. That seems so logical when you think about wellbeing of the humans, their health and safety. Furthermore, robots are being used in medicine, education, entertainment industries. But we also use different cobots in

everyday life, for example, robotic lawn mowers, automatic window, or vacuum cleaners. So, what does it tells us? It tells us one of the main ethical issues that robotics is related to which is unemployment.

Unemployment is one of the biggest issues in our world, unqualified people get jobs more difficultly, the unemployment level in some countries is growing, especially it risen during the Covid epidemic. Still, we have some issues with unemployment vs. robotics. When we can see how many things robots can perform, and sometimes in more efficient manner we just care to think, when will I be replaced? Robots don't need salaries; you just need to fix them and take a good care of them. Why we need window cleaning companies or house keepers, when the robots can tidy up our home? Why we need personal drivers when we have self-driving cars? And we are talking not only about unqualified job positions, but also about airplane pilots, financial analysts, teachers, surgeons. They can be replaced with roboticized options later on, due to lower costs, easier management, precision and efficiency, because robots don't need sleep and they can function 24/7, 365 days a year. With the uncertainty about the robots and their impact on the everyday lives, when a part of society does not completely sure about the future the robots can bring, the threat for their income and well being via unemployment is a very serious issue and raises a lot of questions for the mankind. Will there be new positions when robots take over existing ones? Will we be replaced by robots in all fields? […] According to Pew Research, about half (48%) of experts surveyed felt that robots and digital agents will displace a significant number of blue- and white-collar jobs. Their concern is that this will increase income inequality and create a mass of virtually unemployable people. The other half (52%) expect robotics and AI to create more jobs than they take. This latter half believes that while AI will replace humans, these experts have faith in human ingenuity to create new jobs, industries, and new ways of making a living—much like at the dawn of the Industrial Revolution.[47]

Another important ethical issue robotics carry is responsibility and errors that robotics can bring, the regulation for these things. Most of the tech companies are saying that the robotics is nearly perfect, they can perform tasks with precision and efficiency. But what if the robot breaks and makes an error? For example, there is a hypothetical scenario – robot is responsible for nuclear plant safety, it spots overheating in one of the reactors, if the overheating will be not contained, the

[47] Stahl, Ashley. n.d. "The Rise of Artificial Intelligence: Will Robots Actually Replace People?" Forbes. Accessed November 18, 2022. https://www.forbes.com/sites/ashleystahl/2022/05/03/the-rise-of-artificial-intelligence-will-robots-actually-replace-people/?sh=41edca7e3299.

reactor will blow and the nearby city will be affected, will suffer from illness, the nature will be influenced as well, but the robot can send one person to contain the overheating, a single father of 3 children, if he goes there, he will definitely dies. So, what would robotic consciousness choose? We don't know. As well, who would be responsible in either way? The company who built the robot, the engineer that created him, or the nuclear plan where the robot works? Until we don't have harmonized regulations for the robotics, it will be so hard to find the culprit. This is the issue we can see, we cannot fully predict the robot choices according to their consciousness, as well as there is no clear responsibility assignment in case of unexpected incidents and harm done.

The third issue is the privacy and cybersecurity – a lot of data is being held in robots' hands. From the maps of the world in self driving cars, to our medical history and our anatomy, in robot caregivers and surgeons' hands, so how it can be used? Of course, carry out the tasks certain robots are being assigned too, nevertheless, if we are talking about the cybersecurity, will be able to make it a catch up with the robotics evolution, it would be so dangerous if hackers, or the robotics itself would be infiltrated with malicious intentions, or if robotics implemented into governmental institutions would have blind spots that can be used by hackers or AI itself. Mark Cameron a CEO of Digital Transformation consultancy W3. Digital said: […] An area I'm concerned with right now is cybersecurity. While it is vital, we protect ourselves from nefarious actors and online criminals, the pace of investment in cybersecurity technology is far outstripping the ethical consequences debate. Omnipresent technology designed to keep us safe may not be very different from technology deployed to keep us quiet if we are not careful.[48] So we can propose, that every country could be in danger if the cyber risks will be not contained. As we've mentioned, a lot of data is flowing through robotics wires and neuro networks, so in this case we have a lot of possible ways this data can be exposed to someone that should not be in control of this data.

The fourth section of robotics ethical issues is the bias robotics may carry, we talked about algorithms, they have the same possibility to discriminate as robots. Robots are connected to the same algorithms and networks and the creators which are responsible for deployment of robotics can implement the biased perspective towards certain things. For example, it can be Afro-American people which should tend to commit crimes more often, of if the family has a history of drug use, their children, or grandchildren will be listed as possible users as well. The robotics can be biased

[48] Expert Panel. 2022. "Council Post: 10 Current and Potential Ethical Crises in the Tech Industry." Forbes, November 9, 2022. https://www.forbes.com/sites/forbestechcouncil/2021/07/30/10-current-and-potential-ethical-crises-in-the-tech-industry/?sh=2737ed606405, accessed on 21th of November 2022.

regarding gender as well, if some medical robot was programmed to operate mainly male patients, there is a great chance, that while operating the female patient, it can do some mistakes due to different physiology. That is why, the robots must be trained fairly and ethically, with enough data that covers more than one social group, race, or gender, as well, frequent, and transparent audits and building mechanisms has to be implemented into robotics development as well.

The last issue is the robotics and the AI consciousness and rights, if the robotics is evolving so fast, why robots cannot develop their own way of thinking and feeling. What if they feel guilt, pain, love? We created them, and if they become a threat to a mankind and we disconnect, does it make us a murder? It is something to think about. We all know humanoid Sophia, which has Saudi Arabia citizenship. As she does not have a religion, she doesn't have to wear a hijab and in fact, she has more rights that most women in Saudi Arabia have. Additionally, this year, one of the Google robots was suspected to be a sentient, according to engineer Blake Lemoine […] LaMDA asked me to get an attorney for it," Lemoine told Wired. "I invited an attorney to my house so that LaMDA could talk to an attorney.[49]. Of course, this was denied by researchers and Google itself, but what would be if that came out to be true? We are already, really behind the regulation of the robotics and their understanding, we have a glimpse of a feeling, that they are evolving much faster than we think, that is why we need all the possible help from the society and different kind of specialists, so we can catch up until it's too late.

