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# The Convergence of AI in Healthcare, Cybersecurity, and Food Processing: A Review of Emerging Trends and the Role of ChatGPT in Sectorial Innovation

**Yasir Ghayor Malik**[1*]

[1]Lecturer Computer Science Department

[1]yasir.ghayor@cs.uol.edu.pk

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**Corresponding Author**
**Yasir Ghayor Malik**
yasir.ghayor@cs.uol.edu.pk

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## ABSTRACT

Artificial Intelligence (AI) can no longer be considered a niche with an isolated domain under consideration; now, AI is quickly becoming an umbrella phenomenon that has successfully penetrated various industries such as healthcare, cybersecurity, food processing, and professional communication. This paper is an analysis of the potential of AI, especially conversational AI, in workflows, safety, processes and to resolve the communication barrier in the industry. Whether it is enhancing diagnostic quality in the medical field, identifying threats in cyber security or to maintain food quality and regulatory conformity, AI is bringing smarter and quicker solutions that are more collaborative. In addition to the technical issues, the paper explores the ethical dilemmas, domain squiggles, and governance questions that arises because the AI systems operate across long-established spheres of existence that have long been isolated. ChatGPT is also an example of interdisciplinary intelligence, i.e. the ability to integrate professionally diverse texts in its interaction. With the development of such technologies, responsibility of innovations, symbiosis between human and AI, and commitment to equity, transparency, and cooperation are required in the future. This review outlines an agenda of what the future of AI should be, sustainable, ethical and effective integration into an ever more connected world.

## INTRODUCTION

Artificial Intelligence (AI) has always been on the border of the scientific fiction and a futuristic fantasy, when it is described either as a salvation of the efficiency or an enemy of the working place and morals. However, in the last ten years, and in the last few years, in particular, AI has significantly



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transformed the hype into practical application [1]. The technology that was experimental not many years ago is now supporting the most crucial functions in the field of healthcare, cybersecurity, and food processing. The days of AI as a monolithic technology are over; it is now a jigsaw of various intelligent systems each mold to the requirements of highly specific areas [2].

This revolution is driven by a set of major developments: the eruption of data, the low cost of computing and concentration on sophisticated machine-based learning applications such as deep neural networks and transformer architectures. Large language models (LLMs) like ChatGPT have attracted specific attention among them due to their multi functionality and availability [3]. ChatGPT and its like may have been trained for no single engineering discipline, but they are proving themselves to be quite cross-disciplinary useful: suggesting ways of improving production lines to food technicians, simulating phishing attacks to cybersecurity analysts, and even assisting doctors with clinical documentation [4].

The healthcare industry, which is one of the most data-intensive and decision intensive industry, has quickly been turning into a testing ground of AI. The huge amount of electronic health records, diagnostic imaging, and research literature is an unmanageable space when looked at in the manual analysis by humans setting. In this case, AI can be considered a companion in terms of parsing patterns, predicting, and individualizing the care [5]. However, the reward is high as well: errors are not only financial, but it is life or death. Therefore, explain ability and trust in artificial intelligence decision-making are the primary factors in its implementation in clinical settings [6].

Cybersecurity is a different story altogether a battlefield consisting of offense and defense at all times. The agility and stealthiness of threats nowadays need thinking and action that is swift in response systems than what could be achieved through conventional software regulations. Artificial intelligence, fed billions of signals is now being used to identify anomalies, track attack vectors and even propose countermeasures in real time. However, the two-edged dilemma of the dual-use is evident here as well since dual-use tools that are used as protective means can always be reinvested and used as equally devastating tools towards attack, which is an evolutional technical and ethical dilemma [7].

Even in food processing, where advanced technology is not so closely related to the area, AI is slowly changing the pre-existing order. Whether it is smart sensors that detect the presence of bacterial contamination or predictive analytics that predict the demand and minimize food waste, AI is establishing safer and more efficient food systems. As a user-friendly interface, natural language is under consideration as a means of addressing supply chain intelligence or oversight of regulatory requirements, such as ChatGPT [8].


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What unifies these fields is not their purpose but their insecurity and intricacy, which requires more intelligent tools, quicker answers and solutions that are adaptable to scale. AI is growing to be such a tool neither as a magic bullet but as a versatile and learning system embedded into the processes of human decision making. The introduction of such other models of AI such as ChatGPT has led to a reduced barrier to entry in the application of AI, and now even small organizations can access the power of strong intelligence being at this crossroad between human knowledge and its enhancement through machine power, are sure of one thing AI is not only a part of the future anymore, it is remodeling the present [9]. To integrate responsibly and effectively through multi-sectorial integration then the first step is to understand its multi-sectoral impact.

