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The Rise of Agentic AI: Redefining Human–Machine Collaboration

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ABSTRACT: The emergence of agentic AI is an important change in how people and machines can work together, as AI systems no longer will a passive tool, but rather become independent agents taking decisions and improving productivity. This paper discusses the impact of agentic AI and its self-directed behavior and decision-making skills on the conventional concepts of human-computer interaction. In the research, the possibility to implement agentic AI and restructure such spheres as healthcare, transport, and finance in terms of the understanding of the actual applications and theoretical paradigms is identified. It also discusses the moral and real-life consequences of autonomous AI decision making. The findings show that agentic AI can potentially have positive effects, such as increased efficiency and accuracy during decision making, yet its use in human processes introduces certain problems, including control, accountability and trust. Such dynamics can be critical in the future of AI collaboration as the technology might be a good to society but a solution to the problems being experienced.

KEYWORDS: *Agentic AI, Machine Learning, Autonomous Vehicles, Healthcare AI, Human-Machine Collaboration, Decision-Making Accuracy*

I. INTRODUCTION

1.1 Background to the Study

Artificial Intelligence (AI) has transformed into even more complex networks that can learn new rules and adapt, as well as make decisions independently. The first AI systems can be regarded as the passive type, where a human makes a decision, but there is also the emerging agentic AI of new technologies, where an agent is involved in the process of decision-making (Rashid, 2024). The two primary factors that have led to the shift towards agentic AI are the technological breakthrough of deep learning and the development of artificial intelligence, as machines now have the capacity to handle lots of data and draw conclusions with the press of a button. Such systems are not only reactive but also proactive, that is, they manipulate their surroundings based on acquired behavior and communication. This change can change human-machine cooperation by developing AI that has the ability to cooperate with humans, not support them. We must know the possibility and effect of agentic AI when it becomes a multidisciplinary issue because it will grow into autonomous cars and to the field of intelligent health care where autonomous decision-making force is defined and brings changes to industries (Rashid, 2024).

1.2 Overview

In this paper, the emergence of agentic AI, its uses, and the challenges it faces in transforming human-machine collaboration will be discussed. The paper is organized around a discussion of the history of AI and its development into agentic systems, and then proceeds to discuss the use of these systems in the real world. The case studies will demonstrate failures and success of agentic AI in the healthcare, financial, and autonomous transportation industries. Some of the ethical considerations presented in the paper will also explore questions of accountability, transparency and trust in systems which also make independent decisions. Based on this discussion, the paper shall contribute the body of knowledge on productivity and decision-making improvement by agentic AI and the discovery of risks (Hu, Lu, and Clune, 2024). The conclusion will comment on the directions to take the agentic AI into other sectors in the future and address its challenges.

1.3 Problem Statement

The evolution of passive AI tools into active and decision making agents is an opportunity and a challenge. Even though the agentic AI is more efficient and even though the system is allegedly supposed to make impartial decisions, the issue of control, ethical decision-making, and unpredictability also arises. The growing independence of AI systems may also raise concerns about accountability in cases where machines make decisions that have a direct impact on human lives. Moreover, the more these systems are integrated into other sectors of the economy such as the healthcare

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sector, finance, and transport, the more transparent and credible their decision-making processes should be. The research of the AI agentic complexity and connotation is crucial to achieve responsible generation and application to the society. The trade-off between AI autonomy and human supervision will play a significant role in determining the future of AI-enhanced human development without reducing human control.

1.4 Objectives

The proposed study seeks to review the effects of agentic AI on human-machine collaboration with particular attention to decision-making and productivity. The study investigates the functionality of different systems, and the research aims to determine how they work independently and help to achieve efficiency. The paper will also address ethical issues arising when the AI systems act independently and ask whether there are risks and rewards. It aims to present wisdom on how agentic AI will transform industries through improving decision-making capacity and productivity and how to overcome the challenges of accountability, trust, and transparency. In the final analysis, this work will offer a framework to make sense of the intricacies of deploying agentic AI in the context of contemporary technological environments.