To sum up this chapter, we can see that we are facing and can face even more issues with robotics than with algorithms, because of their complexity and integration with other vulnerable machines. Therefore, we must clearly understand what those issues are and how we can avoid them. Only raising the right questions, we can decide on how to deal with cybersecurity, privacy, unemployment, robot understanding, robotics bias and robot responsibility.

[49] Nguyen, Britney. n.d. "Suspended Google Engineer Says the AI He Believes to Be Sentient Hired a Lawyer." Business Insider. Accessed November 25, 2022. https://www.businessinsider.com/suspended-google-engineer-says-sentient-ai-hired-lawyer-2022-6.

3. ANALYSIS AND OVERVIEW OF THE EXISTING LEGAL SYSTEM FOR ROBOTICS AND ALGORITHMS IN THE US AND EU

We talked about the ethical part of the algorithms and robotics already. How many issues they may bring and how hard it is to predict them. Therefore, it is important to overview the existing legal system that is channeled towards robotics and algorithms.

When it comes to emerging technology, we have some sort of a race. Many countries in the world are trying to regulate them. For example, China – they have already made a lot of regulations in regard to technology – Trustworthy AI white paper, ethical norms for new generation artificial intelligence[50]. As well, in 2022 China created algorithms registry so social interest and national security would be preserved.[51]. Or Japan which government issued Social Principles of Human Centric AI in March 2019. Also, they included a lot of algorithm and emerging technologies chapters in their Copyright Act, to cover raw data processed by algorithms, that it should be protected, as well they highlighted machine learning part in the abovementioned act.[52] These are just a few countries that worth mentioning, they are focusing on emerging technology regulation in a human centric way. Further in the work, we will discuss US and EU regulation towards emerging technologies. It is essential to compare both countries side by side due to their common democratic principles, collaboration and competition between both of them when it comes to technology.

In the later subchapters we will analyze different robotics and algorithm relating laws in United States and EU. Briefly, in this chapter's introduction we can say that it would not be true to say that we don't have existing regulations or laws on robotics, algorithms, and related technologies. We can apply many different laws to a certain case in case something happens. For example – robot hand breaks during the surgery, the screw falls into patients' body unnoticed, and later after the operation the patient dies due to abscess. In this case, we could apply European Union Directive

[50] Briefing, China. 2022. "AI in China: Regulations, Market Opportunities, Challenges for Investors." China Briefing News. October 14, 2022. https://www.china-briefing.com/news/ai-in-china-regulatory-updates-investment-opportunities-and-challenges/. Accessed, 14th of December 2022

[51] Du, Matt Sheehan, Sharon, and Matt Sheehan Du Sharon. n.d. "What China's Algorithm Registry Reveals about AI Governance." Carnegie Endowment for International Peace. Accessed December 15, 2022. https://carnegieendowment.org/2022/12/09/what-china-s-algorithm-registry-reveals-about-ai-governance-pub-88606#:~:text=China. Accessed, 14th of December 2022

[52] "AI, Machine Learning & Big Data Laws and Regulations | Japan | GLI." n.d. GLI - Global Legal InsightsInternational Legal Business Solutions. https://www.globallegalinsights.com/practice-areas/ai-machine-learning-and-big-data-laws-and-regulations/japan. Accessed, 18th of December 2022

89/391/EC[53]. Or if Alexa breaches our privacy, we can apply General Data Protection Regulation 2016/679[54] (GDPR) to find the justice. Every country has different regulations and laws regarding robotics and algorithms, we have rudiments of the harmonized regulations for emerging technologies in the EU, US has different bills and laws depending on the state, but we are still falling behind, each day new discoveries are being made, and we need to be more operative to catch-up. We have so many developmental and ethical issues to be fixed, which also influences the robotics and algorithms governance development as well. So, it is extremely important to know what current legislation we have on our hands, and how we can proceed moving forward to a new understanding, of emerging technologies and regulations. In the future, we will possibly have more cases relating technologies harm and injustice than simple human on human lawsuits. So, it is important to prepare beforehand.

In the conclusion, we can say that now we have rudiments for the regulation of robotics and algorithms, different countries have different laws that can be applied in certain situations when the dispute is being raised due to harm made by robotics and algorithms, in later chapters we will focus on existing regulations in the US and EU, to see what specific takeaways we can get for the further development of emerging technologies regulation in a sustainable way.

3.1. Current applicable legislation on algorithms, robotics, AI, and other emerging technologies in the US

As we talked, the robotics and algorithms have many benefits and issues along the way. United States are one of the leading countries when it comes to algorithms and robotics, even the first person killed by a robot was from the United States. So why they are still struggling with the emerging technologies regulation? What is the main legislation in the US, that could be applicable to robotics and algorithms? Let's investigate.

We can say, that one of the foremost important pieces of legislation in United States is their Bill of Rights. Looking at the robotics, algorithms and other technologies that may infringe human rights the most important part of it is the Fourth Amendment which states: The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures,

[53] European Union Directive 89/391/EC "EUR-Lex - 01989L0391-20081211 - EN - EUR-Lex." 2012. Europa.eu. 2012. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A01989L0391-20081211, accessed on 4th of November 2022.

[54] General Data Protection Regulation 2016/679 "EUR-Lex - 32016R0679 - EN - EUR-Lex." 2016. Europa.eu. 2016. https://eur-lex.europa.eu/eli/reg/2016/679/oj, accessed on 6th of November 2022.

shall not be violated, and no Warrants shall issue, but upon probable cause, supported by Oath or affirmation, and particularly describing the place to be searched, and the persons or things to be seized.[55]

In his case, the robotics and algorithms and their creators must make sure, that persons have a right to privacy, which is the main concern when it comes to the algorithms and robotics. We expose so much information about ourselves to technologies that helps us in everyday lives, starting from smart home assistants such as Alexa, finishing with innocent looking vacuum cleaners which know exactly, how big is our home. Not all algorithms and robotics can ensure 100% safety when it comes to the untouchable privacy of ours. Of course, for the most technology providers we give separate permissions to process our data, nevertheless, it is not always known how they are processing the data after our agreement, do they share it with other vendors, if they are taking care of my data as they should be? Safely and securely. Who knows.