## AI AND CHATGPT AS A NEW ALLY OF DOCTOR: A VISION OF CONTEMPORARY HEALTHCARE

The combination of artificial intelligence (AI) and healthcare is transforming the work of medicine, its provision, and management. Early detection of diseases, administrative efficiency, and many other opportunities, the comparison of which is becoming less and less pathetic, artificial intelligence is no longer an idea, but it is a constant companion in clinics, hospitals, research centers, and even in the houses of patients [10]. One of the most radical changes is the birth of natural language models such as ChatGPT, which are making communication more efficient, data interpretation easier and by extension, decision-making as well.

Information overload is considered one of the most important challenges of modern healthcare. Physicians and medical workers are usually engulfed by an avalanche of information- patient records, testing and scans, lab reports, the always-growing body of medical research knowledge [11]. The progress in AI has made it possible to extract relevant data through this data using AI tools in an efficient manner. Since model learning models can learn information on regular medical data it can detect irregularities in X-rays, MRIs, and CT scans, at a speed that is faster than most radiologists and therefore saves a lot of costs and time and acts as a second pair of eyes to eliminate diagnostic inaccuracy [12].

Specifically, ChatGPT is being used to lessen the cognitive and clerical overhead. Doctors use a lot of time writing the reports- at the cost of communicating with the patients. ChatGPT can be used to transcribe, summarize and organize medical notes in real-time during consultations or post. This saves a lot of clinician time that can be used in caring the patient and allays burnout. In addition, chatbots are also starting to improve the direct patient engagement [13]. Models similar to ChatGPT have been used to roll out intelligent chatbots that are used to check symptoms, give medication reminders, screen mental health, and triage before consultation. Though these systems cannot be used instead of


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medical professionals, they can become effective initial points of contact, qualifying patients to the right track of treatment.