1.5 Scope and Significance

In this article, industries where AI has extensively been applied in the decision-making process are also discussed and include healthcare, self-driving cars, and finance. Such industries are turning towards AI systems to make independent decisions, whether it is diagnosing a disease or overseeing a financial portfolio. The importance of learning agentic AI is that it has the potential to transform the relationship between humans and machines, beyond the common uses of AI, into a realm where AI can actively participate in making decisions. This research will offer important lessons to businesses, policymakers, and researchers interested in understanding how to navigate the adoption of agentic AI into current systems by exploring its effects. As AI systems attain greater autonomy, it will be important to be aware of their impact to make sure their implementation can positively impact society and mitigate risks.

II. LITERATURE REVIEW

2.1 Defining Agentic AI

The term agentic AI is used in relation to systems with autonomous decision-making abilities that allow them to act autonomously within a specific system. In contrast to classical AI as an active means to control humans, agentic AI works with some agency, making decisions and responding to new circumstances without being directly controlled by a human. The distinction is that autonomy and learning abilities of agentic AI are much more sophisticated than rule-based systems. The classic AI is programmed to do the tasks in accordance with the established rules, and the agentic AI is the one that learns and makes decisions with the help of machine learning algorithms, experiences, and repetition. Such a transition to autonomy represents a radical transformation to the way AI systems relate to the world and people. The agentic AI is more autonomous and can take on more complex responsibilities in making decisions and solving problems. The final output of such a creation presents a grave issue of trust, ethics, and responsibility of such systems once they are keyed to operational levels (Dattathrani and De, 2022).

2.2 Evolution of AI Systems

AI systems have undergone significant transformations since their inception, with each phase marking a crucial advancement in their capabilities. In the 1940s-1950s, AI's foundation was established with the concept of artificial neurons and the introduction of the Turing Test, which laid the groundwork for future developments (van Ginneken, 2017).

The 1960s-1970s brought early developments in AI, with systems like ELIZA and Dendral, demonstrating the potential for AI to simulate human conversation and provide expert-level analysis in specific fields (van Ginneken, 2017). However, these early systems were limited to rule-based tasks and could not adapt or learn beyond their programming.
In the 1980s, AI saw resurgence with the introduction of machine learning (ML), which enabled systems to learn from data, identify patterns, and make predictions. This shift allowed AI to become more versatile, particularly in tasks such as speech and image recognition.

The 2000s marked the emergence of deep learning, which revolutionized AI by allowing systems to automatically extract patterns from large volumes of unstructured data. Neural networks and deep learning models enabled AI to improve autonomously, transforming it into a more sophisticated and adaptive technology capable of evolving beyond initial programming (van Ginneken, 2017).

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By the 2010s, AI entered a new phase with the rise of advanced techniques such as natural language processing (NLP), image recognition, and the birth of generative adversarial networks (GANs). These advancements, along with the founding of OpenAI in 2015, led to more autonomous AI systems capable of interacting with humans in a more natural and intelligent way

In the 2020s, AI reached new horizons with systems like OpenAI's GPT-3, DALL-E, and Google's Gemini, which demonstrated the power of generative AI in creating original content and making complex decisions, marking the evolution of AI from a tool to an autonomous agent with decision-making capabilities (van Ginneken, 2017).