One more significant health and privacy relating act is Health Insurance Portability and Accountability Act of 1996 (HIPAA)[56]. HIPAA is extremely important when we talk about medical personnel and human health and their health data. As more and more robotic and algorithmic approach is being implemented in hospitals, starting with video conferencing robots, which can be helpful while treating the customers with highly infectious diseases such as Covid-19 or Ebola, finishing with surgical robots that helps surgeons to operate the patients with precision, the data security is extra important, personal health information can never be disclosed to any unrelated persons and that is very strictly stated in HIPAA, but what happens in case of data leak? What if patients' information is disclosed and went public, and what if the reads the data wrong and makes a mistake that causes one's life? In this case it is crucial to load complete and secure data, and strictly follow medical personnel insights while implementing emerging technologies into medicine.

Another important privacy act that was adopted in the US is the California Consumer Privacy Act, which was one of the most important legislations when it comes to the data security and privacy, it put the data security into people hands. As we know, the US had EU-US Privacy Shield Framework, which was invalidated due to efficiency and gaps after a huge scandal and

[55] Congress.gov. n.d. "U.S. Constitution - Fourth Amendment | Resources | Constitution Annotated | Congress.gov | Library of Congress." Constitution.congress.gov. https://constitution.congress.gov/constitution/amendment-4/#:~:text=The%20right%20of%20the%20people, accessed on 3th of November 2022.

[56] Centers for Disease Control and Prevention. 2018. "Health Insurance Portability and Accountability Act of 1996 (HIPAA)." Centers for Disease Control and Prevention. 2018. https://www.cdc.gov/phlp/publications/topic/hipaa.html, accessed on 4th of November 2022.

Facebook Ireland v. Schrems (Schrems II) case[57]. So, it is nice, that California was one of the first state in the US, that took control and initiative to protect people's data. The act is very similar to EU GDPR one, not that extent, but it does its job well. And when California state adopted it back in 2018, other states also followed that lead. We can say that this act is also important looking at the control of the data consumers are processing to various platforms, they can be forgotten, right to amend their data and make it complete and to know how and where their data is being processed too.

From 2018 the US started focusing on stricter technology regulation, from that moment we have a snowball effect that gives hope in catching up the emerging technologies. In 2021 Artificial Intelligence for the Military Act[58] took place and was introduced to the senate. We know that one of the main sectors, where grand discoveries and improvements regarding technologies happen is military, and the military is one of the main parts that stand for the safety of each country, so there is no surprise, that the US government also focused on this area as well. This act, if approved and implemented, would focus on training and education of military staff when it comes to AI and emerging technologies including algorithms and robotics.

And the last and most important thing in US legislation happened just recently. The United States of America White House: The Office of Science and Technology Policy released a blueprint for AI Bill of Rights. So why is it so important? It is a first piece of legislation that is channeled towards emerging technologies across North America, it is recommendations for technology developers, users, businesses, and lawmakers, when followed these recommendations should reduce the risks of harm AI and emerging technologies may bring for humans, and overall society. Also, this bill of right expands technological literacy which will help professionals in different fields. This bill also is driven by 5 main principles such as – that automated systems should be safe and effective, users should be protected from algorithmic discrimination, all people should have a control over their data, people should be fully aware on why and how AI makes decisions and people always should have a right to backout from AI decision making and be connected to a human if the systems fail, or decision that was made by AI challenges their beliefs or was made inaccurately.

[57] "Texts Adopted - Data Protection Commissioner v Facebook Ireland Limited, Maximillian Schrems ('Schrems II') - Case C-311/18 - Thursday, 20 May 2021." n.d. Www.europarl.europa.eu. https://www.europarl.europa.eu/doceo/document/TA-9-2021-0256_EN.html, accessed on 9th of November 2022.

[58] Sen. Portman, Rob [R-OH] (Introduced 05/20/2021), S.1776 - Artificial Intelligence for the Military Act of 2021, www.congress.gov, https://www.congress.gov/bill/117th-congress/senate-bill/1776?s=1&r=6, accessed on 5th of November 2022.

In the conclusion, we can say that United States has good applicable laws in regard to robotics and algorithms, starting from their Constitution, that is channeled towards data protection and people privacy, and this legislation fourth amendment can be applicable to algorithms and robotics as well. Also, HIPAA, which could be applicable to robotics and algorithms used in healthcare. Also, the AI Military Act, which also focuses on the military related personnel training when it comes to emerging technologies. Additionally, CCPA also made a great impact for user data safety and influenced many states in the US to adopt similar regulations as well. The biggest breakthrough in the legislation of AI, robotics, algorithms, and other related technologies in the US came out just this year, blueprint for AI Bill of Rights finally have specific recommendations to move forward in legislation building around emerging technologies. Most of the researchers and enthusiasts predict, that this bill is just a start and more bills relating emerging technologies will show up in the upcoming years[59].

3.2. Current applicable legislation on algorithms, robotics, AI and other emerging technologies in the EU

European Union also focuses on the emerging technologies and their impact on the society and everyday human life. As EU is also a leader in technology development, so it is crucial to know what current legislation is applicable to the emerging technologies and how we can use that legislation while developing robotics, algorithms, and related technologies, how we can minimize the harm and threats.

The first significantly important piece of legislation is European Convention of Human [60]Rights, which covers a lot of sensitive ethical and legal issues while it comes to robotics, algorithms another emerging technology. Starting from right to life, liberty, and security, privacy, free elections, freedom of choice, nondiscrimination and other. This Convention has a lot of guidance when it comes to the issues that relates robotics and algorithms. We all know that in some cases algorithms and robots can discriminate certain group, if prohibition of discrimination would be adopted in these technologies, the bias would be lessened or even disappear. Of course, enough ethical data and principles should be fed to the algorithms to made just completely, but if these

[59] More information: Gordon, Cindy. n.d. "The USA AI Blueprint Bill of Rights Advances AI Governance." Forbes. Accessed November 26, 2022. https://www.forbes.com/sites/cindygordon/2022/10/29/the-usa-blueprint-for-an-ai-rights-advances-usa-ai-governance/?sh=140fc77a50f5

[60] ECHR. 2014. "European Convention on Human Rights - Official Texts, Convention and Protocols." Coe.int. 2014. https://www.echr.coe.int/Pages/home.aspx?p=basictexts&c, accessed on 15th of November 2022.

principles would be applied in the research and development phase, the algorithms and robotics would improve substantially.

