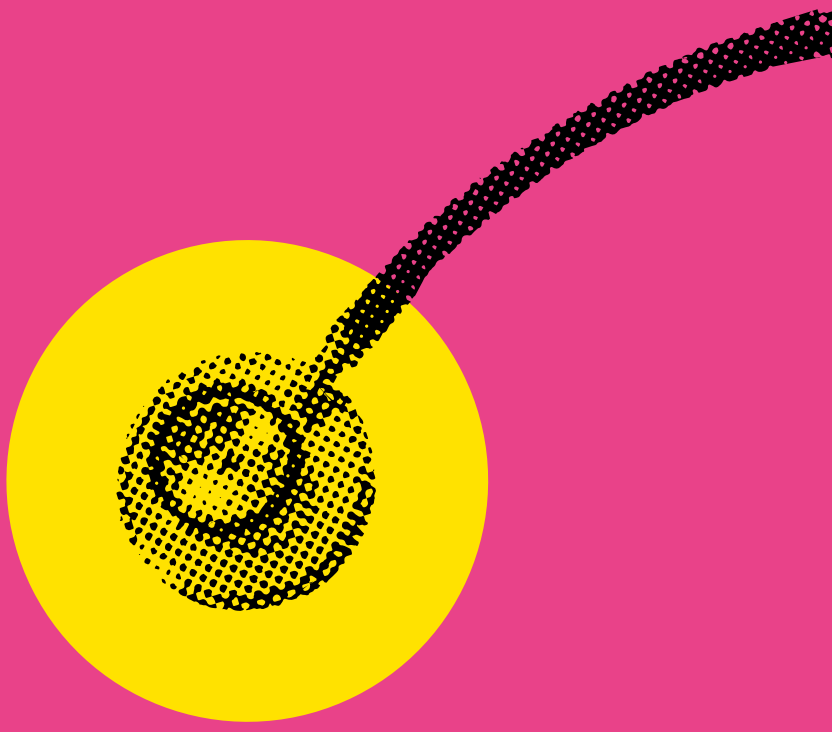
Big data, Artificial Intelligence and Healthcare

DEVELOPING A LEGAL, POLICY AND ETHICAL FRAMEWORK FOR USING AI, BIG DATA, ROBOTICS AND ALGORITHMS IN HEALTHCARE



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**Big data, Artificial Intelligence and Healthcare –
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AI, big data, robotics and algorithms in healthcare**

The European Liberal Forum (ELF)
+ NEOS LAB (editors)

First edition, first print

Printed by Printpool 2019

ISBN: 978-3-200-06554-3

Published by the European Liberal Forum asbl
with the support of NEOS LAB.

Published by the European Liberal Forum asbl
with the support NEOS Lab
Co-funded by the European Parliament.
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Editor: Dieter Feierabend

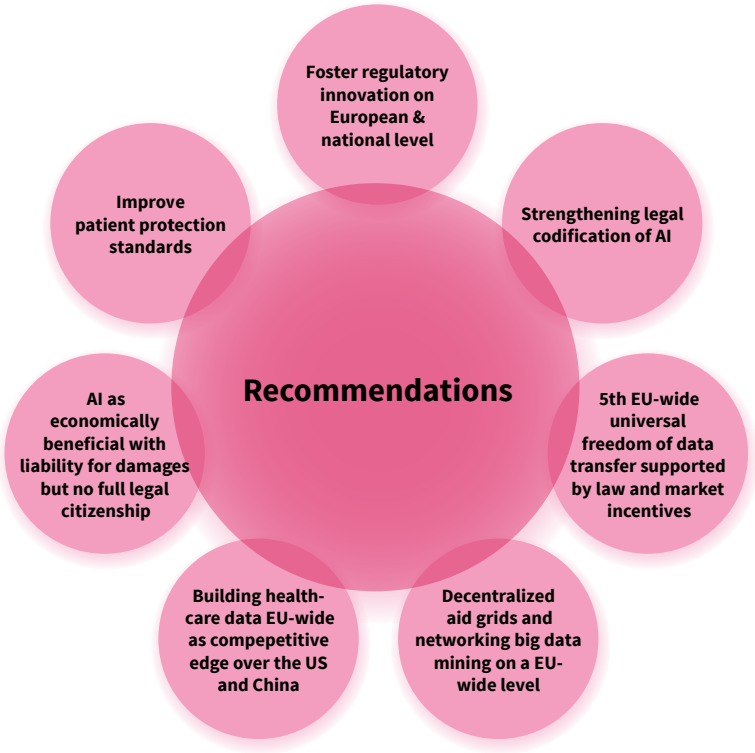
The following report is based on a study initiated and curated by Dr. Dieter Feierabend at NEOS Lab and executed by Julia M. Puaschunder during Summer and Fall of 2019. Dr. Dieter Feierabend supervised, reviewed and substantially improved the readability of the report. Funding of the European Liberal Forum at the European Parliament is most gratefully acknowledged.

Executive Summary

The most recent decade featured a data revolution in the healthcare sector in screening, monitoring and coordination of aid. Big data analytics have revolutionarized the medical profession. The health sector relies on Artificial Intelligence (AI) and robotics as never before. The opportunities of unprecedented access to healthcare, rational precision and human resemblance but also targeted aid in decentralized aid grids are obvious innovations that will lead to most sophisticated neutral healthcare in the future.

Yet big data driven medical care also bears risks of privacy infringements and ethical concerns of social stratification and discrimination. Today's genetic human screening, constant big data information amalgamation as well as social credit scores pegged to access to healthcare also create the most pressing legal and ethical challenges of our time. The call for developing a legal, policy and ethical framework for using AI, big data, robotics and algorithms in healthcare has therefore reached unprecedented momentum.

This study aims at helping a broad spectrum of stakeholders understand the impact of AI, big data, algorithms and health data based on information about key opportunities and risks but also future market challenges and policy developments for orchestrating the concerted pursuit of improving healthcare excellence. Policy makers on the European and national levels should consider following recommendations in the wake of AI (r)evolution:



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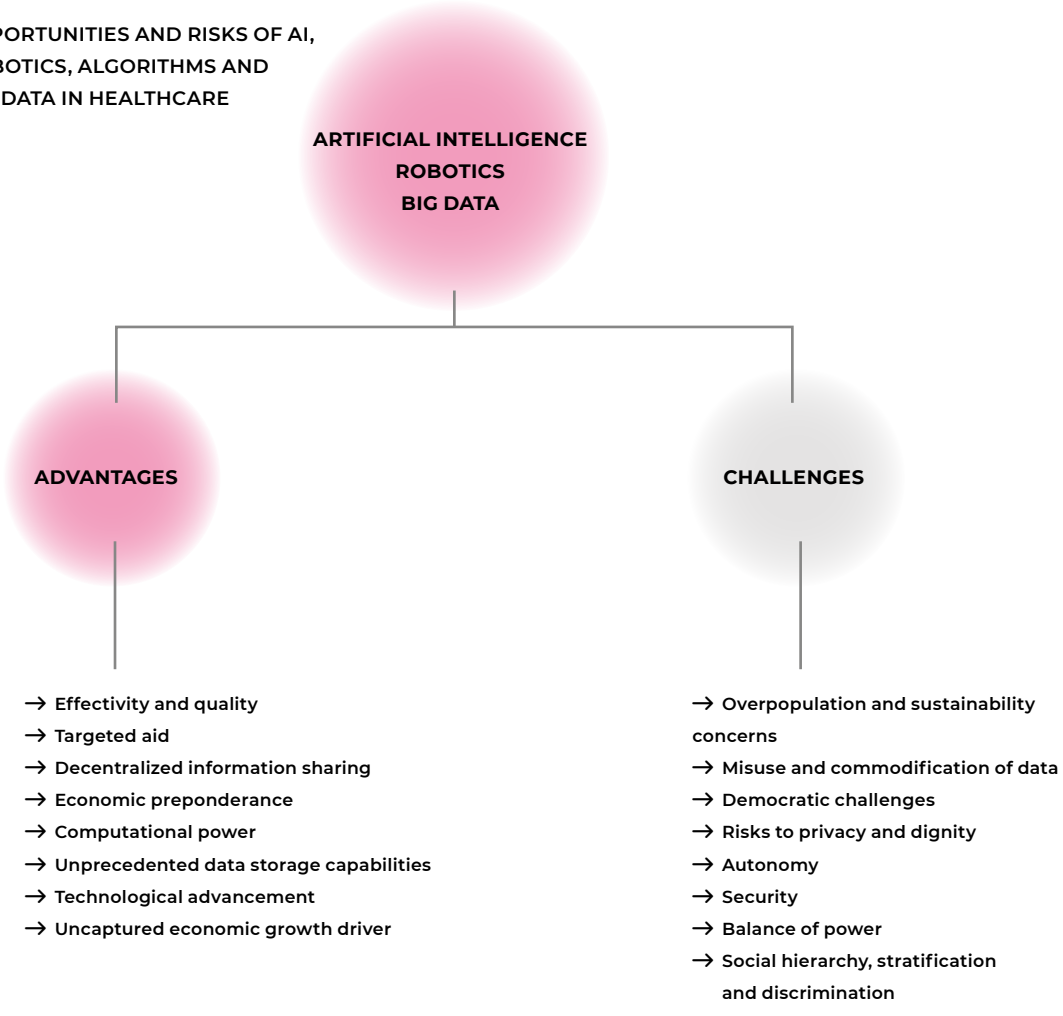
1 Introduction

The use of big data and Artificial Intelligence (AI) has leveraged the effectiveness and quality of healthcare to unprecedented excellence. In the currently ongoing introduction of algorithmic analysis of healthcare data, the emerging potentials of automated control hold extraordinary opportunities for improving human life, such as access to targeted aid and decentralized information sharing. Big data allows early disease intervention and reduces adverse reactions of patients due to lowered medical errors and better understanding of co-morbidity. Novel technology can cross-link healthcare providers with professions and intensify research collaborations through social networks. Disease prevention is enabled through the pre-identification of risk factors for populations and heightened patient safety through directly delivered information and better prediction of outcomes by understanding demographic challenges and health trends around the world. Transmission pathways and knowledge dissemination improve the efficiency and effectiveness of healthcare.

The new technological advancement and entrance of AI into our contemporary society also comes with risks such as compatibility glitches in the robot-human interaction, big data privacy concerns, AI preponderance, liability uncertainty as well as potential discrimination and social stratification while we may also lose humanness in the artificial age. Genetic monitoring capacities coupled with big data insights and social monitoring through biometric screening imply unprecedented ethical predicaments. Big data generated insights bear enormous predictor potentials outperforming human decision making, but big data derived personality cues have recently been tapped for governance control purposes, such as border protection and tax compliance surveillance. The information derived from large datasets describing the populace can also become ground to discrimination as information can be complied over time and inferences derived about the relation of the individual to the general public.

GRAPH 1: OPPORTUNITIES AND RISKS OF AI, ROBOTICS, ALGORITHMS AND BIG DATA IN HEALTHCARE



With the dramatic growth in diversity and entrance of emerging technologies in today's societies, the socio-economic and ethical complexity of these challenges is on the rise (Meghdari & Alemi, 2018). We may now also address the question what is it that makes human humane? In the age of AI and automated control, humanness is key to future success but we may lose human care and genuinely humane compassion to robots being more efficient and cost-effective while not knowing what the impact and outcome is of a new cadre of human-like machines encroaching the healthcare sector. Scientists, policy makers and practitioners therefore demand the creation of a framework on AI ethics.

This study addresses AI and big data in the healthcare sector from an international perspective and a particular focus on the European Union being at the forefront of developing guidelines on the use of AI for the benefit of humankind.[1] Furthermore, the legal and regulatory status of AI will be discussed. Policy recommendations are given that may draw from behavioral human decision making insights and evolutionary economics to outline what makes human humane and how human decision making is unique to set us apart from AI rationality. The discussion closes with an outlook on further topics, which are shaped by the introduction of governance through algorithms.

1 https://digitales.wien.gv.at/site/stadt-wien-entwickelt-strategie-zum-einsatz-kuenstlicher-intelligenz/

2 Legal and regulatory status of AI

The legal and regulatory status of AI is still developing in jurisdictions around the world. The United Nations (UN) agencies and regional organizations report internationally varying contemporary guidelines, ethics codes and action statements. This chapter addresses a qualitative comparative overview over the central dominant AI territories Europe, North America and China in terms of AI focus, technology development and legal codification.

2.1 Europe

In Europe, the European Union is at the forefront to create a responsible, trustworthy AI, which falls in line with key ethical and legal principles to uphold highest social standards (Renda, 2019b). The European Union accounted for 8 percent of global AI equity investment in 2017, which is 1 percent of this investment in 2013. However, member states varied widely in terms of investment levels. Start-ups in the United Kingdom received 55 percent of the European Union total investment between 2011 and mid-2018, followed by German (14 percent) and French ventures (13 percent). This means the remaining 25 countries shared less than 20 percent of all private AI equity investments received in the European Union (OECD, 2019).

While North America and Asia have financial interest and leadership advantages at stake; Europe appears more trying to fill a niche in the alignment of AI with economic, social and environmental goals, such as outlined in the Sustainable Development Goals (SDGs). Medical data is more available in Europe to maintain national security in universal healthcare providing territories, yet at the same time the general data access and reaping benefits from individual consumer data appears more protected in Europe than any other continent. International companies that offer products to European citizens are subject to European legislative privacy protection.

The massive amount of information collected will keep challenging privacy. Governments are now updating their privacy legislation to respond to privacy concerns fueled by the public outcry against massive data breaches and the unfettered use of data by large companies. The EU and international regulators have taken an active interest in AI, not only recognizing its benefits but also being mindful of potential risks and unintended consequences. Based on human dignity of privacy, which The Lisbon Treaty traces back as a quasi-human right, the European Union incepted the General Data Protection Shield (GDPR) in April 2016 as a comprehensive set of rules designed to keep the personal data of all EU citizens collected by any organization safe from unauthorized access or use. Organizations must be transparent about the type of information they collect about consumers and how this information will be used. Around the world, internet companies have to become attentive to GDPR, which establishes guidelines to data minimization, care of sensitive data, respect for the right to be forgotten, data portability and data protection by design. This regulation is regarded as the foundation for EU data protection rules and has direct impact on all issues related to big data in healthcare.

Critics contend that the implementation of data administration remains at the national level. So far, the GDPR is believed to have raised the regulatory costs of new technologies – a trend which is expected to rise in the near future. GDPR presents an obstacle to developers looking to design more complex and sophisticated algorithms. GDPR appears to hit small and medium sized companies harder than large companies that have higher data-retrieved and more financial and legislative support to comply.

