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REDEFINING THE DIGITAL AGE: THE AI RENAISSANCE IN HUMAN-COMPUTER INTERACTION AND DECISION-MAKING

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ABSTRACT

Objective: This paper aims to explore the concept of AI as a modern-day Renaissance movement, triggered by the proliferation of the internet and advancements in artificial intelligence technologies. It delves into the transformative impact of AI on human-computer interactions and decision-making processes.

Results: O'Leary's (1997) early notion of a Renaissance movement sparked by the internet's ubiquity finds resonance in the emergence of the AI renaissance. AI technologies such as natural language processing, machine learning, heuristic language processing, and neural networks have integrated into intricate networked computing environments. These technologies facilitate the handling, retrieval, and analysis of vast amounts of data available on the World Wide Web. Given the overwhelming volume of data, direct human analysis has become impractical, necessitating AI-driven support for efficient data utilization. In today's competitive and tech-driven landscape, the time available for decision-making has diminished, prompting reliance on intelligent agents and delegating decision-making tasks to these digital surrogates.

Conclusions: The contemporary AI renaissance signifies a paradigm shift in human-computer dynamics. The convergence of AI technologies with the internet's vast information landscape has created a symbiotic relationship, redefining traditional computer roles. AI-enabled tools not only manage the deluge of data but also extend decision-making capabilities, optimizing efficiency in an increasingly fast-paced world. This transformative movement transcends conventional computing boundaries and has paved the way for a new era of human-machine interaction.

Keywords: AI Renaissance, artificial intelligence, information overload, human-computer interaction, decision-making

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ARTIFICIAL INTELLIGENCE

The term Artificial Intelligence (AI) was coined in 1956 by John McCarthy (Bringsjord and Govindarajulu, 2018), however, the field of AI was in operation much before, when the famous mathematician, Alan Turing said that the question "Can a machine think?" should be replaced with "Can a machine be linguistically indistinguishable from a human?" The Turing test as we know was devised to understand if a judge can know if there is a difference between answers to an email sent by a woman or a computer. Since then AI has immensely prevailed over humans. For example, IBM's famous Deep Blue beat the World Number 1 player of chess, Gary Kasparov. AI seems to have a mind of its own, a (Cartesian) capacity, for cultivating its expertise in virtually *any* sphere. The aim of AI is to build intelligence in computers. AI has a strong need to reason about situations and deal with uncertainty. It is difficult to define AI as different fields of studies – physics, philosophy, biology, maths, engineering, have different ways to define it and focus on different aspects and abilities of AI. Most often the debate is divided into 2 areas- AI is a device that can think and act like humans, and, AI is a device that can think and act rationally. AI has been able to speak and learn language faster than humans too, however, it faces two impending problems: subjective consciousness and creativity. Subjective consciousness, or the ability to experience pleasure sorrow, empathy, sadness, worry etc, is a problem as measures itself by looking to animals and humans and picking out in them remarkable mental powers, and by then seeing if these powers can be mechanized. Arguably the power most important to humans (the capacity to experience) is nowhere to be found on the target list of most AI researchers. measures itself by looking to animals and humans and picking out in them remarkable mental powers, and by then seeing if these powers can be mechanized. Arguably the power most important to humans (the capacity to experience) is nowhere to

be found on the target list of most AI researchers. And when it comes to creativity, it's quite remarkable that the power we most praise in human minds is nowhere to be found in AI.

Simply said, AI, as defined by Marvin Minsky and John McCarthy—the fathers of the field— is any task performed by a program or a machine that seems to require intelligence. AI systems often exhibit the following behaviours associated with human intelligence: planning, learning, reasoning, and problem solving, as well as social intelligence and creativity. There are four viewpoints related to the impact of AI in our world:

Optimists: They believe that AI can bring in a utopian future since it is revolutionising Genetics, Nanotechnology and Robotics, which allows humans to harness the power, speed, memory and knowledge sharing ability of computers and our brain, such that it gets stored on the cloud for easy access. A genetic revolution can help in changing our genes to avoid disease and slow down, or even reverse ageing, thus extending our quality and length of life span, maybe even helping us achieve the goal of immortality. Nanotechnology revolution, using 3D printers, would help us use information and cheap inexpensive materials to create virtually any physical product Finally, robots would be doing all the actual work, leaving humans with the choice of spending their time performing activities of their choice and working, when they want, at jobs that interest them, thus also changing the job market.