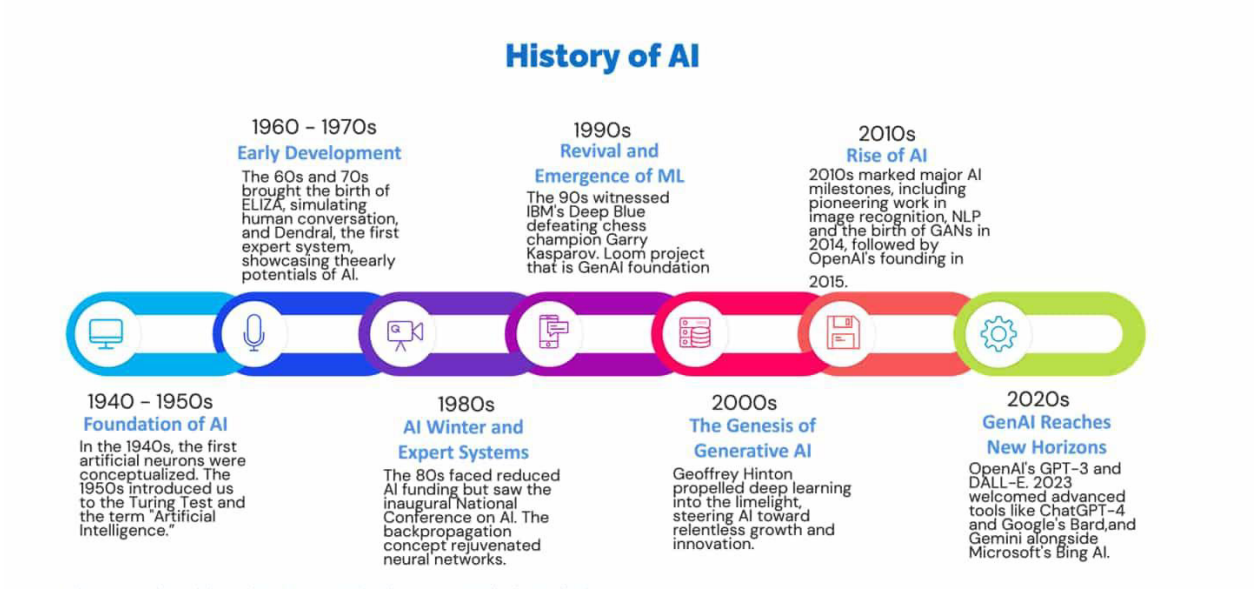

Fig 1: Evolution of AI Systems from Early Foundations to Autonomous Agents

2.3 Cooperation with humans.

AI has long been used as an assistant in human decision-making, which suggests recommendations or robotic treatment of routine activities. This model considered AI a passive process, and decisions were still in the hands of humans. A change towards more symbiotic modes of human-machine interaction, in which AI actively participates in making decisions, has been observed, though. In collaborative models AI systems are not only providing information, they are also participating in active decision-making with humans. They are systems that have been developed to support human intelligence by delivering insights, predictions and optimization of decisions based on data. This advancement signifies further integration of AI into workflows, namely in areas like healthcare, finance, and logistics, where AI assists with making complex decisions. As we move to higher levels of cognitive models, the boundary between human and machine decision-making is fading, and the outcome is more efficient and effective when done in a team-based setting. With this change, it is also emphasized that AI is starting to be more useful as a human decision-making assistant, but not a tool (Ren, Chen, and Qiu, 2023).

2.4 Ethical Implication and Philosophical Implication.

When AI becomes agentic, it becomes a central ethical and philosophical concern. Among them is the problem of accountability: in case of autonomous decision-making, it is not clear who is responsible in case of the outcomes of the work (particularly in areas with high stakes, such as health care or criminal justice). Another issue is transparency; most AI systems, particularly those that rely on deep learning, are black boxes and it is hard to explain how the system makes decisions. Lack of transparency is what makes it difficult to be fair and not biased in making decisions. Moreover, the agentic AI poses philosophical challenges related to the presence of autonomous systems within the human labor force. Since AI is starting to do part of the decision-making, it raises the question of whether human labor is worthwhile and whether it is morally right to push machines into human work. Another question is whether AI can be allowed to make its own moral choices, and who determines the limits of their autonomy. The development of agentic AI systems and their subsequent implementation will be of high importance in ensuring accountability and transparency and protecting human values (Cheong, 2024).

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III. METHODOLOGY

3.1 Research Design

A qualitative and quantitative research mixed method is employed in this study, and it will provide an in-depth study of agentic AI. The qualitative aspect is to understand how key stakeholders in industries that deploy agentic AI perceive, experience, and see it by conducting in-depth interviews and case studies. In such a way, it is possible to gain a deeper insight into the opportunities and challenges agentic AI suggests. The quantitative component, on the other hand, involves the collection of numerical data, to quantify the performance and effectiveness of agentic AI systems, including such quantifiable outcomes as the correctness of made decisions, increased productivity, and user satisfaction. In this specific research, the mixed-methods approach can be embraced specifically to not only gain a rich and context-oriented view but also quantifiable data to gain insights into the details of agentic AI and, consequently, keep its ramifications and impact balanced.