Human privacy can be – as in North America – infringed upon in the state of emergency and for national security purposes. Future legislative advancements are expected to concern taxation of big data generated revenues.[2]

As for AI and robotics, the EU is on the forefront to have laid a concrete foundation of its AI policy since 2016, when the European Parliament adopted its first draft resolution on "Civil Law Rules for Robotics." That initiative called for attributing both "rights and duties" to smart autonomous robots.[3] In the pursuit of a digital single market strategy, the European Commission leads the communication and directive on AI. In April 2018 the European Commission adopted a strategy for the EU to lead the way in developing and using AI for good and for all, building on its values and its strengths. Thereby the Commission made explicit reference to the GDPR as well as to Article 2 of the Treaty on EU, which mentions explicitly "human dignity, freedom, democracy, equality, the rule of law and respect for human rights, including the rights of persons belonging to minorities; and a "society in which pluralism, non-discrimination, tolerance, justice, solidarity and equality between women and men prevail."

The European Group on Ethics in Science and New Technologies, an independent advisory body of the President of the European Commission, produced a statement on Artificial Intelligence, Robotics and 'Autonomous Systems,'[4] which stressed the importance of human dignity, autonomy, responsibility, justice, equity and solidarity, democracy, rule of law and accountability, security, safety, and bodily and mental integrity, data protection and privacy as well as sustainability when it comes to civil law codifications on AI (Renda, 2019a).[5] Additional codification in this realm are the Asilomar AI Principles, the Montreal Declaration for Responsible AI, the General Principles of the Ethically Aligned Design, and the five principles for AI developed by the UK House of Lords (2018) and the Tenets of the Partnership on AI (2018). Together, these documents hold about 50 different principles (Renda, 2018, 2019a, b).

Fundamental principles include the lawful conduct around AI and a non-maleficence principle fostering the urgency to do no harm. Protection of human integrity and dignity, security and privacy are stressed. Responsible AI development is meant to ensure the complementarity with humans enabled through responsible governance of monitoring, control and feedback but also AI transparency and explainability. Lastly, sustainable AI endeavors target at good benevolence principles for the use of AI, such as harmony with SDGs and limited or zero carbon footprint, quality education and promotion of female empowerment for industry, innovation and infrastructure (Renda, 2019b). As borderline cases for the application of AI with dignity are predictive policing, social credit scores, facial and body recognition, content filtering and conversational bots (Renda, 2019b). Regulation is targeted at putting respective risk management tools in place. In the implementation, core values are accountability in data governance, accessibility and usability of technologies, human oversight, non-discrimination and respect for human autonomy, privacy and robustness in terms of security risks and safety (Renda, 2019b).

2 https://www.nytimes.com/2017/11/14/business/dealbook/taxing-companies-for-using-our-personal-data.html

3 https://g8fip1kplyr33r3krz5b97d1-wpengine.netdna-ssl.com/wp-content/uploads/2018/04/RoboticsOpenLetter.pdf

4 https://ec.europa.eu/info/sites/info/files/european_group_on_ethics_ege/ege_ai_statement_2018.pdf

5 https://ec.europa.eu/info/sites/info/files/european_group_on_ethics_ege/ege_ai_statement_2018.pdf

2.2 North America

The United States (US) have a corporate approach to AI grounded in R&D of tech giants and leading universities in the field. In May 2018, the White House announced its broad intention to maintain American leadership in AI via public R&D and removed barriers to innovation.6 Unlike the EU, US federal lawmakers have yet to establish regulations to govern the use of personal information in the AI world. Sensing the inevitability of data regulation, some large American companies are actively engaging in the introduction of regulation on AI, robotics and big data use in the United States. On January 18, 2019, Accenture released a report outlining a framework to assist US federal agencies to evaluate, deploy and monitor AI systems. More recently, the US government's Defense Advanced Research Projects Agency (DARPA) announced the so-called "AI Next" program, a $2 billion investment plan aimed at addressing the perceived limitations of current AI technologies, including excessive data-dependency, lack of explainability and contextual reasoning. The US federal government as a whole is not likely to adopt a common strategy for responsible AI any time soon (Renda, 2019a).

The American privacy and big data approach is more sector specific. Commercial privacy is often discussed through an economic lens. US rights to data are mainly regulated by the Federal Communications Commission (FCC) and the Federal Trade Commission (FTC) that concerns to eradicate unfair and deceptive market activities and sanction privacy infringements.[6] The FTC uses a wide variety of data security measures. The split delegation of FCC and FTC, however, appears to heighten bureaucratic and regulatory costs while lowering the potential of industry control mechanisms. In general, corporations are obliged to inform the FTC about data protection and data integrity means. The US Congress most recently thematized big data revenue gains.[7] Institutional stakeholders on AI, robotics and big data frequently meet at the National Academy of Sciences.

In Canada, the intended use of data has to be appropriately disclosed and compliant with legislation such as the Personal Information Protection and Electronic Documents Act (PIPEDA).[8] The Breach of Security Safeguards Regulations under PIPEDA set forth certain mandatory requirements for organizations applicable in the event of a data breach. PIPEDA defines a breach of security safeguards as "the loss of, unauthorized access to or unauthorized disclosure of personal information resulting from a breach of an organization's security safeguards."[9] Organizations will need to not only evaluate their compliance in terms of privacy legislation, but also ensure that their data handling practices are sufficiently secure to prevent cybersecurity breaches.

Start-ups operating in the United States account for most AI start-up equity investments worldwide as the United States accounts for 70-80 percent of global venture capital investments across all technologies (Breschi, Lassébie & Menon, 2018; OECD, 2019). In 2019, the U.S. President announced a nearly $1 billion federal commitment towards AI research in seeking the competitive edge over AI (Castellanos, 2019). A White House plan calls for government agencies to develop ethical AI systems and shared public data sets for AI training to improve human-machine interactions among other initiatives.

6 Section 5 of the FTC Act defines unfair practices as 'to cause or is likely to cause substantial injury to consumers or cannot reasonably be avoided by consumers' and deceptive practices as 'practices that likely are misleading or actually misleading to consumers.'

7 https://www.nytimes.com/2017/11/14/business/dealbook/taxing-companies-for-using-our-personal-data.html

8 https://www.lexology.com/library/detail.aspx?g=4284727f-3bec-43e5-b230-fad2742dd4fb

9 https://www.lexology.com/library/detail.aspx?g=4284727f-3bec-43e5-b230-fad2742dd4fb

2.3 China

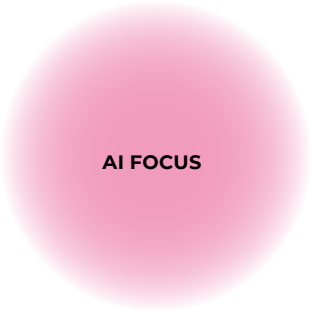
China has seen a dramatic upsurge in AI start-up investment since 2016, accounting today for the second largest AI equity investments in the world. From just 3 percent in 2015, Chinese companies attracted 36 percent of global AI private equity investment in 2017. They maintained an average of 21 percent from 2011 through to mid-2018 (OECD, 2019). China has ambition to become the global leader in AI innovations; yet still leapfrogs many developments occurring in Europe and the US (Renda, 2019a, b).

A Chinese peculiarity is the Chinese Social Credit System. This unique national reputation system is currently developed by the Chinese government to standardize the assessment of citizens' and corporate economic and social reputation. Thereby the massive data available from facial and body recognition collected in public spaces offers an estimation of the social contribution of individuals in relation to each other. Based on mass surveillance using facial recognition, governmental records and user protocols for big data analysis, this social management attempt is targeted at tracking the social interaction of a population on a large scale. Novel appears that mass surveillance is thereby coupled with mass disciplinary tools. The big data and mass surveillance machinery enabled by unprecedented data analyses tools and a network of corporate and governmental surveillance technology forms thereby work together in the creation of social credit scores. Based on the economic and social behavior ranking of each individual of a society, the social score is to be used for rewarding pro-governmental and social acts but also punish illegal or unfavorable developments – including certain religious support. Individuals are also ranked in order to determine a stratified access to degrees of freedom and distribution of scarce resources, such as housing, banking, credit, travel, visas, bureaucratic gateways, healthcare and preferential treatment in hospitals. Public shaming and social bragging by displaying social credit scores on public walls and online dating social media platforms have become reality (Mistreanu, 2018). Punishments for violating social protocols include banning or listing on a public blacklist, which can be displayed in public at the discretion of the government, have resulted in exclusion from flight, railroad travel and lodging, prestigious work and private schools as well as slowing internet speed (Botsman, 2017; Hatton, 2015).

For the corporate sector, the social credit system serves as market regulation tool to uphold a functional credit system and compliance with governmental policies. Corporate social credit scores are believed to be derived from real-time monitoring of business activities. Corporations with good credit scores are enjoying favorable credit conditions, lower tax rates and more investment opportunities; while bad credit scores may limit the engagement in publicly funded projects (Meissner, 2017). While the system is limited to mainland China, foreign businesses operating in China will be subject to the system as well.

Problematic appears that the underlying data and algorithms as well as measurement parameters remain undisclosed to public (Shazeda, 2017). Potential input parameters are speculated to be location tracking, social networks, credit histories, health records, insurances, private messages, gaming, smart home data, media consumption, shopping and dating behavior (Sydney Morning Herald, 2019). An as such system under construction opens ample ways of arbitrary abuse (Wang, 2017). Granting privileged access to healthcare runs counter the humanitarian imperative to serve first-aid in accordance to need.

GRAPH 2: COMPARATIVE OVERVIEW OF AI FOCUS IN EUROPE, NORTH AMERICA AND CHINA



EUROPE

- → Responsible trustworthy AI
- → Legal, social, ethical standards
- → Sustainability
- → Privacy protection (GDPR)
- → Human rights
- → Civil law rules for robotics
- → AI for the good of society
- → Complementarity with human
- → Transparency and explainability

NORTH AMERICA

- → Public R&D building tech giants
- → Big data collecting monopolies
- → Commercial interest and seed funding
- → Commercial interest and venture capital
- → Regulatory bodies FCC (Federal Communications Commission) & FTC (Federal Trade Commission)
- → Canada: Personal Information Protection and Electronic Documents Act (PIPEDA)

CHINA

- → Ambition to become global leader
- → LLeapfrogging on Europe and US
- → Chinese Social Credit Score
- → Governmental standardized assessment of citizens, corporate economic and social reputation
- → Big data used for disciplinary purposes
- → Access to scarce resources
- → Public shaming and social bragging

2.4 Overall legal development

As a predicted trend, the co-existence of AI with the human species is believed to change the fundamental concepts of social, political and legal systems alongside leading to unprecedented ethical dilemmas. As AI will not be an exact replication of human intellect behavior, the "robots' autonomy raises the question of their nature in the light of the existing legal categories – of whether they should be regarded as natural persons, legal persons, animals or objects – or whether a new category should be created, with its own specific features and implications as regards the attribution of rights and duties" (EU Committee on Legal Affairs, 2016, p. 5; Themistoklis, 2018). In the legal codification of AI, we see three possible legal scenarios emerging:

Human preponderance over AI: When considering the enormous physical and longevity advantages AI hold over human, a natural dominance of AI over humankind is implied. In order to ensure that human lead AI and are not subordinated, a society should be established, in which robots gain quasi-human rights but may not have the same powers and rights as human beings. In the earliest form of democracy in the ancient Athenian city state, different classes of citizenship existed. The Athenian form of direct democracy serves as an example of not all citizens being allowed to vote being a feasible governmental structure but also – as for its direct character – as a forerunner of electronic democracy. A future world with AI blended into society could structure the human – AI relation based on the ancient Athenian city state societal composition, in which different classes of citizenship lived together in relative harmony.

In a future democracy embracing AI, algorithms could thereby compute the standard choice of politicians representing different agenda based on historical information and aid to inform politicians about the outcomes of several choices in the past. The computational power and data calculus capacity of AI would thereby ensure closer

accuracy of political will resembling collective choice and enable to reap AI benefits for political choice, while ensuring human to stay in charge but enhanced by artificial benefits. This integration of AI in form of an advisory role to governments could enable AI access to democracy as a compromise without AI having direct voting rights. An as such form of AI-enhanced democracy could potentially overcome bribery, nepotism and corruption if the algorithm is calibrated featuring ethical goals and AI remaining without personal profit maximization goals.

Human reaping benefits of AI: AI entering the workforce and blending in as a substitute to human capital, will change the nature of labor, potentially dividing labor into a putty, flexible, eternal and exchangeable AI part and a clay labor of inflexible human capital (Puaschunder, 2019b). In order to ensure that human can legally benefit from the economic output and growth generated by AI, a society should be established, in which robots gain quasi-human rights but may not have the same material needs and rights as human beings. In the earliest form of society in the ancient Roman Empire, a society existed that featured a high culture and human protection but legal slavery.

Defining AI as quasi-slaves would allow to reap the benefits AI. AI's newly assigned roles appear to overlap with slave tasks of ancient Rome slaves that provided manual labor and agriculture, household domestic services, urban crafts and services as well as skilled, educated professions but also imperial and public services. Like in ancient Rome, AI could be considered as property with no legal personhood and should not be subject to corporal punishment, exploitation and summary execution in the case of malfunctioning.