Pessimists: Joy (2000) wrote "Our most powerful 21stcentury technologies – robotics, genetic engineering, and nanotech – are threatening to make humans an endangered species". According to Joy (2020), since machines have become more 'intelligent' humans have started relying more and more on them to make effective decisions for them. Although it will provide initial comfort, the situation will eventually result in machines taking control of

all the important decisions with people being dependent on them and afraid to make their own choices. The supporters of AI vastly underestimate the potential dangers of thinking machines. People will be given a second-hand status, with machines being the primary state of importance and since the machines will do all the work, people will be unmotivated to go to work. It could eventually lead to humans being computer's pets.

Pragmatists: Peckham (2016) believes that AI can be effectively regulated through programs like OpenAI. Markoff (2016) believes that AI can be distinguished by two sets of belief. The first, trying to duplicate human intelligence, and the second, to enhance the human abilities, like increased memory and knowledge and effective decision making. They believe that humans can use AI to exploit the power of computers to augment their own and always stay a step ahead of AI, or at least not be at a disadvantage. The pragmatists also believe that in the worst of cases a chip can be placed in all thinking machines/robots to render them inoperative in case of any danger.

The Doubters: The doubters don't believe in AI or the fact that it can become a danger to humans in future. They believe that human intelligence cannot be captured in formal rules. They believe that our human minds are nothing like that of computers which is solely based on information processing. A more sophisticated attack comes from doubters who state that it is wrong to believe that once computers have been provided with sufficiently advanced algorithms, they will be able to improve and then replicate the way our mind works. According to them (Jankel, 2015) computers will not be able to achieve the highest of human ability that of being creative as doing so requires breaking the rules and being anti-algorithmic. In other words, creative breakthroughs cannot be predicted so any algorithm developed by AI to do so will fail, leaving a big vacuum to the sole province of the human mind that will always be more valuable than all algorithmic AI technologies put together. It is

like the paintings by the masters which are by far superior to those of the millions of average painters put together. This would mean that all tasks requiring creativity, including innovative breakthroughs, strategic thinking, entrepreneurship, risk taking and similar ones could never, or at least noting the foreseeable future, be done algorithmically, providing humans with a clear superiority versus intelligent machines.

RENAISSANCE

Renaissance was a period of thought which first emerged in Europe between 1355 and 1650. It therefore overlaps both with late medieval philosophy, which in the fourteenth and fifteenth centuries was influenced by notable figures such as Albert the Great, Thomas Aquinas, William of Ockham, and Marsilius of Padua, and early modern philosophy, which conventionally starts with Descartes and his publication of the *Discourse on Method* in 1637. Renaissance was a period which saw a flourishing of new translations, commentaries, and other interpretations of previous works.

Renaissance thinkers were particularly interested in immortality of the soul and eternity of the world. At the same time, we realize that every reappropriation is constrained and even guided by contemporary concerns and biases. It was no different for the period considered here: the old was mixed with and changed by the new, but while no claims can be made for a revolutionary new starting point in philosophy, in many ways the synthesis of Christianity, Aristotelianism, and Platonism offered by Thomas Aquinas was torn apart in order to make way for a new one, based on more complete and varied sources, often in the original, and certainly attuned to new social and religious realities and a much broader public.