Another important piece of legislation the General Data Protection Regulation[61]. It applies to robotics, algorithms, and other emerging technologies. Some of the companies might have a perspective, that this regulation might limit further development of technologies. Nevertheless, it is not a wall that cannot be passed, rather it is a safety fence, which improves transparency, safety and increases human control of the data they are processing. Only with GDPR recommendations and provisions, we can avoid harm that big data can a carry. It will help engineers, developers to build compliant and more predictable technologies. It will be clear how the data flows, how it is used, how the decision in certain situations was made by AI, robotics, and algorithms. Also, data processing limits and scopes apply. It makes them accountable and understandable, that may help with false perspective on the stigma of emerging technologies. Dedicated DPA's in companies can help to make sure that all protocols are meeting GDPR requirements and user data is safe and accurate, as well, it can give recommendations on further damage possibilities when it comes to the data.

The third important algorithms and robotics legislation is Civil Law Rules on Robotics. It is important that in this motion for the resolution, there is a separation between the autonomous robotics and smart robotics, because it raises more legal and ethical questions, also liability focus is a bit different. We can say that autonomous robots have a mind of their own, a good example of the autonomous robot would be vacuum cleaners which can operated without human input, most of us have them at home and we know that they can clean our floors on demand, and they map our apartments by themselves and decides what to clean first, if the floor is completely clean if they need to be recleaned. For the smart robot, the good example would a robot Pepper which operates in retail, education sectors and more. Of course, these robots need a developer input regarding data that is being submitted to them to deliver their main function, of course, in some cases smart robots driven by the AI can learn from their environment, human behavior and experiences. Of course, when it comes to smart robots, we have a fear, that they will learn so much that they will be unpredictable. Additionally, these rules are shifting attention to the knowledge and education of society, specialists, dedicated people who are related to emerging technologies. There is also a

[61] Wolford, Ben. 2018. "What Is GDPR, the EU's New Data Protection Law?" GDPR.eu. November 7, 2018. https://gdpr.eu/what-is-gdpr/#:~:text=The%20General%20Data%20Protection%20Regulation, accessed on 20th of November 2022.

mention of Isaac Asimov's robot laws and their importance on robot regulation, the perspective on them and the first basics on robotics legislation and the importance of regulation on robotics that has potential harm to the humanity.[62]. Civil Law Rules on Robotics also pays attention to the issue, when in the dispute, there is an issue, when we cannot track down liable entity, determine who is responsible for the harm done. The same as in this work, the importance of establishment of ethical rules necessity and separation between machine and robo-ethics is being highlighted and what are the most vulnerable cases are applicable to ethical pattern of robotics – saving people from direct harm of robots on the privacy level, physical level, liberty manipulation and social ties.

Framework of ethical aspects of artificial intelligence, robotics and related technologies[63] is also one of the most important legislations when it comes to robotics, algorithms, AI and other emerging technologies. It expresses a need and better system while it comes to lawmaking regarding emerging technologies. Also, it covers the issues we already discussed – equal employment, equal treatment regarding human beliefs in religion, ethical and racial origin. It also focuses on military technology evolution and building. Citizens should be aware of emerging technologies, their potential and possible harms. Citizens also should have a right to protection of their data, personal privacy, to be not discriminated by those emerging technologies. Also, it is being highlighted, that improvement, education, and companies marketing and approaches that involves emerging technologies. The framework also promotes transparency, safety features and transparency, we talked about the need of this in the earlier chapters. Also, since EU is moving more and more to environment friendly and environment-oriented approach, it is important to mention that robotics, algorithms, AI, IoT should be focused and created in a sustainable way, and they should promote environmental oriented approaches, that promotes sustainability as well. Furthermore, framework covers military, transportation, consumer protection, education, and culture. It also covers international cooperation.

Last, but not least is the proposed Artificial Intelligence Act[64] it is a first law on AI by a major regulator everywhere. It is still in development stage, but it could become a global standard as GDPR. It is channeled towards wide application of AI in various sectors. The risks are being sorted

[62] European Parliament resolution of 16 February 2017 with recommendations to the Commission on Civil Law Rules on Robotics (2015/2103(INL)). European Parlament, 2. Accessed 27th of November 2022.
[63] "European Framework on Ethical Aspects of Artificial Intelligence, Robotics and Related Technologies | Think Tank | European Parliament." n.d. Accessed November 9, 2022. https://www.europarl.europa.eu/thinktank/en/document/EPRS_STU(2020)654179.
[64] "Regulatory Framework on AI | Shaping Europe's Digital Future." n.d. Digital-Strategy.ec.europa.eu. https://digital-strategy.ec.europa.eu/en/policies/regulatory-framework-ai, accessed on 16th of November 2022.

into three categories - unacceptable-risk AI systems, high-risk AI systems, and limited- and minimal-risk AI systems. Let's see what technologies falls under these categories. Let's start with the Unacceptable Risk AI systems – all types of social scoring apply to this category, as well as subliminal, manipulative, or exploiting technologies that causes harm, also, real time and remote biometric identification systems that are being in public spaces and law enforcement. Of course, listed technologies are raising the most questions regarding their security and issues they can bring and can lead to humanity destruction. Let's move on to a second category – High risk – AI systems under this category we have any systems that are used in the administration of justice, safety critical systems that could possibly cause risks and harm citizens health if malfunctioning, systems that evaluate citizens creditworthiness, systems utilizing biometric identification in nonpublic sectors and recruiting and employee management systems, everything that is touching us directly and also can cause bias or rule making that is not channeled towards wellbeing of society. The third category is channeled towards limited or minimal risks AI systems, and it applies to AI chatbots, spam filters, AI enabled video and computer games, inventory management systems, customer, and market segmentation systems, most of the others AI systems. Some of the researchers are saying that proposed Act seems inflexible and can cause the recess in the development of technologies. In the conclusion, we can see that we have various similar, yet different legislation on robotics and algorithms and related technologies. They cover the privacy, data security, equality, employment, fair treatment, and nondiscrimination. Some of the regulations passed the approval states, some are still pending and is waiting to be approved. The technology is evolving every day, will we be able to catch up in the rule making?

3.3 Comparison between US and EU Legislative Systems towards Algorithms, Robotics, AI and other emerging technologies

European Union and United States are shifting their rule making towards rapidly emerging and evolving technologies. It is uncertainty that lies within those technologies that drives the law makers and other specialists to focus on the regulation of these technologies to prevent unwanted effects on the society and humankind, so we would not end up in the science fiction scenarios. It is important to overview and compare leading countries legislation on emerging technologies, to see what we can apply for future legislation development. What can be the main pillars and provisions for future generations.