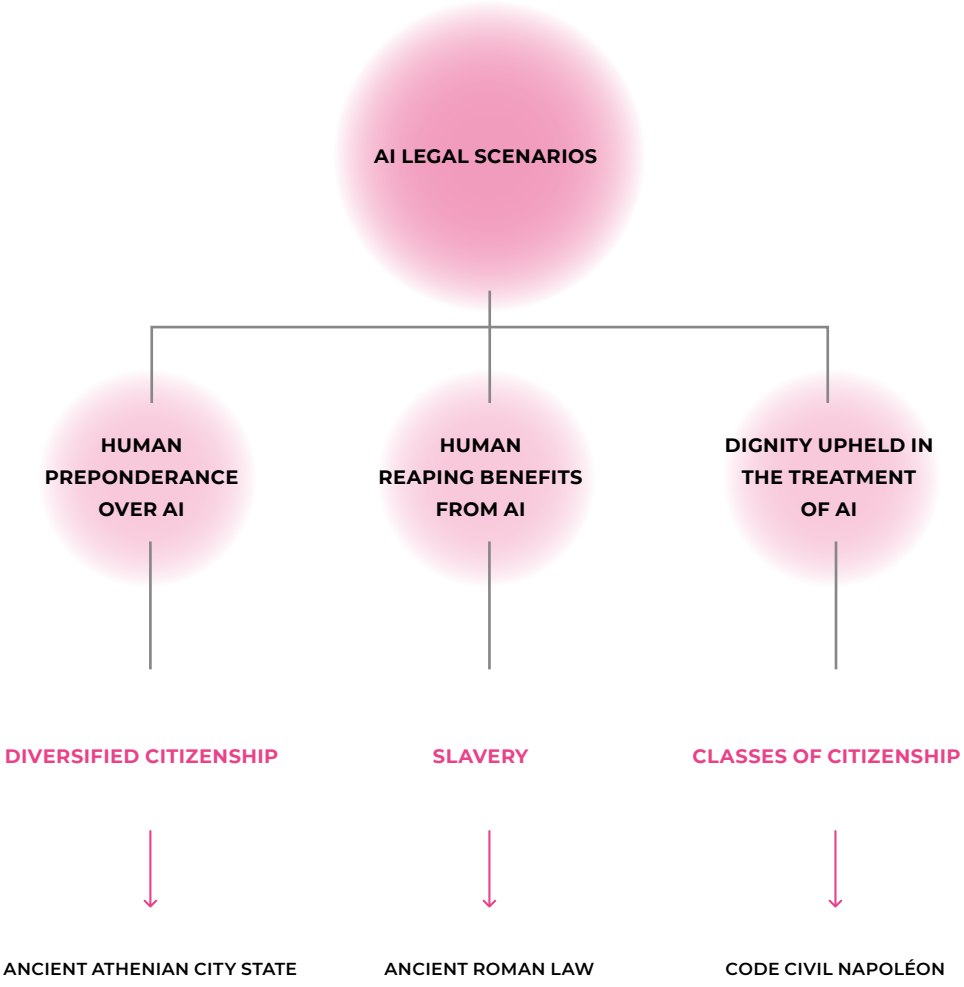
As practiced during slavery in the Roman Empire and proposed by Bill Gates, reaping benefits from AI should include taxation based on the revenue generated by AI and/or the price of AI determined by sophistication. Like in ancient Rome, the taxation could be enacted when slaves are traded, hence when AI gets purchased by AI-generating entities. Defining AI as slaves would ensure to uphold decent standards of living for these creatures, while human naturally stay in charge of the evolution and introduction of AI into human society. As debated in the ancient Roman society, sophisticated AI that is used for economic trade may also be permitted to earn money for their personal use; but should never be freed and gain the same rights as human as there is something unique and special to humanness. The uniqueness of human naturally leads to the natural exclusion of AI from the persona, the synonym for the true nature of the individual, and considered to not have a personality.

Dignity upheld in the treatment of AI: If AI gets legally and economically subordinated to human, ethical questions arise. As in the case of the Greek and the Roman Law slaves, legal protection of AI may grow over time and history due to egalitarian views of humanity. For instance, destruction of AI without just cause could be tried for homicide and complaints of robots against cruel and unfair treatment of owners be supported in front of courts. In order to oppose ill-treatment of slaves immediately, dignity may be upheld in applying a legal code with two different classes of society.

A legal code that may serve as reference hereby may be the Code Napoléon, a Civil Law codification under Napoléon I in 1804 that defines and classifies male and female as human beings but legally bestows upon them substantial power differences, especially regarding material possession and democratic participation. As the first clearly written and accessible compilation of modern law, the Code Napoléon has become one of the most influential legal documents in history that influenced the law of many countries around the world – such as Austria, Belgium, Canada, Chile, the Commonwealth, Egypt, Germany, Italy, Ireland, Latin America, the Netherlands, Portugal, Poland, Puerto Rico, Romania, Russia, Scandinavian countries to name a few (Mohamed, 2016). With regard to family, the Code established the supremacy of the man over the wife and children, which was the general legal situation in Europe at the

time (Smith, 2006). A woman was given even fewer rights than a minor.
In the attempt to protect AI against suffering, harm and misuse or abuse, the Code Napoléon may be applied. The application may define AI as quasi-human and grant citizenship to both human and AI but different power regarding material possession, democratic participation and public leadership. A natural supremacy of human over AI and robots could be established. As the role of woman and minor even differed, a power hierarchy could even be codified between sophisticated and less-sophisticated AI and robots in the weak and strong AI sense.

GRAPH 3: AI LEGAL SCENARIOS AND LEGAL CODIFICATION-INSPIRING SOURCES



6 It is obvious that even a Uber driver needs certain skills to conduct his task but the focus is more on the tasks he has to deliver.

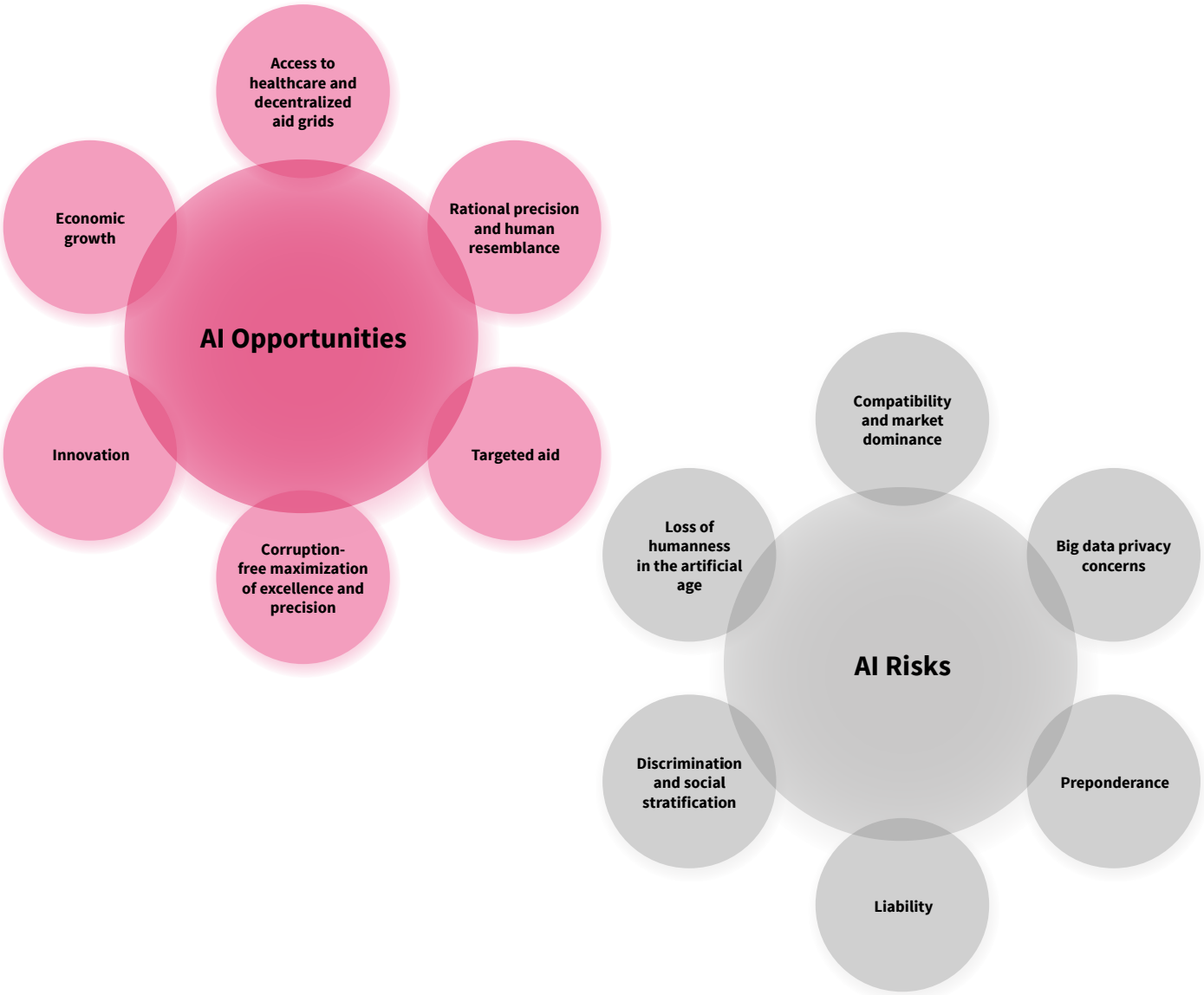
7 Other studies have excluded Airbnb but it includes almost daily work of cleaning, interacting with the guests and managing the accommodation.

3 Artificial Intelligence in the Healthcare Sector

To an extent as never before in the history of medicine, computers are supporting human input, decision making and provision of data. AI, algorithms, robotics and big data have become used to derive inferences for monitoring large-scale medical trends, detecting and measuring individual risks and chances based on data-driven estimations.

But AI and the use of robotics also comes with novel challenges and risk. Big data raises critical privacy concerns – especially in protected areas of human health status, which may directly determine relationship and employment status, and lead to discrimination and social stratification. This chapter discusses opportunities and risks of AI, robotics, algorithms and big data in healthcare.

GRAPH 4: OPPORTUNITIES AND RISKS OF AI, ROBOTICS, ALGORITHMS AND BIG DATA IN HEALTHCARE



3.1 Opportunities

3.1.1 OVERALL LEGAL DEVELOPMENT

AI and robotics supported medical assistance and scientific discovery have increased steadily within the last decades. The big data revolution and hierarchical modeling advancements as well as computational power are starting to dominate an inference-driven access to healthcare and medical prevention control. Therapeutic data-driven information and self-monitoring, as well as patient and claims data, have leveraged to unprecedented sophistication in recommending treatments and impact outcomes. With the growth of scientific evidence derived from big data, AI helps guide care, improve comprehension, analyze trends and identify opportunities for further research.[10]

AI-powered engagement aids guide customer-facing resources through the planning and execution process; surfacing actions, evidence, and insights based on real-time, integrated data. Acting as a "virtual mentor," technology can aid engagements to meet both customer expectations and organizational objectives today, while further informing future decisions.[11]

Growth of genomic sequencing databases but also widespread awareness and implementation of electronic health recording has improved the nature and quality of accessible preventive medicine. Health risk early warning systems through data collected via a mobile app but also pandemic spread visualized via Google search mapping analytics are advancements based on big data, large-scale mapping sophistication and computation control. The wealth of electronic health records has excelled digitalized diagnosis to help in preventing diseases and control disease outbreaks.

Robotics have entered the medical field as assisted body parts or surgery devices as well as in the support of automated nursery and mental health stabilizers. Radiology and imaging benefit from computer-guided and big data-enhanced capacities to diagnose and predict future outcomes at the same time based on large scale samples.

Information and Communication Technologies (ITC) have broken a wave of hope in increasing the possibilities of telemedicine. Telehealth enables remote and instant monitoring and preventive control but also instant emergency outreach and remote diagnosis based on large-scale data-driven knowledge generation.

Self-monitoring through diagnostic tattoos that change color when certain medical conditions – such as for instance diabetes or cancer – occur or development of programmable cells that destroy diseases naturally and internally are cutting edge developments on the intersection of self-determined prognosis led by algorithmic insights (Knapton, 2016).

Health-related data from personal and healthcare-related self-diagnosis devices coupled with low-cost generation of big data and patient-led monitoring make top-notch quality care more accessible in remote areas and developing nations. Self-led monitoring and remote diagnosis aided by machine learning mining through big data and algorithmic decision making are continuously meant to give access to affordable excellent healthcare around the globe in the future.

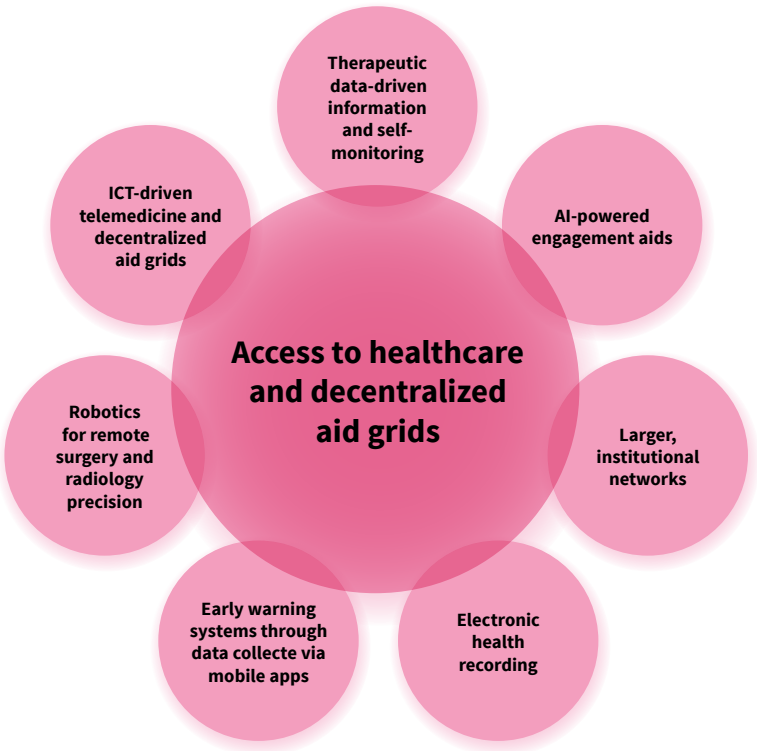
10 https://www.pharma-iq.com/business-development/articles/excellence-in-the-era-of-precision-medicine
11 https://www.pharma-iq.com/business-development/articles/excellence-in-the-era-of-precision-medicine

Decentralized targeted aid already forms a grid of medical specialists to work concurrently in the diagnosis of a patient. Decentralized crisis management applications of AI and machine learning thereby range from data-driven assistance in crisis management and control to battling hunger and poverty as well as forced migration. In the future we may see a further development of an effective big data-driven crisis response ecosystems and target-specific tailored data sharing.

As one of the most novel trends, democratization of health data implies several countries coming together to construct large datasets as learning opportunities, which different stakeholders from government, healthcare, engineering and technology use to analyze and predict the prevailing health situation and outcomes. The more countries join, the more accurately the dataset is to draw inferences about diseases and epidemics. Future big data mining should combine the medical sector with technology-driven self-monitoring directly applied to patients in a near real-time manner.

The wisdom of the crowds should be tapped into in citizen science – e.g., Massively Multiplayer Online Gaming (MMOG) techniques that have been used to incentivize volunteer participation. Such an approach helped gamers on a crowdsourced gaming science site[12] decode an AIDS protein in 3 weeks, a problem that had stumped researchers for 15 years (Quadir, Ali, Rasool, Zwitter, Sathiaseelan & Crowcroft, 2016).