AI AS BECOMING A RENAISSANCE MOVEMENT

O'Leary (1997) was the first person to talk about the upcoming movement of Renaissance introduced due to the internet and its virtually free publication on the World Wide Web leading to information overload for humans. The AI renaissance movement emerges as more tools have emerged to make the World Wide Web more tractable. AI applications like natural language processing, machine learning, heuristic language processing and neural networks are some of the AI applications that have embedded in heterogeneous networked computing environments and used for searching, retrieval and analysis of previously unimaginable quantities of data. Because the wealth of data makes direct human analysis impossible, AI-based support has become necessary to help users fully exploit that information. Our increasingly competitive and technology-driven world has reduced the time available to us for decision-making. To survive in this environment, we are increasingly turning to advanced computer technologies, such as intelligent agents, and delegating some of that decision-making to these electronic surrogates. In the following sections we will discuss various ways in which AI has introduced a Renaissance movement, or to explain it better, a change in the way people traditionally viewed computers.

REINFORCEMENT RENAISSANCE

Just like humans learn from mistakes, AI too is now accomplished to learn from the mistakes it makes due to its deep learning networks called 'deep reinforcement learning' (Silver, 2016). For example, the AI AlphaGo was able to learn by itself, without supervision, and beat the best experts of the ancient board game, Go, by understanding which moves give the reward 'win' and which moves don't 'lose'. Reinforcement learning is the only solution scientists have figured out to solve the 'credit assignment problem'. The credit assignment problem is a problem where the machine (and humans as well) is unsure

which subset of action contributed to rewards and which were a waste of time.

A new company Cogitai, has used deep reinforcement learning to build machines which can learn from experience the same way humans learn from experience, however, the problem of subjective consciousness has still not been tackled by anyone (Tesauro, 1995).

AI RENAISSANCE IN IMAGE FORMATION

Luginbuhl (2019) explored image making in collaboration with AI neural network, General Adversarial Networks (GANs). The goal was to assess how does AI help in moving beyond the traditional and simple use of computer in the image-making process.

As a way of deepening this reflection, the images are developed using speculative fiction to imagine what intelligent machines' creation myths might look like in the distant future, and this helps suggest how we might form AI in the present. GANs are found to help express visual ideas by providing a wealth of imagery and textural detail which can be modified with the selection of training data and transfer learning. Generative Adversarial Networks (GANs) are a generative art technique which uses two neural networks to create new images based on a dataset of training images.

It was found that Luginbuhl (2019) could recruit neural networks to create the imagined images. AI thus became a much helpful way to construct and develop images and direct the output at multiple stages. Difficulties which occurred in Luginbuhl's (2019) process was that a large quantities of training data was needed and the low resolution of GAN created images was addressed by making further GANs, to increase resolution and detail. It seems that our traditional way of thinking about a work's creator are being challenged and upset by these new, more complex, more interactive processes which use technology created by a large number of people, and trained using numerous other artworks. These issues are being

encountered in other arenas, such as responsibility for traffic accidents involving self-driving cars.

According to Nechvatall and Perret (2006), digital technology and AI have changed the artist's habits of thinking, intuition and reason. AI has also facilitated changes in consciousness by primarily allowing the artists to act differently with new tools.

This new nosology has also been titled as cyberism where art and science after years of separation have finally started to become entangled with each other through the discreditation of the concept of objectivity. This nosology is about knowledge that can transform things and states of the system.

A state of renaissance is being reached where artists and critics are leaving the age of sterile reductive analysis and entering into one of fecund synthesis; much like the poetic-mythic-scientific age of the early Renaissance. The binding force of this synthesis is certainly inter-subjective pleasure (art) and a lust for yeasty comprehensions out of which new possibilities grow. The resulting pan-panoramas will luxuriate this era and be the counter-attack to fundamentalist repression as its imminence will supersede our mistrust of irrationality and lead us into a qualitative approach by escaping locked down definitions.

AI is neural networking based and represents an analogy to the nervous system in our body and although the traditional role focused on board games like chess and checkers it is now being increasingly filled by the graphic arts (Smith and Fol Leymarie 2017). Artists need to understand that although computers are a deterministic device which we ourselves have created, we must also acknowledge that it is one of the most unique inventions and has no limits to the growth of its powers.

AI RENAISSANCE IN BLOCKCHAIN

Dinh and Thai (2018) firmly believe because of the renaissance movement caused by AI and Blockchain, they can be disruptive technologies and fundamentally reshape how we live, work and interact.