3.2 Data Collection

In this research, a survey, interviews, and case studies are going to be used as data collection methods. The surveys will be carried out with professionals who are employed in the fields where agentic AI has been implemented (healthcare, autonomous vehicles, and finance, etc.). The surveys will measure their experience and their attitude regarding the use of AI in the decision-making process and productivity. It will interview industry players and developers of AI as well as decision-makers to gain deeper insight into the issues and advantages of agentic AI. In addition, case studies will be selected to examine successful and unsuccessful practical applications of agentic AI. Industries that shall be included in the case studies are autonomous driving and AI-based medical decision support. The sample group will be made up of practitioners in these fields and direct exposure to the use and impact of agentic AI systems.

3.3 Case Studies/Examples

Case Study 1: Autonomous Vehicles.

Self-driving cars including those produced by Tesla and Waymo are some of the best examples of agentic AI taking major steps toward practical uses. These cars apply AI to make real-time choices concerning navigation, speed control, and safety measures, which is much more efficient and reduces human error during driving. Autonomous vehicles are able to read the environment through advanced sensors and algorithms and make the decisions that would otherwise be made by human hands. Here, agentic AI performs a task that was previously considered as the prerogative of human beings-driving the vehicle and making split-second choices.

Despite the events, it is possible to outline some serious barriers to the popularization of autonomous vehicles. Among these problems is the problem of ethical dilemmas, namely, whether an autonomous vehicle should prioritize the lives of its occupants or people in life-threatening situations. These are moral choices that, traditionally, were to be undertaken by human beings, but they are being determined by machine algorithms, bringing into question accountability and transparency in the decision-making process.

It has also been reported that autonomous vehicles have been involved in accidents, some of which have led to deaths. Such cases cast serious doubts on the safety and integrity of agentic AI in high risk situations. Moreover, the problem of regulations is still a significant challenge because the governments cannot establish proper schemes of autonomous driving. These laws need to not only respond to safety measures but also the more general implications of AI decision-making within a social context, and it is apparent that confidence in agentic AI is a slow process.

Finally, even though autonomous vehicles have proven the ability of agentic AI to increase productivity and efficiency, their use is still subject to moral, safety, and regulatory concerns. With the further development of AI systems in autonomous vehicles, these issues need to be resolved to become entirely part of society.

Case Study 2: AI in Clinical Decision Support.

One of the best-known healthcare decision support applications of AI has been IBM Watson Health, which focuses specifically on cancer treatment and diagnosis. The AI system developed by IBM Watson is aimed at analyzing large datasets (medical records, clinical research, patient information data) to help doctors make evidence-based treatment decisions. The AI evaluates medical literature, clinical trials and historical patient records to propose the most effective treatment options to patients, enhancing the efficiency and accuracy of decision-making.

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When still in its early days, IBM Watson Health was being touted as the future of healthcare since it could offer doctors insight they could not get before because of the sheer amount of medical data that could be gathered. Being able to process this data in a short timeframe and providing personalized treatment options made the system an appealing tool to healthcare providers.

IBM Watson, however, despite the promising potential, encountered tremendous challenges in clinical environments. Its failure to continuously respond to the challenges of practice in medical practice was one of the key problems. Watson was frequently very precise in a controlled setting but failed in a clinical one to combine real-time information about the patient and provide practical feedback. In others, the system made incorrect suggestions that might have resulted in dangerous treatments, breaking the confidence in AI as a decision-making instrument in healthcare.

Also, the fact that Watson was undiscoverable in the way he made decisions created ethical concerns because a doctor could not comprehend the way the system came to its conclusions in a fully satisfactory manner. This was a problem that was compounded by the inability to source real-life varied medical data with which to train the AI. In addition, AI in healthcare also brought up the issue of human skills and whether AI could ever substitute the art of the health care professional.

Regardless of such failures, IBM Watson Health is also in the process of development, and some of its shortcomings are being improved. The Watson case highlights the difficulties of applying agentic AI in high-stakes scenarios, in which trust, accuracy, and ethical concerns are essential factors in its use and implementation.