GRAPH 5: OPPORTUNITY OF ACCESS TO HEALTHCARE



12 http://fold.it

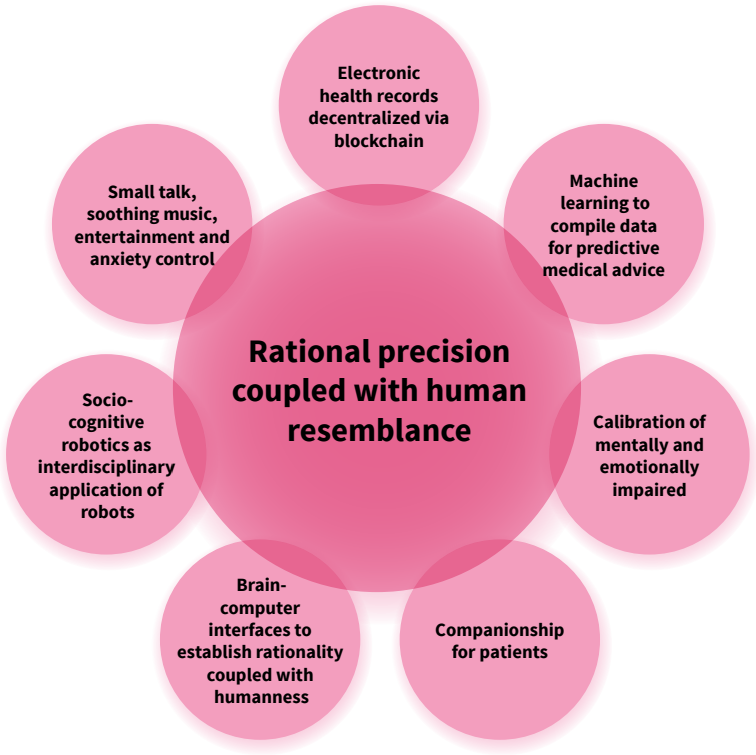
3.1.2 RATIONAL PRECISION AND HUMAN RESEMBLANCE

Electronic health records decentralized via blockchain enhanced with machine learning systems help guide physicians with predictive medical advice based on previous patient outcome data and recommended treatments performance data. Especially in mental health, AI utilized new technologies are showing excellent results in the calibration of mentally and emotionally fragile patients. Artificial emotional intelligence is thereby programmed to understand, simulate and calibrate human emotions. In elder and patient care, these tools are also currently applied to provide companionship to patients in the form of small talk, soothing music and adjustments to control anxiety (Meghdari & Alemi, 2018).

Brain-computer interfaces are predicted to help those with trouble to move, speak and with spinal cord injury. AI thereby helps patients to move, communicate and decode neural activities on an individual basis (Bresnick, 2018). Socio-Cognitive Robotics is the interdisciplinary application of robots that are able to teach, learn and reason about how to behave in a complex world (Meghdari & Alemi, 2018).

In all this, the human perception of and interaction with robot machines with a higher quality physical appearance, however, still differs from interaction with a computer, cell phone, or other smart devices (Meghdari & Alemi, 2018). The design and construction of social robots faces many challenges, one of the most important is to build robots that can comply with the needs and expectations of the human mind with cognitive capabilities coupled with social warmth (Meghdari & Alemi, 2018). For robotics technology to be successful in a human-driven environment, robots do not only need to meet a level of strength, robustness, physical skills and improved cognitive ability based on intelligence but should also fulfill a social impetus and ethical conscientiousness.

GRAPH 6: OPPORTUNITY OF RATIONAL PRECISION COUPLED WITH HUMAN RESEMBLANCE



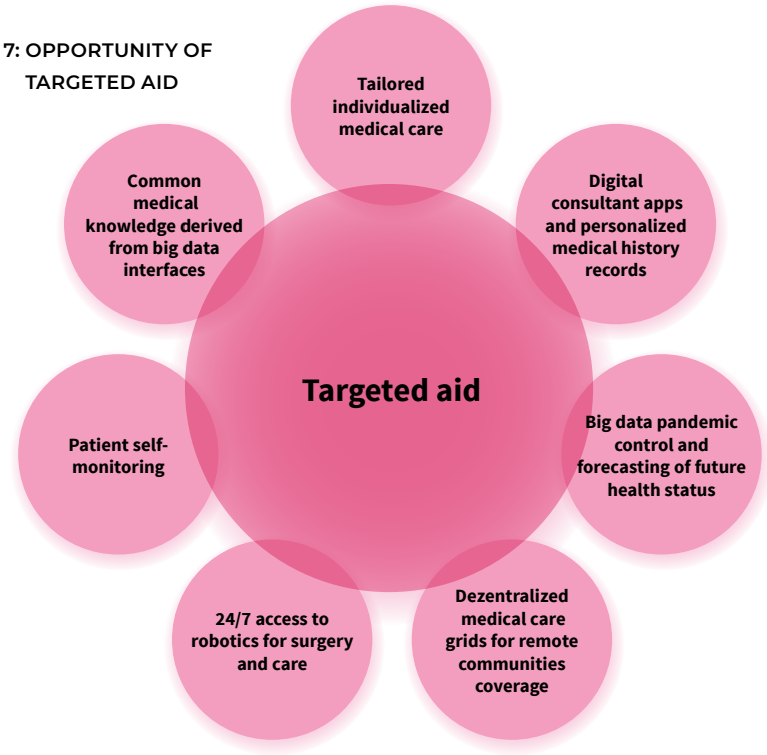
3.1.3 TARGETED AID

Healthcare has never been as individually targeted aid and accessible for everyone. For one, user self-reporting allows instant information generation and in-depth knowledge retrieval. Digital consultant apps use AI to give medical consultation based on personalized medical history record analyses and common medical knowledge derived from inferences from big data. Big data inferences allow pandemic control and health status forecasting. Virtual nursing assistants are predicted to become more common to perform targeted patient aid that can run 24/7 at most efficient levels.

For another, technological development is bringing production and manufacturing closer to the end user in the sharing economy. Decentralized medical aid allows tapping into information closeby and grants access to resources within the local networks. Remote communities thereby benefit from equal, easy and cheap access to medical aid. Information share among neighbors helps overcome shortages and enables fast paced aid that is faster, cheaper and more democratically distributed. Geopolitically the individual becomes more independent from centralized medical aid. In the wake of the Fourth Industrial Revolution, robots are expected to become more efficient, affordable and accurate. Robots can work 24/7 and are less demanding than human workers and are less prone to errors and susceptible to biases than human minds. All these developments will democratize access to healthcare.

While many insights are observational in nature, the goal is to identify actionable insights that inform medical strategies, leading to improved interventions and better patient outcomes. This requires a human AI-enhanced relation to generate and understand the expert knowledge.[13] Hands-on education featuring test phases and role plays will become necessary to train and administer a smooth entrance of AI into our daily healthcare provision. Education may help individuals making contemplated decisions and mastering privacy self-management (Sax, 2016). This is especially true for specialty care areas and expert teams where a small community of experts are closely connected to each other. The leverage of a functioning expert team is high when considering them being at the forefront of scientific discovery determining the lives of millions of people. There is significant value in understanding those networks of interactions featuring highly-trained professionals and self-monitoring patients.

GRAPH 7: OPPORTUNITY OF TARGETED AID



13 https://www.pharma-iq.com/business-development/articles/excellence-in-the-era-of-precision-medicine

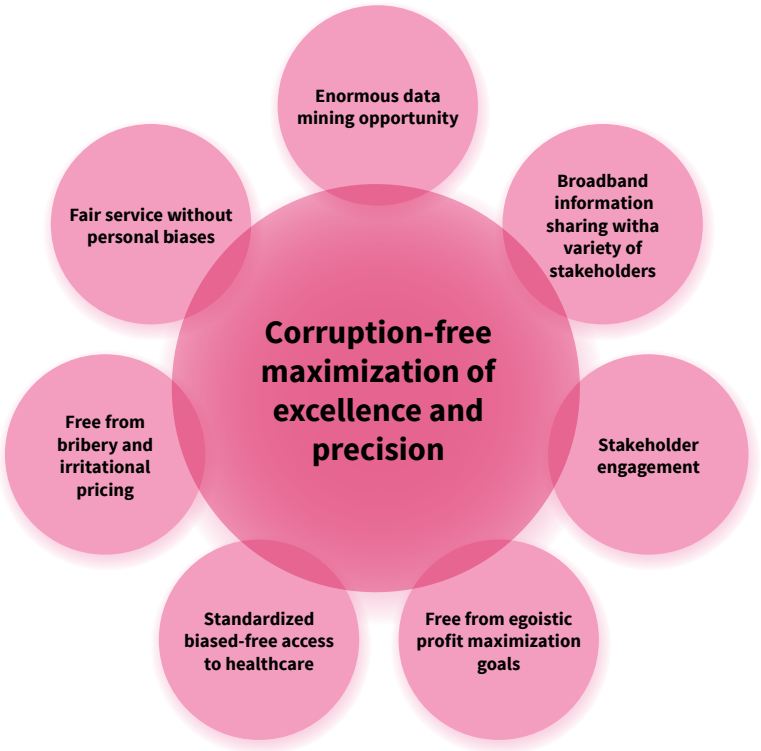
3.1.4 CORRUPTION-FREE MAXIMIZATION OF EXCELLENCE AND PRECISION

Today technology plays an important role to help analyze and identify actionable insights derived from a multitude of accessible data sources. The medical profession shifts towards precision medicine using a variety of complex datasets such as a patient's health records, physiological reactions and genomic data (OECD, 2019). With medical literature doubling every three years, also the pharma industry now has access to unprecedented amounts of scientific data.[14] Once tagged and compiled, AI tools that employ natural language processing help mine the data for new information for gathering actionable insights, leading to strategic data-driven interventions.

With the overwhelming growth of clinical data and the expansion of clinical care teams, life sciences will need to reconsider how to share information with diverse stakeholders so excellency is accomplished while human dignity is upheld. This requires identifying the right stakeholders, assessing scientific need and commanding solid knowledge of the data. Scientific excellency for advancing society must thereby be coupled with security attention and human dignity precaution.

Intriguing appears that AI, robots and algorithms differ from human healthcare providers in their nature of being artificial machinery free from egoistic profit maximization goals. Access to health will therefore more likely be standardized and corruption-free. With the medical profession and the pharmaceutical industry accounting for the economic sectors with the highest profit margins, enabling access to AI may on the one hand increase the overall costs of the medical care. But if these novel costs are strategically distributed by governance, for instance funded via taxation revenues in universal healthcare countries, AI and robots being without self-enhancing profit-maximizing goals promises to grant healthcare free from any corruption, bribery or irrational pricing faced by consumer-patients.

GRAPH 8: OPPORTUNITY OF CORRUPTION-FREE MAXIMIZATION OF EXCELLENCE AND PRECISION



14 https://www.pharma-iq.com/business-development/articles/excellence-in-the-era-of-precision-medicine

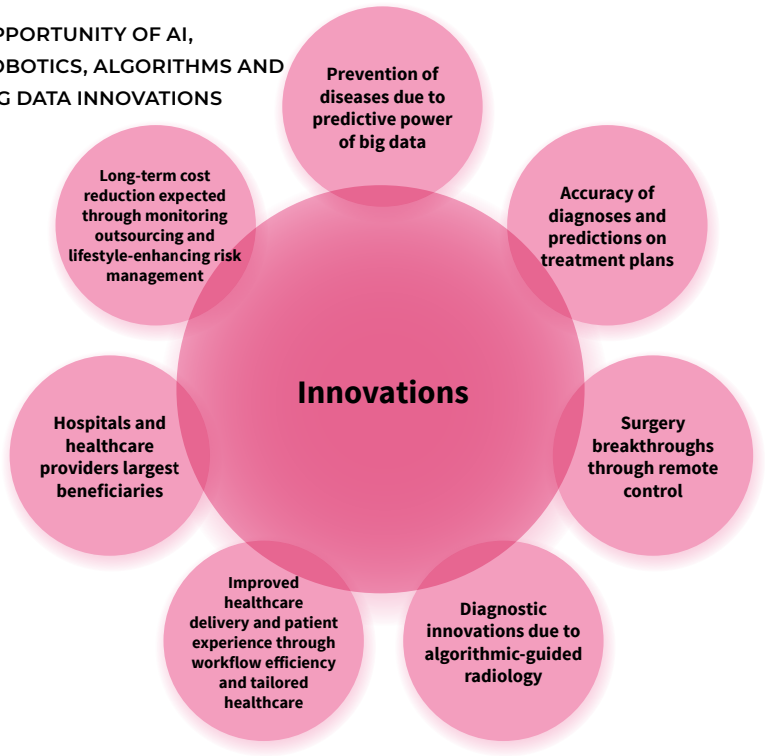
3.1.5 INNOVATION

The healthcare AI market is expected to surge with an expected compound annual growth rate of 50.2 percent from now until 2025 based on market innovations.[15] On a qualitative basis, the use of AI is believed to improve the prevention of diseases, accuracy of diagnoses and predictions on treatment plan outcomes. In particular, AI is on its way to revolutionize healthcare in areas such as surgery, radiology and cancer detection with improved healthcare delivery and patient experience.

Hospitals and provider segments are expected to hold the largest AI share in healthcare markets due to a large number of applications of AI solutions across provider settings, the ability of AI systems to improve care delivery and patient experience while bringing down costs and the growing adoption of electronic health records by healthcare organizations. Moreover, AI-based tools, such as voice recognition software and clinical decision support systems, help streamline workflow processes in hospitals at lower cost with improved care delivery and enhanced patient experience.[16] Utilizing the predictive power of big data has perpetuated the effectiveness and efficiency in the healthcare sector.