A blockchain is a public ledger, shared and agreed on by all users in a distributed network. Data records, for example, transactions, are stored in blocks together with hash values and timestamps. Every block is connected to the previous one, creating a chain (hence, the name). One key feature of blockchain is immutability; that is, it is almost impossible to modify any information without having network consensus.

Blockchain technologies are classified into two groups. In proof-of-work (POW) blockchains such as Bitcoin and Ethereum, users—called miners—participate in a mining process to solve a computationally hard problem to create a new block (Nakamoto, 2008). The miner who won the right to create a block earns a block reward and collects the transaction fee. POW protocols are, in general, energy-consuming. Also, they are subjected to majority hash rate attacks when the block reward reduces, as seen in recent events with Bitcoin and other POW based cryptocurrencies (Wong, 2018).

The new generation of protocols use proof-of-stake (POS) blockchains, in which there is no energy-consuming mining process. Instead, participants' chances of creating a block increase with the number of coins—the stake—that they have. The most notable among this group are Nxt, Peercoin, delegated EOS, bitcoin mimic Ouroboros (Kiayias, 2017), iChing and a recent hybrid POS+BFT Algorand (Chen and Micali, 2016) from MIT.

As people hype over cryptocurrency, they are unable to focus on the true potential of blockchain technologies which can revolutionaries web where people are able to control

their own data, identity and destiny, giving us a better control on how our data on Facebook or Ebay is used.

The design and operation of a blockchain involves thousands of parameters and tradeoffs between security, performance, decentralization, and many others. AI can ease those decisions, and automate and optimize blockchain for higher performance and better governance. Moreover, as all data on blockchain is publicly available, AI plays a key role in providing users confidentiality and privacy.

Although blockchains are safe, the applications and functionalities built on top of the blockchain platform are not so safe and can be hacked. For example, the cryptocurrency Ether was hacked and became a victim of 50-million-dollar theft due to an anomaly in the writing of smart contracts. AI helps blockchain by machine learning, a blockchain governed by an intelligent machine learning algorithm might be able to detect the presence of attacks and automatically invoke the appropriate defence mechanisms. When the damage is unavoidable, the AI might at least isolate the attacked component from the blockchain platform, keeping the rest safe from the attack.

Blockchain solely, comes with a cost. It can protect your data from Facebook and Netflix but also have to make you work hard as the recommendations and personalisation would be lost. AI comes to the rescue to maintain both privacy and personalised experience, with a new content selection model.

A decentralized content provider, for example, a social network on blockchain, can leverage AI on the users' side to personalize content. A machine learning program will run on users' devices to analyze their browsing behaviors and hobbies. Relevant content to the users will be pulled, rather than pushed, and displayed to users. Note that the whole computation is performed locally—no personal data ever leaves the users' devices. Further, sanitization of

users' content preferences may be performed to prevent content providers from profiling users. Thus, this new pulling-based model provides both privacy and personalization at once.

With the rapid advancement of machine learning, AI will be capable of refereeing more complex situations. Users will eventually be able to resolve on-chain (even off-chain) disputes without going to a court room. After evidence and documents are provided, AI could perform automated arbitration in an unbiased and tamper-resistant manner. All decisions would be data driven, and, thus, more consistent and justified.

AI RENAISSANCE IN HEALTHCARE

For a long time, Healthcare industry has faced a dearth of digital infrastructure, when the result of the services in the world were being revolutionised by AI, even booking a cab. But this has changed due to the AI renaissance. Earlier, the records of health care were maligned and unmanaged, but steadily, the health care department is also maintaining electronic digital healthcare records. For example, the genetic revolution has caused innumerable genetic records to be stored of people. Similarly, data is also collected from social media to help in the diagnosis and treatment of various disorders.

Clinicians face the consistent problem of converting evidence into practice, as only half of the evidence-based methods are practiced, or the amount of time which is taken from the emergence of evidence that supports a practice and implementation of that practice. AI has helped by managing data and maintain electric health record, thus creating alerts, alarms and order sets to help change the behaviour of both clinician and patient. The major problem with patients, especially the chronically ill is that the patients don't adhere to the medicines. AI has helped by maintaining records and analysing which patients are more prone to delaying medicines.