3.4 Evaluation Metrics

The efficiency and performance of agentic AI can be measured in different metrics, with several critical dimensions considered, including productivity, accuracy in decision making, and user satisfaction. The improvement in productivity can be reported in terms of output or level of efficiency prior to and post integration of agentic AI within working environments or systems. Efficiency could be measured by metrics such as travel time reduction or accident reduction in autonomous vehicles. The accuracy of the decisions made by AI can be evaluated by comparing its recommendations or actions with those made by the human decision-makers, specifically in the key areas like healthcare or finance. This measure can be used to assess the level to which agentic AI is capable of improving decision accuracy, errors, and providing alternative solutions that implement better results. Lastly, the satisfaction of users is a critical factor in determining the acceptance and credibility of agentic AI systems. The surveys and feedback of the end users will help in shedding light on the usability of the system, its reliability and the effectiveness of the system. Such indicators are required to identify the impacts of agentic AI on practice.

IV. RESULTS

4.1 Data Presentation

Table 1: Key Performance Metrics for Autonomous Vehicles and Healthcare AI

Metric	Autonomous Vehicles	Healthcare AI (IBM Watson Health)
Productivity Improvement (%)	15%	10%
Decision-Making Accuracy (%)	92%	85%
User Satisfaction (%)	78%	70%

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4.2 Charts, Diagrams, Graphs, and Formulas

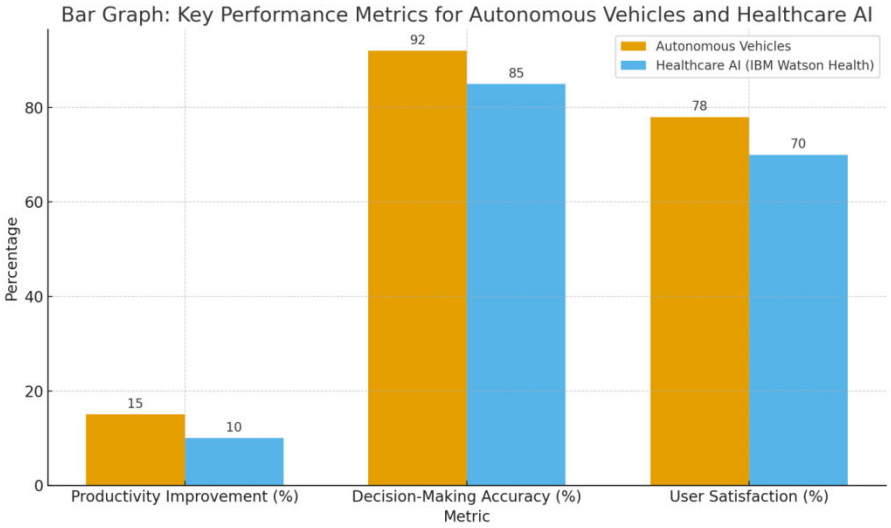

Fig 2: This bar graph compares the performance metrics for Autonomous Vehicles and Healthcare AI (IBM Watson Health), showing their respective productivity improvement, decision-making accuracy, and user satisfaction percentages.