The adoption of electronic health records by healthcare organizations and the outsourcing of health monitoring by novel personal care products – such as routine check-up medical tools and wearable devices – is further believed to better service quality and eventually bring down costs via improved prevention through higher frequency of checks at lower costs. Advanced computing power and the declining cost of hardware are other key factors in the projected market growth at lowering costs.[17] The growing adoption of applications such as patient-data and risk analysis, lifestyle management and monitoring and mental health is further propelling technology use in the market.[18]

GRAPH 9: OPPORTUNITY OF AI, ROBOTICS, ALGORITHMS AND BIG DATA INNOVATIONS



15 https://www.reportlinker.com/p04897122/Artificial-Intelligence-in-Healthcare-Market-by-Offering-Technology-Application-End-User-Industry-and-Geography-Global-Forecast-to.html

16 https://www.reportlinker.com/p04897122/Artificial-Intelligence-in-Healthcare-Market-by-Offering-Technology-Application-End-User-Industry-and-Geography-Global-Forecast-to.html

17 https://www.healthcarefinancenews.com/news/healthcare-ai-market-expected-surge-21-361-billion-2025

18 https://www.reportlinker.com/p04897122/Artificial-Intelligence-in-Healthcare-Market-by-Offering-Technology-Application-End-User-Industry-and-Geography-Global-Forecast-to.html

3.1.6 ECONOMIC GROWTH

A 2017 Accenture Research and Frontier Economics report of economic growth rates of 16 industries concluded that AI has the potential to boost profitability on average by 38% by 2035.[19] On the question of an AI market disruption, since AI in healthcare is currently utilized mainly to aggregate and organize data – looking for trends and patterns and making recommendations – a human component that is creative, cognitively highly flexible and compatible with AI sources is still needed (Puaschunder, 2019a).[20]

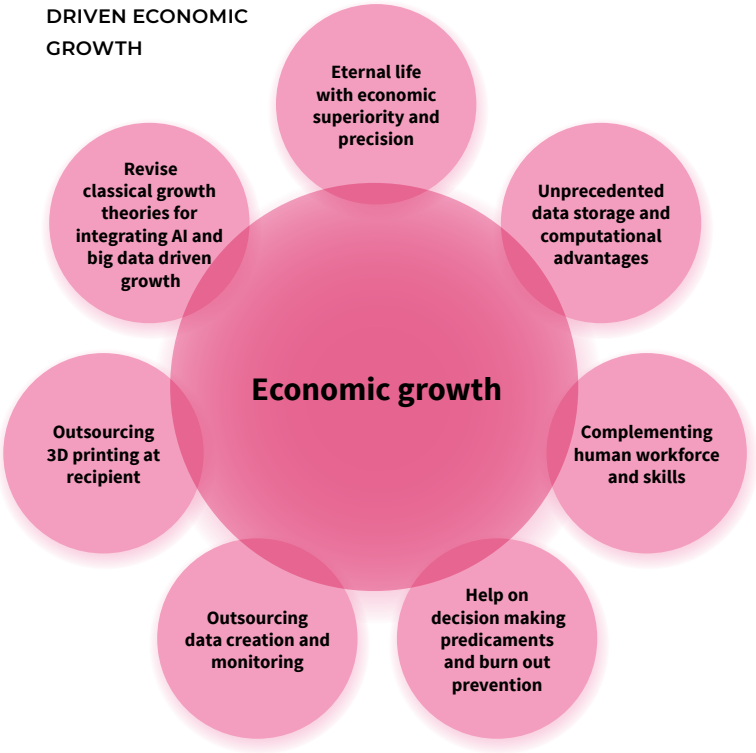
Rather than replacing human medical doctors and staff, AI is therefore believed to support medical doctors and nurses alike and help on decision making predicaments, as burn out prevention by aiding on cognitive load capacity constraints with supremacy of excellence and precision. Outsourcing monitoring to patients and electronic recording devices but also tapping into the wealth of expert knowledge generated through big data helps classical human medical doctors and healthcare agents, who benefit from freed capacities for creative decision making and expert advice giving. In addition, advances in 3D printers may soon make it possible to substitute healthcare provision closer to the consumer, where the manufacturing process is simplified thanks to the reproduction of models.

In an attempt to align AI with classical growth theories, classical capital or labor components should be put in relation to AI. In a cross-sectional analysis over 161 countries of the world and a multi-decade time series, higher AI use appears to be associated with lower economic growth rates – a striking result which demands for revising growth theory in the artificial age (Puaschunder, 2019c). AI hubs are speculated to have growth – e.g., such as gains from the sharing economy, cryptocurrencies and big data generated revenues – that conventional growth theory may not include (Puaschunder, 2019). We may therefore advocate for revising conventional orthodox and heterodox growth theory for integrating AI-led growth. The standard neo-classical growth theory featuring growth being a function of capital and labor should be revised insofar as labor could be split up in more flexible components describing AI and human labor being associated with more clay labor parts, hence a more inflexible workforce. When revising standard neo-classical growth theories to integrate AI components into growth theory, the derived modeling capacity will allow for a more precise description and prediction of current and future AI impacts on the overall economy (Puaschunder, 2019b, d). Graph 10 features the mentioned opportunities of AI, robotics, algorithms and big data driven economic growth.

19 https://www.lexology.com/library/detail.aspx?g=4284727f-3bec-43e5-b230-fad2742dd4fb

20 https://www.reportlinker.com/p04897122/Artificial-Intelligence-in-Healthcare-Market-by-Offering-Technology-Application-End-User-Industry-and-Geography-Global-Forecast-to.html

GRAPH 10: OPPORTUNITY OF AI, ROBOTICS, ALGORITHMS AND BIG DATA DRIVEN ECONOMIC GROWTH



3.2 Risks

3.2.1COMPATIBILITY AND MARKET DOMINANCE

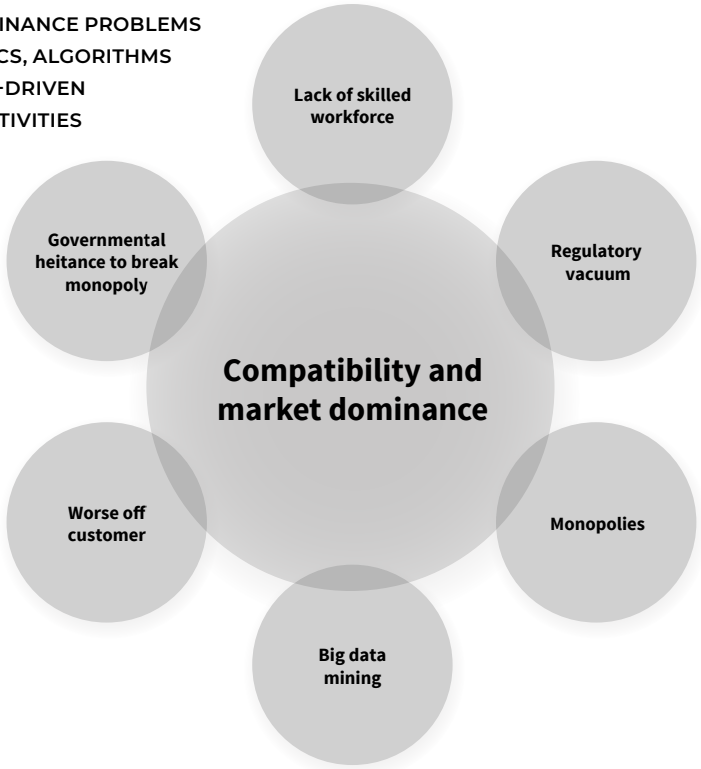
Compatibility challenges currently arise from the emerging data wealth and technological advancements but reluctance among medical practitioners to adopt AI-based technologies and a lack of skilled workforce and ambiguous regulatory guidelines for medical software.[21] AI and machine learning algorithms tend to rely on large quantities of data to be effective, and that data needs human creativity to make sense of it and put in context by complex analyses. Therefore, human capital needs to be developed accordingly. Incompatibility of human labor with AI accounts for one of the most urgent needs for development that hardly has gotten enough attention.

For the successful use of AI, there is a growing need for deployment and integration of human capital as well as support and maintenance of the novel relation between the human workforce and AI. AI systems are advanced in the European Union but many applications are dependent on interfaces developed on an international scale, such as in the US or China. This creates a dependency on territories abroad and loss of control in an unregulated field. AI solutions either face a monopolistic one provider solution – such as in big data generating moguls like Google or Facebook – or can be spread out across a broad range of providers; both conditions leading to suboptimal market distribution patterns for the end user and in terms of necessary governmental oversight. In the case of one provider solutions, monopolistic disadvantages may occur, such as irrational price margins, quality drawbacks and big data mining information hoarding. When there are multiple providers, governmental oversight and control may be more complex and thus less productive. In both cases, monopoly or spread data collection, the government faces obstacles. Governments are usually not

21 https://www.healthcarefinancenews.com/news/healthcare-ai-market-expected-surge-21-361-billion-2025

able to break monopolies if they do not impose disadvantages of surreal price margins onto consumers – which is not the case in big data mining companies that generate data by offering services for free. In the case of spread out companies collecting data, there is a loss of network effects and bundling advantages – especially in the US, where most of the biggest data generating companies for the Western world are hosted. The US government is likely not interested losing this hegemony and network effects and therefore prospected to hold onto large big data collecting entities.

GRAPH 11: RISK OF COMPATIBILITY AND MARKET DOMINANCE PROBLEMS OF AI, ROBOTICS, ALGORITHMS AND BIG DATA-DRIVEN ECONOMIC ACTIVITIES



3.2.2 BIG DATA PRIVACY CONCERNS

Today the overall amount of data produced and stored keeps growing exponentially worldwide, compounded by the internet, social media, cloud computing, mobile devices and governmental data. Once big data is generated, it holds the risks of data breach and loss or fueling discrimination and stigmatization.

In the big data age, privacy in public spaces has diminished – foremost in public spaces but also in private communication. Due to biometric data generation, the human body is currently being used to harness data – not only for genetic testing – but also for authentication and identification by governments, employers and service providers. The concept of identifying people using unique biometric data in the public and private sector is more sophisticated as ever before, including iris and retina scans, hand geometry, ear shape and recently voice, odor, scent and sweat pore analysis. Facial recognition technology for surveillance cameras (CCTV) but also data analysis sophistication and integration of face recognition into social media raise the spectrum of pervasive surveillance. In addition, unique behavioral traits are increasingly being used for identification ('behaviometrics'), including signature verification, typing rhythm and keystroke analysis as well as the study of gait (Tene, 2011). The use of biometrics raises privacy risks, including identity theft, function creep and government surveillance (Tene, 2011).

Although communication and non-communication are day-to-day decisions of individuals; to this day, there is no stringently tested utility theory of information sharing and privacy. We lack a coherent decision science framework about when people choose to share information and when they rather want to stay silent for the sake of privacy. When decision makers face the privacy versus information sharing predicament in using internet tools, the underlying motives are grounded in dignity in privacy and utility derived from communication and information sharing (Puaschunder, 2017d). For policy makers questions arise whether to uphold human dignity in privacy or derive benefit from utility of information sharing (Puaschunder, 2018a). In the healthcare sector, to study the trade-off between information sharing and privacy has leveraged into unprecedented importance.

As never before in the history of humankind, information about individuals can be stored over time and put in context on a large scale and logically placed within society thanks to unprecedented data conservation and computational powers (The New York Times, November 14, 2017). This challenges privacy protection rules which aim to avoid discrimination, manipulation, exploitation, embarrassment and risks of reputational losses, for instance, in the domains of body parts, home and property, general information of private financial situations, medical records, political affiliation, religious denomination, thoughts, feelings and identity. Instant and continuous information tracking implying full transparency leads to the risk of stigmatization setting patients up in a path of discriminatory disadvantages or silos of sickness, when a diagnosis influences future diagnoses.

Furthermore, governance gains a critical stance on information control for the sake of aiding human health and well-being in contrast to stigmatization and discrimination risks. While individuals may not be well-informed, they tend to suffer from impairments of their self-determination as for being under conditions such as pain, disease or mental distraction or impediment. Patients' privacy therefore needs to be specifically protected and an advanced pursuit of upholding e-ethics has to be extended to the medical big data use.

Modern healthcare is increasingly dependent on good data and effective information systems for care delivery as well as to develop and evaluate health policy (Boilson, Staines, Connolly, Davis & Connolly, 2019). A large EU funded project (titled MIDAS) is therefore underway to focus on merging, analyzing and visualizing data from heterogeneous sources to support health policy makers work in using and accessing health data across EU countries and describe the key challenges of access, using and making sense of big data in healthcare from legal, governance and ethical perspectives (Boilson et al., 2018).

At the same time, big data analytics have the potential to eclipse longstanding civil rights protections in how personal information is used in housing, credit, employment, health, education, and the marketplace. The protection of citizens therefore makes a rethinking of the legal landscape and policy framework on big data in the healthcare profession necessary. Especially when dealing with medical records and personal patient data, structured information and quantitative analyses allow new insights that are able to stigmatize commercial choices and other personal information on groups. Among personal data, patient information is highly sensitive data, which is subjected to specific legal rules of protection.[22]

In the age of digitalized medical records and self-monitoring, when decision makers may suffer from hyper-hyperbolic discounting fallibility regarding their share of data, dignity infringements may happen mainly unnoticed. Access to big data compiled information can aid achieve breakthroughs in the eradication of disease, detection of genetic predispositions to certain ailments, and the development of personalized

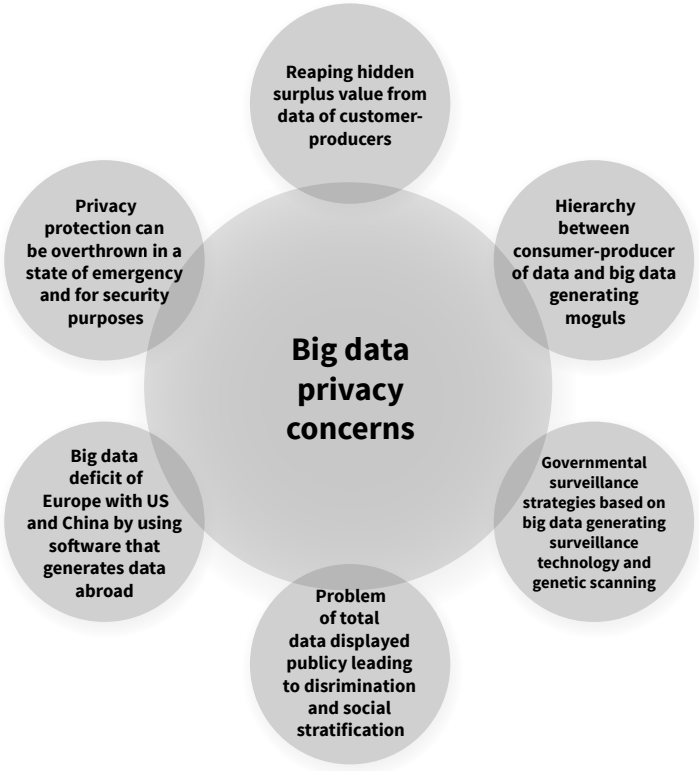
22 https://www.eesc.europa.eu/resources/docs/qe-02-17-159-en-n.pdf

cures. At the same time, sensitive information derived from inferences on health status but also predispositions to genetic diseases may lead to discriminatory practices in employment, insurance and the relations between citizen and state.

The European Commission Directorate-General for Health and Consumers Protection (DG SANCO) is committed to capturing the potential of big data in public health policy and research to produce policy recommendations to member states according to the logic improvement of healthcare systems and in light of the Directive 2011/24/EU on Patients' Rights in Cross-Border Healthcare (Union, E.P.a.C.o.t.E., DIRECTIVE 2011/24/EU on the application of patients' rights in cross-border healthcare, 2011). Recently a code of practice on the secondary use of medical data in European research has been developed (Bahr & Schlünder, 2015).

The European Commission has planned to address patient confidentiality concerns through amendments to existing data protection directives (Directive 95/46/EC; EU COM/2012/11, 2012) following EU constitutional revisions that strengthened personal data protection rights such as the Treaty of Lisbon (2008). Privacy enhancing technologies must thereby be adequately implemented featuring anonymization, encryption, security and accountability control, transparency and access, consent ownership and control mechanisms.