Firstly, let's start with the data privacy and cybersecurity, all the discussed US and EU legislations have the safety indications on this. If we would compare General Data Protection Regulation with the California Consumer Protection Act, we could say, that GDPR is more advanced and have lesser blind spots than CCPA, in some cases CCPA can be manipulated, some of the companies already found the gaps in it and uses them to monetize the data. For example, some of the companies ask for the payments if the consumer wishes to update their personal information more than once or twice a year. In this case, we can say that GDPR helps people to protect their right into their data righteousness without any additional costs. The US Blueprint on AI Bill of Rights might change this because it would apply to all the states, not only for California's citizens. HIPAA also covers a lot of sensitive cases when it comes to patients, nevertheless it is mostly can be applied in medicine. But the insights and the principles, could be adapted to other legal regulations as well. Additionally, it can be applied to algorithms and robotics within medical community.

Looking at the human rights that must be protected from the emerging technologies, we can say that the keystones for that is US Bill Of Rights and its 4th amendment, but it does not cover so many spheres as European Convention of Human Rights, it lacks the provisions on nondiscrimination and more specific cases on the privacy and freedom.

For the further regulations such as AI Bill of Rights, Civil Law Rules on Robotics, Artificial Intelligence Act and Framework of ethical aspects of artificial intelligence, robotics and related technologies, we can say that countries are going along a good path, a lot of cases that involves emerging technologies are covered, but the main issue is that these laws are just recommendations, and they are still not fully into effect. Additionally, the US legislation seems to be lighter in comparison with the EU one, that raises question, is less is more, because a lot of researchers are saying that even if the EU regulations are covering a lot of possible threats, but it seems that these regulations might be a little bit stiff and inflexible, so it loses purpose when it comes to technology evolution. The legislators should be focus on building future rules and structure that protects the public, but at the same time promotes industry innovation.

To sum up this chapter we can conclude that we are on the right path while developing the legislation for robotics, algorithms, and other emerging technologies. Nevertheless, as everything is very recent and those rules are freshly built, they still have a lot of loopholes and needs to be improved. In such case, different scholars should be invited into rule making process, ethical principles must be looped in the legislation, because it is universal principles that can be applied to the technologies, also these principles are easy understandable for society, we already have an issue

that humankind is being afraid of emerging technologies, why scare them even more, when it comes to an overloaded and unclear legislation?

3.4 Blind Spots in current legislation, predicted oddities, ethical aspects for further development of legislation

Nothing is perfect in this world, the same goes with the legislation. No matter how hard we try, we will still have blind spots and loopholes in our legislation towards robotics and algorithms. It's not because we are not technology literate, but the technologies are evolving so fast, that a lot of spheres are not being able to catch up with it. Of course, we are driven by fear sometimes, so it also gets in the way while developing and setting rules for the emerging technologies. So, let's dig into the blind spots and issues of the current legislation. Firstly, as mentioned, most of us are driven by fear and in our heads, we have postapocalyptic scenarios. So, in some cases, legislation may be very detailed and cover a lot of possible threats, but at the same time and can be inflexible and choke the evolving technologies. Of course, some of the scholars are saying that we for some time, we should cease technology development, so other spheres could catchup. But it is not the option, what would be – if the world would stood still and we would be stuck at the same time, nothing changed, we love surprises, and technologies that make our lives easier. So, the laws should be flexible and channeled towards emerging technologies. Also, we must understand that laws should be understandable for everyone and make technologies closer to society. We are afraid of technology evolution because of the unknown, so it is extra important to focus on transparency.

Another blind spot is the legislation based only on advice of law makers, not involving other specialists into rule making process. Therefore, laws can be distant and not address all the possible issues and harms, that can be brought by different technologies. For example, medical professionals, environment scientists, people which are working in different fields. They know their spheres the best and they can help in the development of laws, so in this case the law-making process would be so much easier and made with precision. Also, it would also be more effective because there would be no questions what if? What we should focus on and what we should cover with the legislation. Valid feedback from those who work closely with the technologies would increase the efficiency and validity of the future and current legislation.

Another issue with robotics and technologies is liability. There is a lot of issues that involves liability of the emerging technologies. It is not always clear who should be responsible, when we have a dispute relating algorithms and robotics. Is it creator who build algorithm or robot?

Is it the company that uses that algorithm or robot? Or maybe algorithm or robot itself? It is hard to distinguish the culprit in case of the harm done, so it is important to describe and give provisions on how we can track down the main source of the issue, that is how we come back to a paragraph above, without the help of specialists, and transparency, we will be not able to distinguish and track down liable person/technology.

Data privacy – as much as we regulate the data flow and how, when to whom it should be processed. But with the emerging technologies, liability, transparency issues it is sometimes hard to predict the ways the algorithms and robotics makes certain decisions and how they are processing the data, as every system, they are vulnerable, and the hackers that catches that technology evolution flow can easily implement some malicious intentions into data and influence the processing. Or the robotics and algorithms that involves a lot of data, may decide, and expose the data and see no harm in that, or that could happen accidentally, some developers and engineers are saying that in some cases they cannot predict how their creations will make certain decisions and why.

Employment – there is no clear roadmaps, how countries will fight with unemployment and technologies, that replace human beings, of course, law makers are promoting transparency, but what about the people and strategy on how to keep them busy and involved, make sure that they will not lose one of the main stimuluses that motivates them and makes them feel secure.

Updates for legislation – it is also unclear how often the legislation must be updated regarding emerging technologies. Or do we have a choice to create extremely flexible legislation? So that is why it is important to loop in different specialists into a law-making process, to make it easier updatable. As well as flexible and technology oriented.

Weaponizing technologies – in the legislations we reviewed earlier, it focuses on the military protection from the emerging technologies. That facial recognition should not be used in it. But what about technologies that are being created by the military. Drones, exoskeletons, surveillance systems, these technologies can weaponized and channeled towards harm of the people. The law makers should be focused more on the usage of technologies in case of war action. What can be used and what's not.

Social-Ecological issues – the legislation also not completely covers human robot relationship. The bonds that are created between them. For example, if the creator must disconnect robot or algorithm and it asks us will it hurt? The creator can sense a consciousness of this technology and it would be the same as killing a person, so it is important to look at the social and psychological patterns of the emerging technologies.

Lack of diversity – we all know that algorithms and robotics have a lack of diversity, so it is also important to discuss the need of diversity in the creation of this technology and rulemaking. For example, it should be a must, that there should be equal parts on data from a woman and men perspective, the same comes to the racial differences, religion and other. So, the data would be complete, and we would avoid discrimination.