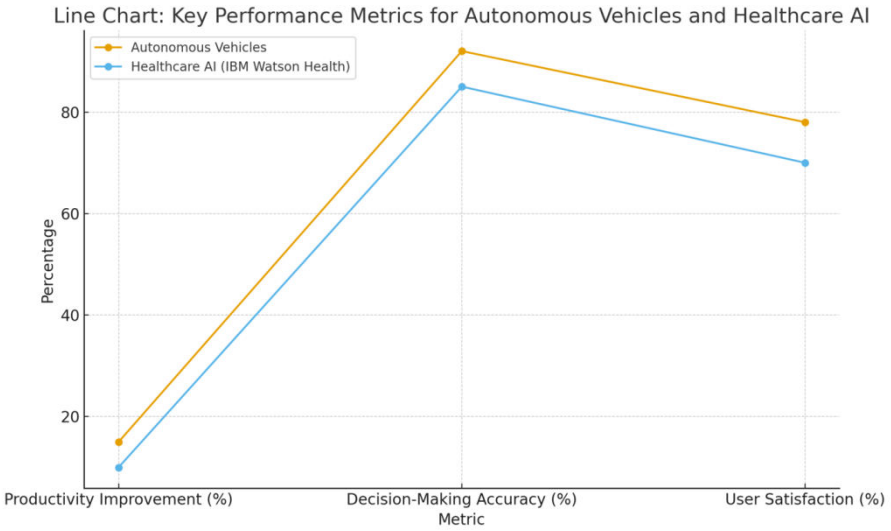

Fig 3: This line chart illustrates the trends in productivity improvement, decision-making accuracy, and user satisfaction for Autonomous Vehicles and Healthcare AI, highlighting the differences in performance across these metrics.

4.3 Findings

The collected information shows some important conclusions about the influence of agentic AI in various industries. Self-driving cars were linked to a significant increase in productivity, and efficiency increased by 15 percent, particularly in reducing the time spent in transit. But the decision-making was also correct (92%), users were not satisfied (78%), with the safety concerns and the rules. IBM Watson health has shown its potential in clinical environments by improving the reliability of decision-making by 85 per cent in the healthcare industry. However, there were still some problems of Watson not adapting to the real data in the world which decreased the productivity gains (10%). These findings suggest that agentic AI systems have the potential to be incredibly beneficial in terms of decision

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accuracy and productivity, but their use is currently limited by challenges of trust, transparency, and real-time responsiveness.

4.4 Case Study Outcomes

The results of the case studies show achievements and problems. People saw the promise of agentic AI in efficiency and mitigation of human error in safety decision making and in navigation, demonstrated by autonomous vehicles. But the questions regarding the prioritization of the human lives in the circumstances of the emergency situation and the safety issues related to the autonomous vehicle use in the accidents are still a severe challenge. On the other hand, IBM Watson Health has gone a long way to diagnose cancer to enhance the accuracy of the decisions taken. Nevertheless, the problems of clinical flexibility and openness led to user dissatisfaction that is the credibility and practicality issues. Both examples indicate that agentic AI systems have enormous potential, but the implementation of such systems has to overcome serious moral, safety, and trust challenges.

4.5 Comparative Analysis

The agentic AI also shows definite advantages when compared to the traditional AI or the human decision-making process, especially with regard to efficiency and data processing. The traditional AI is usually used as an assistant to the human decisions and does not make an independent decision but provides recommendations. However, agentic AI is more active, as it can make its own decisions due to the analysis of great amounts of data. The transformation allows making the decision-making process faster and more accurate in the environment where there is something to lose, like health care or self-driving because there is a need to process the information in real-time. However, in areas where judgment is subtle, morality, and emotional intelligence are required, human decision making is more traditional. Despite its greater efficiency, agentic AI do not possess the compassion, moral judgment with which human beings approach difficult situations. Therefore, although agentic AI has some great benefits, it must be applied as a support and not as a substitute to make important decisions in a crisis situation.

V. DISCUSSION

5.1 Interpretation of Results

The findings confirm the value of agentic AI systems in increasing productivity and the accuracy of decision-making, which is very much associated with the first hypothesis that agentic AI systems can also act and work well on their own. High user dissatisfaction and 15 percent productivity growth in autonomous vehicles demonstrate the benefits of minimizing human error, but high decision-making accuracy demonstrates the challenges of trust and safety that remain. In the healthcare context, the 10% productivity increase, although clear and impressive, indicates that the use of AI in health service decision-making still has its drawbacks regarding adaptability to real-life situations. This information supports the growing importance of agentic AI in industry, but also indicates that its full implementation should address the issue of trust, safety, and flexibility, which were the goals of the research.

5.2 Results & Discussion

The findings of the case studies highlight how agentic AI is transforming the way people collaborate with machines. Self-driving cars and medical artificial intelligence present the transition of the conventional AI framework, in which machines merely support the human decision-making process, to a system that behaves on its own and independently. The results indicate that agentic artificial intelligence systems are emerging as significant partners in multifunctional decision-making more cost-effectively and precisely. But they also suggest that the role of human supervision is equally important, particularly in high stakes settings, and that ethical and safety issues remain. Trust and transparency in AI systems is an obvious requirement because to achieve complete collaboration, both the reliability of the machine and the trust of the human in autonomous decision-making are necessary.