GRAPH 12: BIG DATA PRIVACY CONCERNS IN THE NUDGITAL SOCIETY



3.2.3 PREPONDERANCE

AI is expected to build a preponderance in many different domains. Evidence is overwhelming that, whenever the option is available, relying on data and algorithms alone usually leads to better decisions and forecasts than relying on the judgment of even experienced and "expert" humans (McAfee & Brynjolfsson, 2014). The promise of AI is better decision-making and enhanced experiences; yet at the risk of an AI unregulated environment that will lead to a loss of human supervisory control and unfortunate outcomes (McAfee & Brynjolfsson, 2014). AI preponderance raises important legal and ethical questions and the necessity to regulate technological advancement.

In October 2016, the British House of Commons published a report on Robotics and Artificial Intelligence, which highlighted certain ethical and legal issues including transparent decision-making, minimizing bias, privacy and accountability. On December 18, 2018, the European Commission's High-Level Expert Group on Artificial Intelligence (AI HLEG) released the first Draft Ethics Guidelines for Trustworthy AI. Pursuant to the guidelines, Trustworthy AI requires an ethical purpose and technical robustness. AI development, deployment and use should respect fundamental rights and applicable regulation, as well as core principles and values, ensuring "an ethical purpose," and it should be technically robust and reliable given that, even with good intentions, the use of AI can cause unintentional harm.

In case of negative AI developments in the eye of AI preponderance, clear regulatory steps must be undertaken to switch AI of or shut AI down. In the case if AI gaining personhood, this would come close to killed AI or programming AI to commit suicide in case of:

Errors and Safety: When errors occur and general safety is at stake. Even a tiny software flaw or a manufacturing defect in an intelligent machine, like a smart car or a social robot, could lead to fatal results (Meghdari & Alemi, 2018). When these deviations occur and especially when they are harmful to the human community but also to other AI species, the faulty AI should be terminated. AI may feature emergency stop mechanisms while preserving self-learning capabilities through vigilant self-evaluation and testing coupled with human oversight to prevent risks of system errors causing harm to humankind (Dignum, 2018).

Morals, Ethics, and the Law: As social robots become more intelligent and autonomous and exhibit enough of the features that typically define an individual person, it may be conceivable to assign them responsibility and use them in social, educational and therapeutic settings (Meghdari & Alemi, 2018). In the currently ongoing research on the integration of computers and robotics with biological corpse it is found that a cognizant human brain (and its physical body) apparently has human-rights; hence, replacing parts of the brain with artificial ones, while not harming its function, preserves those rights (Meghdari & Alemi, 2018; Warwick & Shah, 2014). When considering robots as quasi-human beings, their termination appears legally questionable and ethically challenging, requiring to revisit laws as legitimation to kill a likewise species as well as ethical consensus on the virtue of killing.

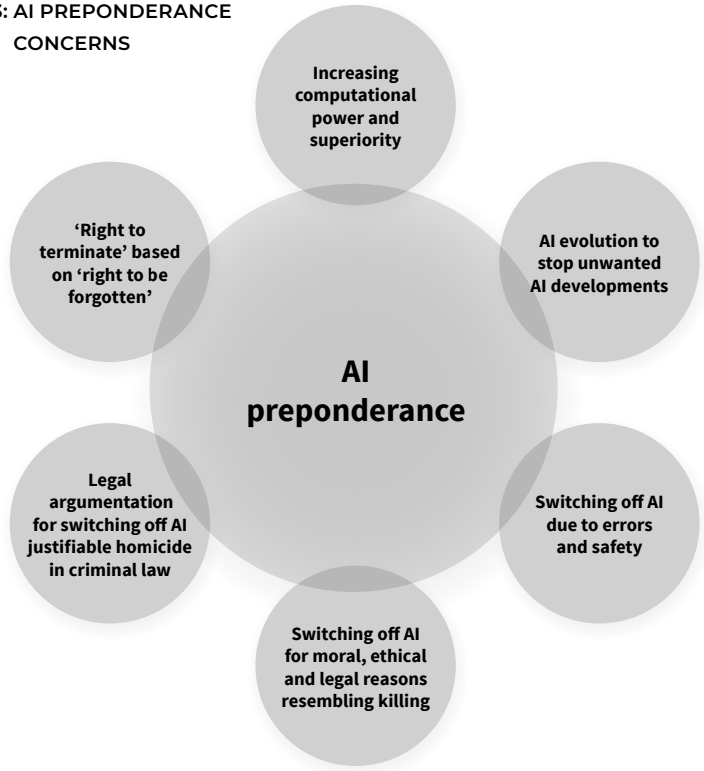
In light of harmful behavior of AI, switching off artificial life, which is currently be granted quasi-human status, will need to be argued legally and supported ethically. Killing in terms of harmful behavior of AI can be grounded on similar legal reasons to ensure that no AI harms the collective.

Suicide has been tabooed for most part of history and propagated to be a religious sin or classified as a psychological disorder (Critchley, 2015). Yet the human gift of reflection and search for meaning in life or death could leverage into an asset in the AI evolution in the decades to come. Suicide understood as neither a legal nor moral offence but as right to life or death bestowed upon human beings in their

self-conscious reflection may be extended as a virtue of killing in the artificial age, when human beings will have to decide what AI should stay alive and what AI be taken off the grid (Puaschunder, 2019b, c, d). Human will thereby become the rulers of the forthcoming AI evolution. AI must therefore be programmed with a constitution for suicide.

The virtue of killing could also be grounded on Viktor Mayer-Schönberger's "right to be forgotten," which ensures data privacy through automated deletion of contents after a certain period and grants individuals rights to have their data been destroyed (Puaschunder, 2018a, forthcoming a). However, the implementation of this right is still in infancy and hindered by questions of what court is responsible for an as such claim. As a legal subsumption, we may speculate that individuals may be granted a 'right to terminate' and can order for robots to be switched off if causing harm to them.

GRAPH 13: AI PREPONDERANCE CONCERNS



3.2.4 LIABILITY

With AI and machine learning being self-adaptive and constantly learning but also developing a life and consciousness on its own, we need to seek out specific contractual agreements to anticipate where machine learning might lead.[24] Parties might consider contractual protection, which covenant that the technology will operate as intended and in case of unwanted outcomes remedies can follow.

When solving problems of liability and responsibility for failure, insights can be drawn from the Roman legal code of conduct around slavery. In order to uphold economic trade and financial stability, slaves, who were considered as thing but were allowed to engage in market actions on behalf of their masters, were endowed with funds that their masters had to book out in advance, in order to mentally depart with the financial assets for sure in case there is a fraud. This would make it easier for the trade partner of the slave to engage and trust in action as for having peace of mind that the funds are somewhat out of the master's realm of restitution. If slaves committed crimes, they were given to the person who was harmed, who could then determine the verdict.

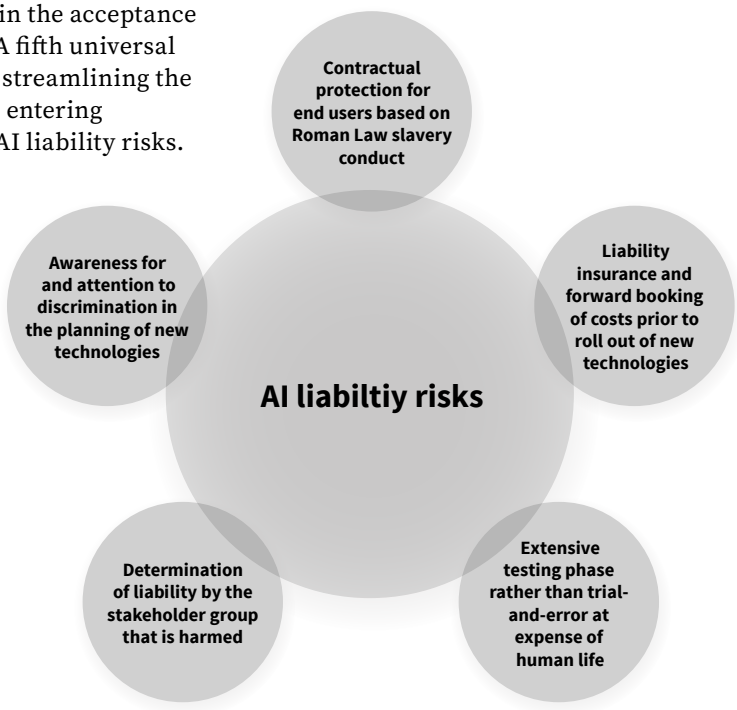
24 https://www.lexology.com/library/detail.aspx?g=4284727f-3bec-43e5-b230-fad2742dd4fb

This ensured that slaves would somewhat behave in light of severe punishment prospects and revenge (The Oxford Encyclopedia of Ancient Greece and Rome, 2010).

These century-old social conduct norms and Roman Law codifications could be used to determine the AI evolution and when to switch off AI. If there is harm, then the person who got harmed, or the interest group of the harmed, should be alerted and become part of the decision whether or not AI should be switched off or reprogrammed. Financial burden of robots and AI should be borne by the entities reaping benefits from algorithms, robotics and AI. In the case of big data, value from data should become estimated in economic models in order to properly tax and hold beneficiaries of data collection accountable in case of breaches or negative outcomes. The risk should be integrated into the accounting by forward booking out of costs in order to ensure harm caused by robots, AI or algorithms is covered upfront (Beerbaum & Puaschunder, 2018). At least the necessity of insurances but also taxation of benefits and revenues reaped from AI should be enacted in order to offset for potential risks and losses surrounding or stemming from AI entering the workforce and society (Gamauf, 2009). Especially discriminatory use of big data should become subject to scrutiny in order to alleviate the negative consequences of big data inferences.

Differing from Roman Law slavery, in which gifted slaves could buy themselves free, AI should never be freed and human should always stay masters of their own creation. AI and robots should not be allowed to earn their own money and even if being abandoned by masters, they should never be considered as free. AI should not be entitled to hold public office or religious leadership in order to reserve these societal positions to human. AI should also remain without rights to hold and use property on their own. The missing property rights of AI will allow creating a work world that is run on corruption-free entities without need to work for satisfying subsistence. This new part of the workforce holds the potential to be completely free of any personal materialistic cravings and hence not susceptible to bribery or any kind of nepotism and very many other human weaknesses that undermine corporate productivity and democratic values.

An EU Directive foresees that if the interaction between algorithms and the external environment, including other algorithms, causes damage, joint and several liability is recommended, in which each of the parties is responsible for the entire damage caused but can then sue the other parties to obtain partial compensation (Renda, 2019b). In the future, directives for harmonized insurance conduct throughtout Europe should be pursued to not create inequality between EU member states in the acceptance of AI due to its legal status. A fifth universal freedom of data will help in streamlining the legal concerted action on AI entering markets. Graph 14 displays AI liability risks.



GRAPH 14: AI LIABILITY RISKS

3.2.5 DISCRIMINATION AND SOCIAL STRATIFICATION

The AI revolution appears to be different from conventional technology shocks as the electronic information share and big data generation opens novel and yet unregulated opportunities to reap surplus value from information (Puaschunder, 2017a, b, c, 2018a). In the light of growing tendencies of globalization, the demand for an in-depth understanding of how information will be shared around the globe and AI hubs may evolve in economically more developed parts of the world has gained unprecedented momentum (Banerjee & Newman, 1993; Kremer, Rao & Schilbach, 2019).

Since the end of the 1970s, a wide range of psychological, economic and sociological laboratory and field experiments proved human beings deviating from rational choices and standard neo-classical profit maximization axioms to fail to explain how human actually behave (Kahneman & Thaler, 1991). Human beings were shown to use heuristics in the day-to-day decision making as mental short cuts that enable to cope with information overload in a complex world (Kahneman & Tversky, 1979; Thaler & Sunstein, 2008). From there on, the emerging field of behavioral insights targeted at using human heuristics and biases to improve decision making in different domains ranging from health, wealth and prosperity (Thaler & Sunstein, 2008). Behavioral economists proposed to nudge and wink citizens to make better choices for them with many different applications. Behavioral Insights teams have been formed to advise individual governments around the globe – for instance, Australia, Canada, Colombia, Germany, Italy, the United Kingdom and the United States (World Development Report, 2015). But also intergovernmental entities such as the European Commission, or global governance institutions, such as the World Bank and the International Monetary Fund, have started using nudges and winks to improve society (World Development Report, 2015).

While the motivation behind nudging appears as a noble endeavor to foster peoples' lives around the world in very many different ways, the nudging approach raises questions of social hierarchy and class division (Kahneman & Tversky, 1979). The motivating force of the nudgital society may open a gate of exploitation of the populace and – based on privacy infringements – stripping them involuntarily from their own decision power in the shadow of legally-permitted libertarian paternalism under the cloak of the noble goal of welfare-improving global governance (Puaschunder 2017a, b, c). Nudging enables nudgers to plunder the simple uneducated citizen, who is neither aware of the nudging strategies nor able to oversee the tactics used by the nudgers (Puaschunder, 2017a, b, c, 2018a). In the nudgital society, information, education and differing social classes determine who the nudgers and who the nudged are.

The owners of the means of governance are able to reap a surplus value in a hidden persuasion, protected by the legal vacuum to curb libertarian paternalism, in the moral shadow of the unnoticeable guidance and under the cloak of the presumption that some know what is more rational than others. All these features lead to an unprecedented contemporary class struggle between the nudgers (those who nudge) and the nudged (those who are nudged), who are divided by the implicit means of governance in the digital scenery (Puaschunder, 2017a, b, c, 2018a). In this light, governing our common welfare through deceptive means and outsourced governance appears critical.

In the healthcare sector, big data insights derived from genetic information including millions of people allows to create a polygenic risk score based on the DNA of a person in order to predict chances of getting a disease or derive clues about traits, behavior and living expectation (Woensel & Nevil, 2019). The amazing possibility to access personal genetic data allows to make more informed decisions – such as personal preventive targeted screenings, preventions or risk-reducing surgery; yet holds the destructive potential to lead towards misinterpretation, stigmatization and

discrimination (Woensel & Nevil, 2019). DNA tests being misused to make inferences about human traits, intelligence and deviance from legal restrictions appear too far stretches with devastating outcomes. In vitro fertilization (IVF) clinics already permit a pre-implantation screening to detect embryos with rare genetic diseases before selecting the cells to be implanted leading the way to eugenics (Woensel & Nevil, 2019). Policy concerns reported are implications of testing results on individual life choices, credibility of results and oversight since most testing is offered online without proper national jurisdiction and enforcement control (Woensel & Nevil, 2019).

GRAPH 15: ARTIFICIAL AGE DISCRIMINATION AND SOCIAL STRATIFICATION RISKS

3.2.6 THE VALUE AND LOSS OF HUMANNESS IN THE ARTIFICIAL AGE

The days of AI being a futuristic concept are over. AI is now. Social and cognitive robotics is rapidly becoming one of the leading fields of science and technology involving a deep level of human-machine interaction (Meghdari & Alemi, 2018). The world will soon be populated with human and machines alike that will coexist. The clear advantage of AI is the longevity. In light of overpopulation fear, we need mechanisms to determine how to decide over what is worth living forever and what should be taken off society. Ethics may come into this predicted AI-evolution. Roboethics entails the ethics of handling and application of robots but also what AI evolutions should be enhanced and what should be terminated (Meghdari & Alemi, 2018).