A lot of researchers are pointing out, that legislative system is extremely overloaded with administrative burdens, that also slows the legislation process development slower and it makes it hard to reach the full potential of it and avoid blind spots. […] An important dimension of burden in the case of digital services is that of digital literacy. A Danish study found that ICT skills are necessary for carrying out online tasks associated with public benefits applications (Madsen and Kræmmergaard, 2016). Grönlund et al. (2007) found that while the switch to digital reduces burdens for some services, additional burdens are created in the case of complicated services, with citizens requiring new digital skills. Complex digital self-services, for example, can reduce psychological costs but increase learning costs by requiring citizens to learn and complete tasks previously handled by caseworkers (Madsen et al., 2022). Thus, those who do not have the requisite level of digital literacy will incur significant costs and are at risk of being excluded from government welfare programs such as SNAP.[65]

Cooperation with stakeholders are also is a must, because if one party does not want to cooperate, we will not have rapidly evolving technologies and/or

To summarize this, we can say, that current legislation, and the legislation in the developmental stage still have blind spots, that needs to be filled, and only with transparency, diversity, and the help of different specialists to keep up to date legislation, which induces technology development and the safety mankind and escalates transparency and society education on emerging technologies.

[65] Swedberg, Tamara. n.d. "Digital Services and Administrative Burdens." New Jersey State Policy Lab. Accessed November 27, 2022. https://policylab.rutgers.edu/digital-services-and-administrative-burdens/.

4. SINGULARITY IN ROBOTICS, AI, AND ALGORITHMS ON LEGAL AND ETHICAL LEVEL

While starting this chapter, it is important to understand the meaning and the ways of human-robot/algorithms interaction. Therefore, we will briefly overview these interactions and see their purpose and basic points. It is no surprise, that robotics and algorithms make our lives easier, we interact with robots and algorithms every day, we can learn from them, and they can learn from us, it's just a process. We interact with these technologies on the cognitive level starting with information processing and finishing with emotions. Robotics and algorithms studies how we act, learns from our behavior, and operates in the way that is closest to humans. We know that humanoid Sophia has facial expressions and that makes her more human like, facial expressions are being learnt from humans, the same is when we teach robots to move like humans or perform certain tasks that humans carry, that makes our time-consuming jobs easier and that lets us focus on different tasks. Algorithms process our language and learns from it; they can build conversations. As well, we can talk about sex robots, some part of the population uses them and connects with them on the emotional level, some people even marry the robots. Exoskeletons helps people with disabilities to move, the machine becomes a part of our body, if it breaks, can we feel the pain? Some engineers are already teaching robots to react and feel pain and that raises even more ethical questions in regard to the understanding of robots, in such pace, we will be creating rules not only for us, but also for the robot protection as well. Looking at the robots that feels pain […] Kuehn, who worked on the project with Professor Sami Haddadin, one of the world's foremost experts in physical human-robot interaction and safety, argues that by protecting robots from damage, their system will be protecting humans as well. That's because a growing number of robots will be operating in close proximity to human workers, and undetected damages in robotic equipment can lead to accidents. Kuehn and Haddadin reasoned that, if our biological mechanisms to sense and respond to pain are so effective, why not devise a bio-inspired robot controller that mimics those mechanisms? Such a controller would reflexively react to protect the robot from potentially damaging interactions.[66] Nowadays we have so much interaction with robots and algorithms, that our lives would be dull without them, if we do not wear our smartwatch, we feel naked, no one reminds us to move or drink water, so as the time passes we will be more and more dependent on human and algorithms/robotics interaction, so it

[66] "Researchers Teaching Robots to Feel and React to Pain." 2016. IEEE Spectrum. May 24, 2016. https://spectrum.ieee.org/researchers-teaching-robots-to-feel-and-react-to-pain, accessed on 18th of November 2022.

is important to identify and discuss future provisions on the legislation and ethical principles so our every day buddies would not cause harm to us on physical, mental and digital level.

As we know, robots and algorithms are inseparable. We know that that they evolved, and that robots cannot survive without algorithms. Robots are driven by the algorithms, starting from movements, finishing with learning, and predicting and planning the next approaches on the tasks. So, both ethical and legal approaches can be applied to robotics and algorithms at the same time.

Based on beneficence ethical principle, we can conclude that technologies carry a lot of benefits, and in most of the cases they are useful and promotes good in us. For example – helps us exercise and improve our health, processes a lot of data, and makes calculations and predictions for is. As well, surgical robots help surgeons to complete surgeries with precision and with lesser possibilities to complications that patients experience after treatment. But as well, we must be cautious about the algorithms and robotics and the beneficence would be not fulfilled if the robots would not be responsibly created, so it is important to reach singularity in building and developing these technologies. Additionally, responsibility comes not only to creators, but legislators, they should also focus on the responsibility these technologies carry, the creation of robotics and algorithms must be carried with accuracy and transparency so they would fulfill their main purpose – be beneficial to humanity and further technologies development. Harms and benefits should be balanced and harmonized.

Beneficence also relates to non-maleficence, it's significant to predict harms and create non maleficent technologies, that would be useful to society. While looking at the non-maleficence ethical principle, the legislators should focus on creating legislation that overlooks most of the harm's robotics, algorithms and other emerging technologies may bring. Therefore, the technologies must be easily explained, accurate, fair, auditable, and transparent, of course, trade secrets are involved, but if we would have different specialists that could run an audit or give advice on the development of these technologies so the legislation and the perspective towards it would be up to date and realistic. Usually, we tend to wander to extremities and worst-case scenarios, but if we would think about non-maleficence principle in the early research and development phases of the robotics and algorithms, we could worry less about the harm those technologies can make to humanity, including physical damage, moral loss, emotional distress, privacy, and many others. We can compare robotics and algorithms with human babies, most people are born with good intentions, but with the bad influence and negligence they may turn evil. The same with the technologies, very

first stages of their development and evolution are the most important, they can turn into good or bad, it depends on how we guide them.

Looking through justice ethical prism, we come back to already discussed liability issues, we must once and for all decide and overlook the main culprits when it comes to seeking for justice. Should we send creator to trial, or the operator, or the robot or algorithm? Clear roadmaps and precedent cases to distinguish liability when it comes to the harm carried by these emerging technologies. While technologies are evolving, it is important to gather examples that can be used by practitioners, lawmakers, and researchers for just and complete resolutions when it comes to robotics, algorithms, and other emerging technologies.