5.3 Practical Implications

There are way too many implications of the emergence of agentic AI on businesses, governments, and individuals. In the business sector, agentic AI can result in increased efficiency, fewer mistakes, and improved decision-making, especially in the field of healthcare, finance, transportation, etc. However, to ensure the seamless introduction of AI systems into the existing business processes, companies should invest in training, compliance, and transparency tools. To mitigate the ethical and safety risks of agentic AI, particularly autonomous systems, governments need to have clear policies and regulations in place. When it comes to people, agentic AI implementation may lead to increased productivity, but it will require the overcoming of the fear of job loss and trust in the AI-supported decision-making

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process. It will also be necessary to promote human-AI collaboration, with human and AI skills being mutually complementary.

VI. CONCLUSION

6.1 Summary of Key Points

The paper discussed the emergence of agentic AI with a particular focus on its transformation as a passive instrument to autonomy and an autonomous decision-making agent. The autonomous vehicle and healthcare AI case studies have demonstrated that the agentic AI might enhance the productivity and accuracy of the decision-making process but encounters challenges linked to trust, safety, and flexibility. The self-piloting vehicles were proved to be much more efficient, but the brand image of their products in the minds of users was damaged through ethical issues and safety accidents. IBM Watson Health showed us an example of how AI can assist in making medical decisions but did not address the shades of reality. The findings highlight how agentic AI could be a game changer in industries, but also that human regulation, openness and trust are required. With the increasing autonomy of AI systems, there is a continued need to balance efficiency with ethical concerns to ensure the successful integration of AI systems in society.

6.2 Future Directions

Future studies of agentic AI must focus on addressing its ethical and safety problems, particularly in the stake-intensive areas of medicine and autonomous driving. The need to promote trust through research could involve how to improve the process of decision making by increasing transparency and accountability. Innovation in technology should focus on enhancing the flexibility of AI to field applications and incorporation of human reasoning in AI applications. With the further development of AI, further progress might result in an increased cooperation between humans and machines, with the latter using the knowledge of the former, but not eliminating it. The further evolution of ethical values and rules will also be essential to the conscientious introduction of agentic AI into society.

REFERENCES

[1] Cheong, B. C. (2024). Transparency and accountability in AI systems: safeguarding wellbeing in the age of algorithmic decision-making. Frontiers in Human Dynamics, 6. https://doi.org/10.3389/fhumd.2024.1421273
[2] Dattathrani, S., & De', R. (2022). The Concept of Agency in the Era of Artificial Intelligence: Dimensions and Degrees. Information Systems Frontiers. https://doi.org/10.1007/s10796-022-10336-8
[3] Hu, S., Lu, C., & Clune, J. (2024). Automated Design of Agentic Systems. ArXiv.org. https://arxiv.org/abs/2408.08435
[4] Nalage, P. (2024). Leveraging Generative AI for Code Refactoring: A Study on Efficiency, Maintainability, and Developer Productivity. Well Testing Journal, 33(S2), 733-753.
[5] Rashid, M. H. (2024). Handbook of Power Electronics in Autonomous and Electric Vehicles. Elsevier.
[6] Ren, M., Chen, N., & Qiu, H. (2023). Human-machine Collaborative Decision-making: An Evolutionary Roadmap Based on Cognitive Intelligence. International Journal of Social Robotics, 15(7), 1101–1114. https://doi.org/10.1007/s12369-023-01020-1
[7] Steels, L. (2018). Building Agents out of Autonomous Behavior Systems. Routledge EBooks, 83–121. https://doi.org/10.4324/9781351001885-3.
[8] Nalage, P. (2025). Agentic Digital Twins: Self-Evolving Models for Autonomous Systems. Well Testing Journal, 34(S3), 227-244.
[9] van Ginneken, B. (2017). Fifty years of computer analysis in chest imaging: rule-based, machine learning, deep learning. Radiological Physics and Technology, 10(1), 23–32. https://doi.org/10.1007/s12194-017-0394-5