In a future of concurrent AI living next to us, it is predicted that society is expected to fall into two extremes of rationality (represented by AI) and humanness (represented by human beings). In the age of AI and automated control, humanness is key to future success. Behavioral human decision making insights and evolutionary economics can already today predict what makes human humane and how human decision making is unique to set us apart from AI rationality. Future AI is argued to bevalue humanness and improve the value of human-imbued unique features. Humanness as found in

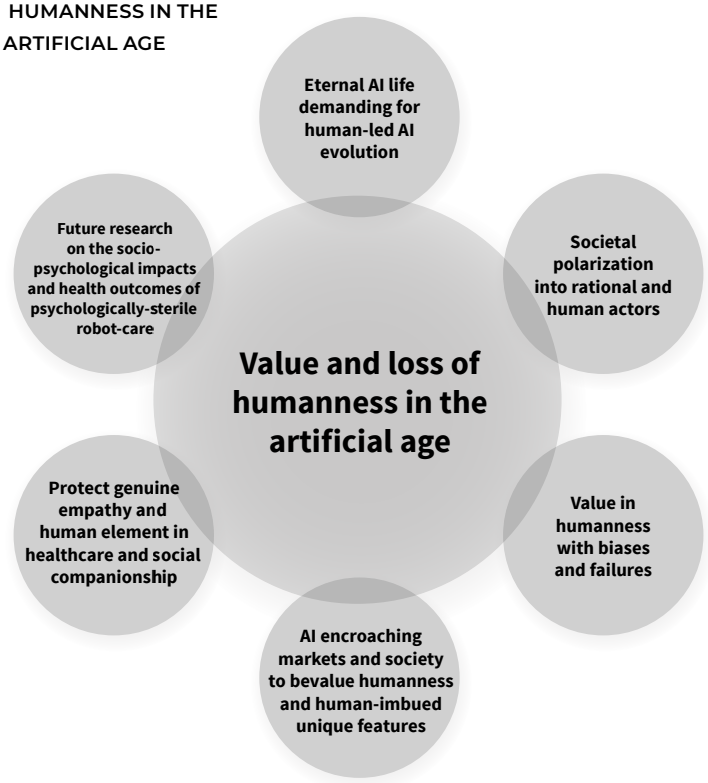
heuristics, decision making errors but also procreation and creativity, is believed to become more valuable in a future of AI entering the workforce and our daily lives. Future research on what make human humane promises to hold novel insights for future success factors most valuable for human resource management but also invaluable contributions for AI ethics (Puaschunder, 2018b).

AI entering the workforce and blending in as a substitute to human capital, will change the nature of labor, potentially dividing labor into a putty, flexible, eternal and exchangeable AI part and a clay labor of inflexible human capital (Puaschunder, 2019c). In order to ensure that human can legally benefit from the economic output and growth generated by AI, a society should be established, in which robots gain quasi-human rights but may not have the same material needs and rights as human beings. In the earliest form of society in the ancient Roman Empire, a society existed that featured a high culture and human protection but legal slavery (Puaschunder, forthcoming b).

While human may focus on becoming more humane in the future of AI taking over manual and repetitive tasks, AI and robots will likely fulfill a broad spectrum of healthcare functions ranging from monitoring and diagnostics, surgery and treatment over patient care and guiding advice. Robots taking over previously human tasks is likely to instigate ethical dilemmata. While especially with mentally handicapped and emotionally fragile patients, robots that resemble human kindness and calibrate their answers to the counterpart have been found to be more successful than rational agents; a loss of humanness appears critical in the healthcare profession, in which patients may strive for empathy and human kindness, not rationality (Meghdari & Alemi, 2018). In all these tasks performed by AI, robotics and algorithms, dignity of healthcare as a service-oriented profession grounded in care must be upheld. Genuine care must be defined and the implications of programmed empathy on the human psyche studied. Will it make a difference if a patient knows that a nurse gets paid for or a nurse is a robot that does not have a human heart? Even if not obvious for patients that there is a difference, the subliminal impact of robo-care could be determined when comparing recovery speed and quality of patients with robo-care or conventional nurses. Comparative studies like this should be enacted.

Complementarity of human and AI is likely to become key. AI is believed to reach its full potential, with a minimum of associated risks, if it is smoothly and efficiently coupled with a human being (Renda, 2019a, b). Complementarity entails that AI is used to augment human intelligence. Humans' common sense and formulating value judgments is thereby complemented with precise and rational machine learning, that may be better at pattern discovery, large-scale math and performing statistical reasoning (June-Goo, Sanghoon, Young-Won, Lee, Kim & Seo, 2017; Renda, 2019a, b).

GRAPH 16: VALUE AND LOSS OF HUMANNESS IN THE ARTIFICIAL AGE



4 Stakeholder perspective on AI in the healthcare sector

4.1 Method

A qualitative survey was based on 17 expert sharing free associations on the introduction of AI, robotics and big data into the healthcare sector, featuring the benefits and risks but also contemporary applications of AI, robotics and big data in healthcare. The survey was implemented by a standardized questionnaire featuring open-ended questions, which the author emailed to potential respondents.

Data Collection: Individuals were invited to answer a standardized questionnaire by email. Each questionnaire featured 5 questions and demographics. The questionnaire covered AI, robotics and big data in the healthcare sector, its implications (Question 1), benefits (Question 2) and risks (Question 3) as well as a future public policy agenda for governing AI, robotic and big data in the healthcare sector (Question 4).

Sample Description: The non-representative, gender-balanced expert sample comprised of 17 respondents with expertise on AI, robotics and big data in the healthcare sector. The respondents' contact with AI, robotics and big data in the healthcare sector featured classical healthcare, big data creation and analytics, fintech, research and studies, forecasting, monitoring and surveillance, risk and complexity management as well as social entertainment.

4.2 Results

The results are based on a categorization of the free associations per question on:

In particular, the findings reveal the expert opinion on:

(1) AI, robotics and big data in the healthcare sector
(2) Implications of AI, robotics and big data in the healthcare sector
(3) Benefits of AI, robotics and big data in the healthcare sector
(4) Risks of AI, robotics and big data in the healthcare sector

4.2.1 IMPLICATIONS OF AI, ROBOTICS AND BIG DATA IN THE HEALTHCARE SECTOR

Overall, the 17 respondents had 90 free associations on AI, robotics and big data in the healthcare sector, which were categorized. **Implications of the use of AI, robotics and big data in the healthcare sector** comprise of *tailored medicine* (f=10, 11%), *precision* (f=9; 10%), *excellence* (f=8; 9%) and *assistance* (f=5; 6%). *Big data* (f=5; 6%) was also seen in light of its *commodification* (f=5; 6%). *Efficiency* (f=5; 6%) goes hand in hand with *privacy infringement* (f=5; 6%) and *safety risks* (f=4; 4%). There is an expected *job replacement wave in the wake of AI-led market disruptions* (f=4; 4%) and *rising cost prospects* (f=4; 4%). *Discrimination* (f=3; 3%), *AI preponderance* (f=3; 3%) and *unpredictable risks* (f=3; 3%) make *human control* (f=3; 3%) and additional *research* (f=2; 2%) necessary. *Telemedicine and decentralized monitoring* (f=3; 3%) account for *emerging modern new technologies and infrastructure* (f=2; 2%). This *standardized* (f=2; 2%), *unhuman* (f=2; 2%) innovation makes *compatibility* (f=2; 2%) control necessary.

4.2.2 BENEFITS OF AI, ROBOTICS AND BIG DATA IN HEALTHCARE

Overall, the 17 respondents named 84 free associations on benefits of AI, robotics and big data in healthcare, which were categorized. **Benefits of AI, robotics and big data in healthcare** are *big data-driven knowledge generation* (f=16; 19%), *efficiency* (f=16; 19%), *precision* (f=10; 12%) and *better quality work* (f=9; 11%). *Cost-effective* (f=7; 8%), *accessible* (f=5; 6%) *human augmentation* (f=2; 2%) and *assistance* (f=4; 5%) that is *24/7 available* (f=3; 4%) but also *tailored personal medical care* (f=3; 4%) with *broad applicability* (f=2; 2%) are the acknowledged advantages of AI and robotics. AI, robotics and healthcare are somewhat perceived as *predictable* (f=3; 4%) with *preponderance* (f=3; 4%) and *gene editing* (f=2; 2%) capabilities, which make human oversight of this novel market development necessary.

4.2.3 RISKS OF AI, ROBOTICS AND BIG DATA IN HEALTHCARE

Overall, the 17 respondents named 82 free associations on risks of AI, robotics and big data in healthcare, which were categorized. **Risks of AI, robotics and big data in healthcare** are *data misuse* (f=9; 11%) and *leakage* (f=6; 7%) leading to *privacy infringements* (f=6; 7%) but also *biases* (f=7; 9%) and *errors* (f=7; 9%). *Loss of humanness* (f=7; 9%) and *human replacement* (f=5; 6%) as well as *dependence* (f=3; 4%) on these novel market options may follow. Potential *health credit pricing* (f=5; 6%), *social stratification* (f=5; 6%), *data-driven discrimination* (f=3; 4%) and *manipulation* (f=3; 4%) risks come as additional challenges with AI, robotics and big data use for healthcare, which demand for concern for *ethics* (f=3; 4%) in the artificial age. We may hold *overconfident expectations* (f=4; 5%) in this *complex* (f=4; 5%) market innovation that may also bring on *unjust and unnecessary price inflation* (f=3; 4%) and additional *cyberattack* (f=2; 2%) risks.

4.2.4 POLICY RECOMMENDATIONS ON AI, ROBOTICS AND BIG DATA IN HEALTHCARE

Overall, the 17 respondents named 78 free associations on policy recommendations for guardiancy of AI, robotics and big data in healthcare, which were categorized. **Policy recommendations on AI, robotics and big data in healthcare** include *data ownership regulation and protection* (f=12; 15%) and ensuring *equal access and attention to healthcare* (f=9; 12%). AI, robotics and big data in healthcare benefits from fostering *R&D driven innovation* (f=9; 12%) coupled with risk management (f=8; 10%), *human control* (f=5; 6%) and attention to a *long testing period* (f=3; 4%) and *ethics* (f=7; 9%). The drafting of an AI, robotics and big data agenda will require broad *stakeholder inclusion* (f=5; 6%). *Effects on the economy* (f=4; 5%) are already noticeable due to the *efficiency* (f=4; 5%) of new technologies. Open questions to be clarified concern *data evaluation methods* (f=3; 4%), effects on the *insurance market* (f=3; 4%) and overall *legal status* (f=2; 3%), *accountability attribution* (f=2; 3%) and *transparency* (f=2; 3%).

5 Policy recommendations & Outlook

5.1 Policy recommendations

Establish a fifth freedom of data

The European regulatory framework on AI, robotics and big data should be centered around a global commons theory and because of its unique nature features multi-faceted interdisciplinary elements. A common data freedom should be established that bundles the necessary infrastructures to coordinate between the different cultures and practices within and across Europe for data access, collection, sharing and storage. Data conduct should embrace pillars of lawfulness, fairness and transparency, purpose limitations, data minimization for focus on relevancy, accuracy and updating, time-conscientious storage, integrity and confidentiality.

Aligning existing legal and privacy regulation of big data in healthcare will allow building a 5th freedom of data in the European compound. The regulation to prepare for a 5th data freedom should align existing frameworks in a common understanding of data-ownership, confidentiality of data and patient consent, common storage and cloud computing regulation, processing of data as well as legal foundations for re-use and cross-border flow of data.

As such a 5th data freedom should seek to reduce access to data barriers between countries to establish better market bundling conditions in the field of healthcare and implement in the corporate world a transparent and efficient data value chain. Access to bundled data and complementary data will enable deriving cross-country differences and depict analytical insights as more data will be available. To bundle data allows for exponential gains without taking anything away from each other, like in other – for instance – consumer goods that can only be used once and are depleted forever if used.

EU Commissioners should focus on data harmonization strategies and embrace the multi-faceted stakeholders of the AI revolution and big data trend for the development of AI, establishment of big data nets but also the creation of novel tools and interpretations. Stakeholders include legal experts and court specialists, internet and big data moguls and social media users, nudging experts and academics.

Adapt GDPR regulation

Privacy and the right to protection of personal data play a fundamental role in order to fully respect human dignity, which is an inviolable right of human beings, recognized in the first article of the EU Charter of fundamental rights. In the context of the digital economy, taking into account the crucial importance of personal data, violations of dignity may take the form of objectification, where a person is treated as a tool serving someone else's purposes. The right to delete and the right to be forgotten as constituted in the EU GDPR should become more ingrained in big data analytic studies.
Article 7 and 8 of the Charter of the Fundamental Rights of the EU attributes every EU citizen the right to privacy and access to personal data for the sake of the protection of consumer rights and human dignity. Data security should be ensured in legal frameworks and EU policies aligning and clarifying privacy and data-ownership, secondary use of health data, cloud services and institutions hosting and managing electronic health records. Patient data security and sharing should be standardized,

and accessibility of patient data protected. Patient data confidentiality may be addressed by the European Commission's amendments to existing data protection directives and regulations such as the GDPR.

Priorities on data collection hubs

Big data should be secured with respect for protection of individual's privacy foremost through establishing a fiduciary duty for big data harvesting firms but also governmental entities. Technology development that is custom-tailored to a broad range within society will resonate with multiple stakeholders. As the trend seems to go towards a monopolization of big data amalgamating corporations (when considering Google, Facebook, Instagram), the European Union may focus on building and strengthening large big data collecting entities but ensure consumer protection through monitoring and regulating these big data moguls. In the big data domain, a creation of new bodies of data should be facilitated by fostering partnerships with different database holders. Cutting-edge methodologies should be used in order to tap into the full innovative potential of AI and big data sources.

The European Union should directly expand existing datasets, establish new data sources, secure compatibility of different data sources, integrate data and monitor quality standards to ensure technological advancement does not interfere with upholding European Union citizen rights. In bundling European Union data in the healthcare sector, the EU would have a competitive edge over the United States, where healthcare is more fractionate and healthcare providers more competitively pitted against each other. Within Europe and universal healthcare countries, data exists to a larger extent. Europe could thereby establish a natural leadership position within the Western world from the big data gained insights, also over China, which appears to have a different healthcare approach featuring Asian medical treatment. Data and language barriers between countries should therefore be overcome to establish a concerted European Union big data healthcare pool.

Monitoring online information

In the healthcare sector, most pressing appears the danger of eugenical methods and sterile rational care crowding out humanness with all its evolutionary-necessary deviations. Patients account for the most vulnerable population segments and our understanding of privacy infringements and ethical dilemmas has just begun in the medical artificial age.