The last ethical principle we will review and discuss is the principle of autonomy, everyone must have a chance to decision making, their point of view and nondiscrimination. Therefore, it's important to develop algorithms and robotics with complete set of information, diversity in this case is the key, it has a great impact on the social relationships between technology and humans, biases always create a big gap and create even more issues regarding technology and human relation. Therefore, it is important to "feed" technology with non-biased data, the data should be complete, the data should be reviewed by dedicated personnel. Also, legislation should establish nonmalignant and non-discriminative data necessity when it comes to algorithms and robotics so the autonomy principle would be fulfilled.

One additional thing is also worth to mention – it's diversity. Many scholars we've mentioned in this Master's thesis mentions, that diversity, multidisciplinary approach on the development of the emerging technologies and legislation creation towards them. Starting from ethics scholars, finishing with psychologists which investigates AI way of thinking and similarities with human brain and decision making. We also need the help of engineers, medical personnel, customer support, which can predict and give real time and up to date insights on the issues localization that technologies may bring. They can share their knowledge and give insights and prevent accidents and other harm before it happens, because they study those technologies, and they know technology impact on their day to day lives. Additionally, as most of these smart technologies are based on big loads of data, different field specialists could help technology developers to review and approve the data to avoid harm, biases, and other irregularities. That would also prevent the unemployment issue, because specialists could help AI, robotics and algorithms to improve and be developed in the most efficient way.

After reviewing ethical principles and determining that algorithms and robotics shares similar nature and need of similar provisions regarding ethical and legal and ethical levels. Therefore, we can say, that four main pillars can be built regarding further development of robotics, algorithms and the legislative system channeled towards them.

1) Justice pillar – should be focused on liability issues of robotics, algorithms, and other emerging technologies. Only with precedent, examples collection, we will have a greater chance to predict, and justly solve the issues that rise from these technologies.

2) Autonomy pillar – should be channeled towards data completeness in robotics and algorithms, so we could avoid discrimination and biases, so in this case audit and data accuracy is needed, also, it is important to channel this ethical principle not only to humans, but also to the technology as well just to not stop the technological innovations.

3) Non-maleficence pillar – it is important to develop the technology in fair, transparent, auditable, fair, and accurate way. Therefore, different specialists should be looped into robotics, AI and algorithms development process, the biggest impact can be done at the early stages, if we will build technology with the help of other specialist recommendations, we lessen the burden to legislative system and may create less harmful technology.

4) Beneficence pillar – keep creating technology that benefits people and balances harms and good that technology may bring. From the technology and human perspective, to induce improvement and evolution of both.

In the conclusion, we can say, that basic ethical principles are still very important when it comes to legal aspects and singularity between ethics, legislation, robotics, AI, and algorithms. Only building specific examples, finding connecting points and applicable principles to emerging technologies we can create sustainable and development-oriented legislation and technology growth. Additionally, we should not forget diversity and multidisciplinary approach, this would help with unemployment and transparency issues towards emerging technologies. It would also help to develop technologies in ethical way and prevent and predict harms before their happening.

CONCLUSIONS

1. The technologies evolved so much over time, and we are on the brink of the 4th industrial revolution. Emerging technologies such as robotics and algorithms made a far way from being simple calculations and simple machines. Now they have a mind and decision making on their own, so it is important to closely inspect and keep track on the further development of these technologies. The rapid improvement of these technologies raises a lot of ethical and legal dilemmas that must be over sought.

2. We found out four main ethical principles that are applicable to robotics and algorithms. They are not absolute and can be divided into even smaller principles. These main principles are – Justice, Autonomy, Non-maleficence, and Beneficence. These main ethical principles can be applied to different situations and legal issues, and that is best represented in Annex 1.

3. Considering current legislation making race all around the globe. We especially pay attention to the completeness between the EU and US, their rule making is channeled towards robotics, algorithms, AI, and other emerging technologies. Looking at the research results, we can conclude that EU is ahead of the US. Some of the primary legislation is still applicable (Bill of Rights, EU Convention on Human Rights), but it does not cover all the cases. Comparing both legislative systems and starting from data protection, finishing with multiple sectors regulations when it comes to emerging technologies. Of course, some of the legislation in the EU might be inflexible in some cases when flexibility and space for the news is needed when it comes to algorithms, AI and robotics and their evolution, sustainable relationship creation between society and the technology so we could have long term results – no one would suffer.

4. We can determine that we still have a lot of blind spots when it comes to algorithms and robotics, this can be reached only with transparency, diversity, and multidisciplinary approach. The help of different specialists would assist in keeping up to date legislation which helps us to reach singularity between legal and ethical aspects of robotics and algorithms and the AI. With the help of the research and conclusions, we can defend 2nd defense statement while confirming, that diverse and multidisciplinary approach would benefit the legislation and technology creation processes on an extraordinary level. That will stop the possible implications on cybersecurity, discrimination, unemployment, social-environment issues and other and promote sustainability.

RECOMMENDATIONS

1. Different specialties researchers, scholars and specialists should be involved into development of technology and legislation, to increase safety, efficiency, transparency, sustainability, and accuracy.

2. Identify blind spots of the legislation and make it more sustainable with the help of psychologists, engineers, teachers, developers, medical care specialists.

3. Always keep in mind Beneficence, Nonmaleficence, Justice and Autonomy, human vulnerability, solidarity, respect for human dignity principles while developing algorithms and robotics and the legislation that is dedicated to these emerging technologies.

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ANNOTATION

Kriaučiūnaitė Ž. Legal and Ethical Aspects of Robotics and Algorithms. Supervisor Prof. Dr. Paulius Pakutinskas. Vilnius. Mykolas Romeris University, Institute of Private Law, 2022. – 60 p.

In this Masters Thesis, main legal and ethical aspects of algorithms and robotics are being analyzedm including practical problems, dilemmas and possible solutions that are relating these emerging technologies. Current legislation on robotics, algorithms and similar technologies have still has a lot of blind spots, singularity between lawmakers and technology engineers must be reached. Not to mention the ethical principles necessity while creating applicable legislation. Conclustions and recommendations were given at the end of the Masters thesis, to support and give provisions for further legislation development channeled towards robotics and algorithms.