AI has also introduced a renaissance by contributing to systems biomedicine, which consists of the integration of bioscience, computer sciences and medicine (Lucignani and Neri, 2019). The science helps in understanding a holistic aspect to the human subject and their disease states. It is founded on two major concepts: (1) the human body has complex and dynamicbiological properties, which exist because of the interaction of molecular agents, which sustain the physiological functioning of the entire organism as well as the pathogenesis of diseases; (2) these complex interactions of molecular agents can be analysed by using the power of bioinformatics and artificial intelligence (AI).

Bioinformatics plays a key role at the standardisation and the computational level, because immense amounts of biomarker big data cannot be analysed, correlated and interpreted solely based on the capabilities of the human mind. These complex interpretations and analyses done by AI, help in understanding the aggressiveness of the disease, response to treatment, based on the individual and population data sets.

The recent evolution of AI, with the introduction of more efficient convolutional neural networks as a basis for deep learning tools, and the hardware improvements by parallel and fast computing, are bringing us towards a new age of molecular and morphologic imaging (Pespance, Codari and Sardanelli, 2018).

AI is thus needed not only or interpretation but also for building patient models, digital twins or avatars to stimulate in a virtual environment, risk factors and their susceptibility to treatment. The ‘digitally naïve” medicine imaging specialists who used a mix of visual and quantitative interpretation are now taught to use quantitative methods for analysing imaging biomarkers in the patient’s everyday workflow and ready to correlate such data with patient’s clinical sign with the help of AI. This surely has brought a renaissance in medical imaging, with the help of AI.

Teleophthalmology is a branch of telemedicine that delivers eye care through digital medical equipment and telecommunications technology, but, for it to be successfully adopted it needs to address a need for substantial improvement in quality of care and increasing timely care.

Korteum et al. (2018) demonstrated a change in the process of eye care, by providing a virtual medical retina clinic care for over 1700 patients. The patients were suffering from optical coherence tomography (OCT) and color fundus imaging and basic undiluted eye exams, with subsequent image evaluation by qualified graders. The virtual clinic model reduced costs, and increased space in non-virtual “face to face” clinics.

Kotecha, Brookes and Foster (2017) had established a similarly successful virtual clinic for low-risk glaucoma screening, and had relatively low clinically significant false negative rate of 4% when reviewed by an ophthalmologist “face to face” audit.

AI’s use in home-based monitoring is being validated for screening in DR and gaining approval from Food and Drug Administration (FDA) (Van der Heijden, 2018). Automated whole-eye binocular OCT, is a promising technology which will soon enable ophthalmologists to remotely acquire increasingly detailed imaging along with pupillometry, perimetry, motility, and visual acuity (Chopra, 2107).

“Telephotocoagulation” is a new model of remote care delivery which demonstrated the feasibility of creating image-based and fluorescein angiogram-based treatment plans for remote navigated retinal photocoagulation (Kozak, et al., 2017). These tele-treatments provide methods to decouple diagnosis and treatment location. Since the qualified specialists are frequently residing in urban areas, these tele-treatments provide convenience to provide care to a dispersed population and patients in deceiving countries.

Ultra-widefield imaging, a recent and rapid advancement of technology in image acquisition. This method has changed the treatment paradigms of common posterior segment pathology such as proliferative diabetic retinopathy. When used along with a teleophthalmology platform, nonmydriatic ultra-widefield imaging can reduce the rates of ungradable images, decrease image evaluation time, and increase the rate of identification of DR compared to traditional fundus photography (Silva, et al., 2014).

Thus, AI has also started a renaissance in the ophthalmology area. It has increased image quality, reduced the number of ungradable images, and initiated a more effective triage care in the setting of limited availability of subspecialists.

CONCLUSION

The renaissance movement heralded by AI has implications which are beyond are imagination. As consumers and investors, we should understand, appreciate and be careful of its growth.

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