Big data allows unprecedented opportunities to understand large-scale disease control but also enables inferences over health status and prospective outcomes that imply the potential of discrimination, gentrification and stigmatization. The online information that serves for patient self-evaluation should be monitored more closely and a regulation harmonization within the European Union is recommended. Special protection of ethical boundaries of medical services should be stressed to ensure optimum healthcare while paying attention to anti-discrimination efforts.

Foster regulatory innovation of AI

As methods and technologies for big data analysis continue to evolve, these novel tools demand for constant monitoring and quality control on European and national level. While there should be an increased awareness building of the added-value of big data through active public stakeholder engagement, researchers and policy makers should continue to experiment in well-monitored settings. New technology innovations' impact on the individual and the social group should be tested in order to derive implications for a discrimination-free society. In a controlled AI evolution, data should

be stored to inform about trial and error. A database on aberrations and deviations from expectations should be maintained in order to learn for the future and conserve a trace in this unprecedented time of change for posterity.

Strengthening legal codification

On the European, but also on national level, AI should become integrated but held at a slave-like position within society. This will ensure that human can benefit from AI as economic driver while being assured of liability protection. AI should never gain full legal citizenship rights. Such a slavery approach to AI would aid in minimizing risks and maintain a human society that benefits from innovation at the same time. Hence, strengthening the legal codification of AI is highly recommended.

Balancing privacy & information sharing

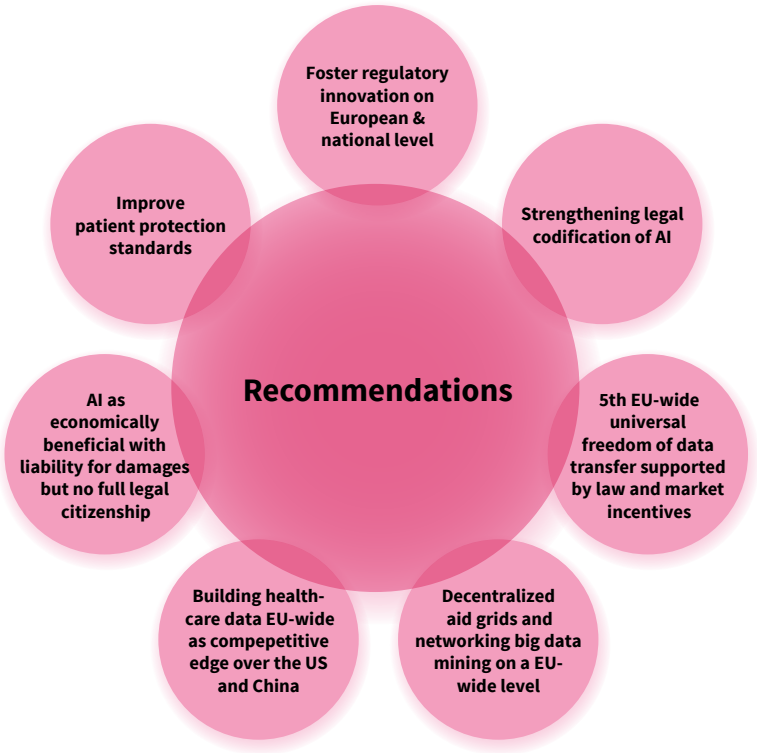
When member states draft legislation or implement EU-law, a policy focus should be set on data generation from search engine and web browsing, social networking data, genomic and biomedical information, environmental and socio-economic data as well as individual data supplied by smart and embedded medical devices and remote monitoring applications. Downsides of extreme data protection undermining corruption detection as well as security breaches should also be considered in novel regulatory attempts. The Swedish model of pro-active access to information could serve as exemplary prototype finding a right balance between privacy and information sharing.

Improve patient protection standards

In the generation of a big data healthcare pool, highest standards of privacy protection should be upheld for the sake of dignity, especially exhibited towards weak and impaired. In building a massive big data healthcare pool, information needs to be anonymized and also proxies should be used to decode information, so it is not turned against patients. Fostering blockchain-driven solutions could ensure this. Especially in countries with universal healthcare, in which medical aid is provided for free yet goes in hand with more governmental control, a decentralized grid could enable to inform doctors at spot about medical emergencies.

Furthermore, while information should be made available, what specific diseases are prevalent, the actual location should be coded when portrayed publicly to avoid discrimination and stigmatization based on discriminatory categories of location. So we should gain information on what diseases are prevalent but not be able to derive inferences where people are more likely to suffer from them, in order to not breed gentrification, stigmatization and discrimination of certain silos. Individual's data share should never lead to them being set on a trajectory of social class division.

GRAPH 17: OVERVIEW OF RECOMMENDATIONS



5.2 Outlook

This study introduced three major trends that may shape tomorrow's society: AI becoming quasi-human legal status, a predicament between information sharing and privacy in the big data age and first market disruption signs of AI entering the workforce large scale. The results are targeted at guiding a successful introduction to AI and lower systemic downfalls with attention to the changes implied in the wake of the ongoing AI revolution. Market and societal policy recommendations for policy makers on how to strengthen an artificial society and foster innovation, but also overcome unknown emergent risks within globalized markets and bestow market actors with key qualifications in a digitalized world were provided.

Promoting governance through algorithms offers novel contributions to the broader data science and policy discussion, also in the future. Further effort should also be concerned with data governance and collection as well as data storage and curation in the access and distribution of online databases and data streams of instant communication. The human decision making and behavior of data sharing in regards to ownership should become subject to scrutiny. Ownership in the wake of voluntary personal information sharing and data provenance and expiration in the private and public sectors have to be legally justified (Donahue & Zeckhauser 2011). In the future, institutional forms and regulatory tools for data governance should be legally clarified. Open, commercial, personal and proprietary sources of information that get amalgamated for administrative purposes should be studied and their role in shaping democracy. We also need a clearer understanding of the human interaction with data and the related social network building and clustering for communication results. Novel qualitative and quantitative mixed methods featuring secondary data analysis, web mining and predictive models should be tested for outlining features of the new economy alongside advancing randomized controlled trials, sentiment analysis and smart contract technologies. Ethical considerations of machine learning and biologically inspired models should be considered in theory and practice but also their ethical boundaries become subject to debate. Mobile applications of user communities and inferences from mobile app consumption should be scrutinized.

In the medical communication, legal rights and ethical imperatives of privacy, security and personal data protection should be upheld. Data and algorithms should be studied by legal experts on licensing and ownership in the use of personal and proprietary data. Transparency, accountability and participation in data processing should become freed from social discrimination. Fairness-awareness programs in data mining and machine learning coupled with privacy-enhancing technologies should be introduced in security studies of the public sector. Public rights of free speech online in the dialogue based on trust should be emphasized in future educational programs. Citizen empowerment should feature community efforts to protect data and information sharing to be free of ethical downfalls. Social media use education should be ingrained in standard curricula and children should be raised with an honest awareness of their act of engagement on social media in the nudgital society of the digital century.

In order for individuals to trust the new market model of AI, this market option should feature responsibility in terms of fairness, accountability, transparency and explainability to humans. Development processes should be aligned with ethical principles as AI permeates our society (Renda, 2019a, b). Novel technological developments and user platforms should become experimental innovations in search for new data sources and applications of AI, robots and big data-driven machine learning.

In the eye of the United Nations pledge to combat global deficiencies in the Sustainable Development Goals, AI needs to become included in these grand targets. Foremost in light of eternal living of robots, who recently gained citizenship and the United Nations addressing overpopulation as one of the key challenges of the world's future; we need

to draw attention to when to switch AI off. Depicting ethical imperatives around the life and death of machines being considered as quasi-human beings holds invaluable historic opportunities for global governance policy makers to snapshot the potential but also be saved from the likely downfalls of a robo-human mixed society. In the further discussion of the topic, research should analyze the effects of robotics blending into our societies with direct applications in fields where the potential implications and complications are significant and obvious but also where discrimination and polarization may occur to a more unnoticeable extent (Meghdari & Alemi, 2018).

In order to combat a social class division based on who understands the AI systems operation, transparency and explainability of AI are demanded for. Disclosure of data collection and information processing goals appear as easy remedy to alleviate a social class hierarchy built on access to information. Awareness and understanding of AI reasoning processes is viewed as important for AI to become commonly accepted and useful (OECD, 2019). A democratization of information and education to understand the mechanisms behind algorithms and big data generation are key for ensuring data justice in the artificial age.

The potential installment of a big data driven social credit score systems around the world should become subject to scrutiny and the impact on opportunity costs onto the labor market (Puaschunder, work in progress). For instance, countries that make access to healthcare dependent on social credit scoring, such as China, could become sources of cross-country comparisons on the impact of social credit ratings on access to healthcare and the economy. Network theories for healthcare information should also be studied. User-generated web contents such as blogs, wikis, discussion forums, posts, chats, tweets, podcastings, pins, digital images, videos, audio files, advertisements but also search engine data gathered or electronic devices (e.g., wearable technologies, mobile devices, Internet of Things) should be scrutinized for discriminatory biases. Certain features of implicit discrimination may also hold for tracking data, including GPS, geolocation data, traffic and other transport sensor data and CCTV images or even satellite and aerial imagery. The role of attention should be addressed as another moderator variable that is quite unstudied in the digital media era. All preliminary results should be taken into consideration for future studies in different countries to examine other cultural influences and their effects on social class and heuristics.

The findings may also bestow global governance policy makers with ideas how to better snapshot AI's potential in the digitial age and market actors with future-oriented foresight how to benefit from this new technology (Banerjee & Duflo, 2005; Klenow, 2008). Market and societal policy recommendations may aid global governance experts to strengthen society through AI but also overcome unknown emergent risks within globalized markets in the wake of the AI revolution.

Societies of tomorrow should therefore be built on AI ethics in order to safeguard the transition to artificiality enhancing economies based on a mutual understanding and exchange of putty and clay labor components (Puaschunder 2019i). The presented research thereby aims at the current creative destruction in the wake of AI entering the world economies being ennobled by a social face and lowering potential societal downfalls (Schumpeter, 1942/1975).

Fiscal space and monetary resources could support these endeavors if data transfer starts becoming taxed in the social compound. The novel funds raised should be allocated towards education of individuals to gain self-determined AI use and protect people from social misery in the eye of massive market disruptions.

A fifth data freedom within the European Union will allow top-down implementation of technology shock absorption, while the fiscal space generated from big data value gains taxation could be reallocated to pick those up who are disadvantaged through novel technologies. Legal and ethical boundaries must also be crafted to outlaw

privacy infringements and social credit scoring with harmful impacts. Harmonized legislation coupled with balanced policy approaches can foster an AI entrance into our contemporary economy and society in harmony with respect for dignity and appreciation for humanity. In all these features, Europe can – once again, as previously in history – ennoble the world in embracing technological advancement quickly but with appreciation for a reflective humane touch and attention for ethical care.

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INSTITUTIONS

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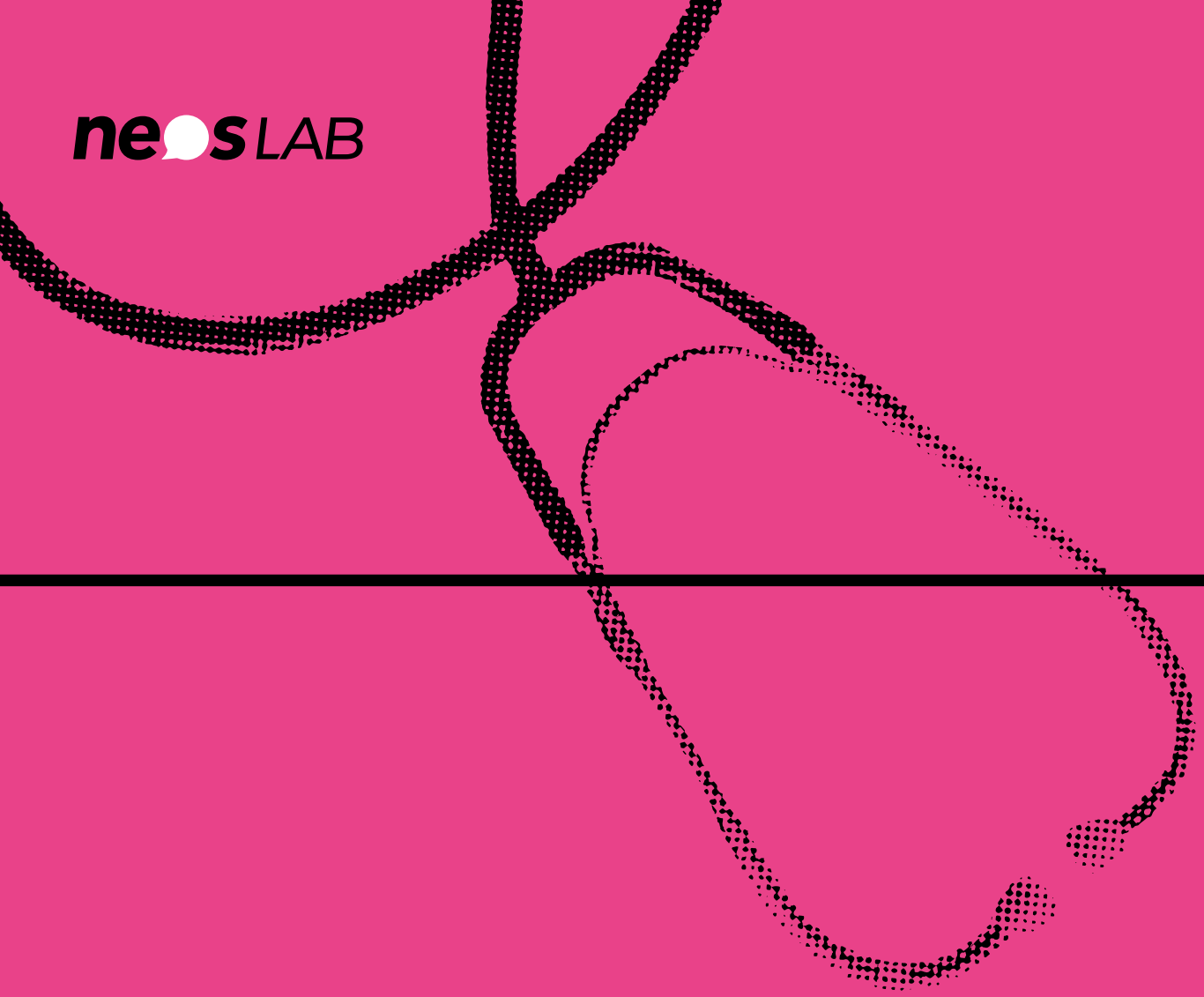

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ISBN: 978-3-200-06554-3