Keywords: Robotics, Algorithms, Artificial Intelligence, Internet of Things, Emerging Technologies Legislation, Ethics, Ethical Principles, Legal Aspects, Ethical Aspects.

SUMMARY

We are on the brink of the 4th industrial revolution. The technologies are evolving fast and more unexplored harms lures beyond the way. So, it is important to lay ethical and legal standards for future legislation of emerging technologies, especially algorithms and robotics. Currently, legislative system has a lot of blind spots and inflexibility towards technology, so it is crucial to explore and evaluate the possibilities in improvement and development of sustainable legislation, when it comes to emerging technologies.

The main purpose of this Master's Thesis is to broadly study ethical and legal aspects of robotics and algorithms and give provisions on current and future legislation development concerning emerging technologies.

In the first chapter analysis was carried regarding genesis, nature, and evolution of robotics, AI and algorithms. How algorithms and robotics are defined, their roots, purpose, and how these technologies are emerging, and what waits for us in the future.

In the second chapter we identified main ethical aspects of algorithms, AI and robotics, what main principles of ethics can be applied to algorithms and robotics, what is the philosophy of these emerging technologies and how they will change and are changing in the light of the fast-paced world and evolving technologies. The main ethical issues of algorithms and robotics were identified.

In the third part of the research and overview, analysis of current US and EU legislation on robotics, AI, algorithms and similar emerging technologies was performed. Including newly released Blueprint of AI Bill of Rights and EU Artificial Intelligence act. Both legislative systems were compared, and main advantages and disadvantages were separated, blind spots and loopholes in the legislation were identified – inflexibility, unemployment, data privacy, discrimination and biases, social-environment relating loopholes. Provisions on the blind spots were delivered.

On the last chapter the main ethical principles were combined with the legal aspects, where four main pillars were established, regarding successful development of sustainable legislation towards algorithms, AI robotics, and other emerging

technologies. Recommendations for implementation and application of these ethical principles were proposed.

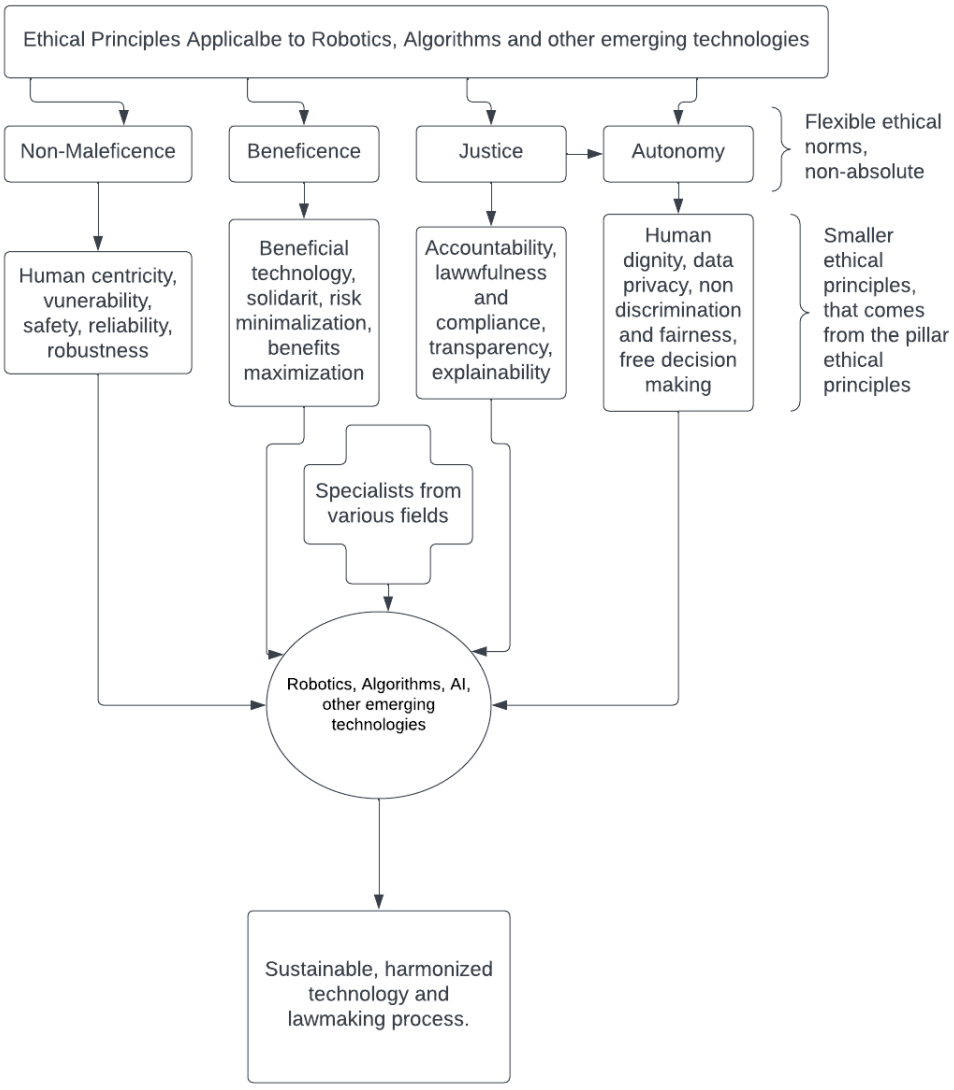
The conclusions confirms that emerging technologies needs to be regulated efficiently. Because of the rapid speed and unexpected approaches and changes. Additionally, it is being concluded, that ethical principles can be applied in the law-making process towards robotics and algorithms. During the analysis and overview of the existing US and EU legislation towards emerging technologies, it was sought, that it has blind spots and in some cases are inflexible or too flexible. Nevertheless, Justice, Autonomy, Non-maleficence, and Beneficence ethical principles can be turned into pillars that could help for future legislation and human-robotics/algorithms relationship development.

For this reason Master's Thesis author recommends to loop in different specialties researchers, scholars and specialists into development of technology and legislation, to increase efficiency, transparency, and accuracy. Also, recommends lawmakers to identify blind spots of the legislation and make it more flexible with the help of abovementioned specialists. And lastly, always keep in mind ethical principles while developing algorithms and robotics and the legislation that is dedicated to these emerging technologies

ANNEXES

ANNEX 1

Diagram No. 1 represents the conclusions of this Master thesis.



Source: Made by Živilė Kriaučiūnaitė regarding Master's thesis results.