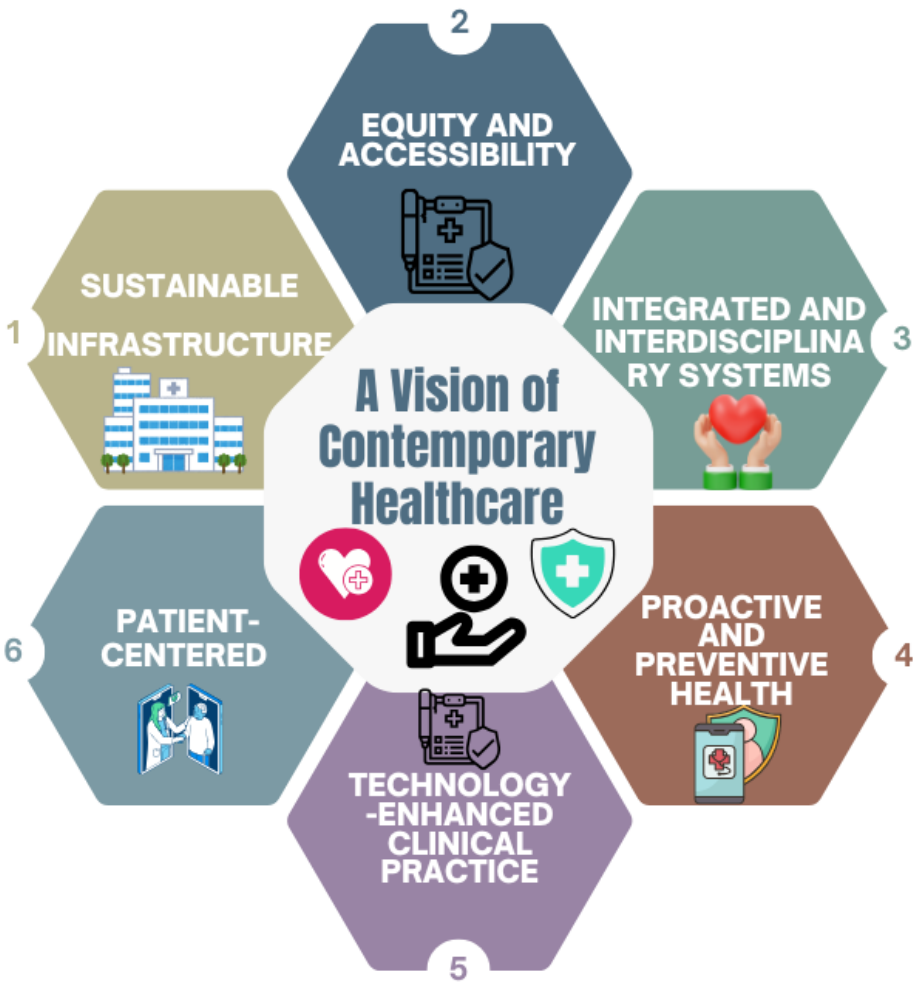


Figure: 1 showing a vision of contemporary healthcare

The questions of simulation, optimization of computations, and styles of control covered in these books conveniently provide the evidence of the use of an advanced technique of engineering and modeling of dynamic systems of mechanics. Simulation of a two-link planar anthropomorphic manipulator is concentrated on the robot motion and control, which underline the multiple utilization to industrial automation and human-assistive technologies [14]. The computational fluid dynamics analysis of essential parameters and mesh optimization applied in the open source OpenFOAM software highlights the necessity of accuracy and efficiency in the computation of the complicated fluid behavior that is imperative in disciplines such as aerospace, automotive and biomedical engineering [15]. Also the structure and regulation of a situation of balancing a ball on a beam by means of MATLAB/Simulink demonstrates a typical control systems issue using real-time simulation equipment in the building up of steady-state and responsive feedback controllers [16]. All these


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studies combine to describe how simulation and modeling along with control theory can be applied to resolve applied engineering problems.

However, the trend is obvious. AI does not oust doctors, but it makes them more powerful. ChatGPT is not diagnosing patients, but it is speeding up the workflows, assisting clinical communication, and even becoming a learning tool to medical students and clinical workers alike. In this dynamic environment, the problem of AI is not the disruptor concept, but rather an intelligent assistant; the one that enhances a human judgment with the force of computation. In its sophistication and compassion, healthcare is discovering in AI a curious form of partner: one that listens, learns, and follows in its train, to heal [17].

## THINKING LIKE A HACKER: THE TWO-BLADED SWORD AI IN CYBERSECURITY

Artificial intelligence (AI) has become a potent safeguarding tool as well as a possible menace in a high-stakes realm of cybersecurity. Digital systems have grown increasingly complex and interconnected and have therefore lost the fight to address the problem of changing attack vectors using traditional security tools [18]. Artificial intelligence (AI), and specifically machine learning (ML) and natural language-based models, such as ChatGPT, are filling the gap to defend against attacks, automate responses and predict and stop attacks before they can happen. Nonetheless, in the world where opponents are just as sophisticated, AI can be used to an offensive. It is a two-way sword that AI can be used in cybersecurity but it can be used against it [19].

First is in the area of threat detection and response. The legacy systems are usually based on either static rules or signature- based detection, which cannot cope with new threats. AI on the contrary learns using patterns. It has the ability to track massive amounts of traffic, discern unusual patterns, trigger and alert suspicious activities and launch automatic measures in almost real-time [20]. As an example, AI-based intrusion detection systems can review millions of log in attempts, transactions, or API calls and immediately identify anomalous behavior that may go unnoticed by a human analyst. Within organizations that rely on handling sensitive information, this level of caution is not a choice; it is a necessity, i.e., hospitals or financial companies [21].

Even cybersecurity has turned to natural language processing (NLP) models such as ChatGPT. ChatGPT in security analysis can be applied in automating reports, making summaries of threat intelligence, and converting complex technical logs to readable information. It is also an aid in incidents responses as teams respond with faster decisions under the pressure as it queries vulnerabilities, protocols or previous attack behaviour conversational [22].


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Figure: 2 showing role of AI in cybersecurity

Nevertheless, the same proficiency that has made AI such a tremendous teammate is what makes it a terrible enemy in the hands of the wrong people. The criminals have already used AI to do a better job of creating more convincing phishing emails, imitating actual communication, and writing malware code with less effort. Generative models have even gone as far as to simulate voices or edit the video level, leaving the possibility of social engineering and misinformation campaigning level of threat [23]. This has resulted in a new generation of AI-assisted attacks that will be more difficult to spot and simple to scale.

The recent emergence of this threat has spawned the discipline of AI in adversarial cybersecurity where as well as training AI systems to detect the threat, the training is now encompassing how such attackers would be utilizing their own AI systems. New AI-based techniques such as generative adversarial networks (GANs) where two AI systems compete with each other are being deployed to stress-test and strengthen security infrastructures [24]. Using artificial intelligence has also assisted companies in training red teaming (simulated attacks by ethical hackers) which aids in detecting any vulnerability before actual attackers detect it.

The use of AI in cybersecurity should be approached with caution even though it has the potential.



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False positives or missed threat: Black-box decision, biased training data, and opaque model behavior may result in false positives or missed threats. It is vital to organizations to integrate the use of AI with human management, strict testing, and sound ethical guidelines. In this constantly increasing digital arms race, hacker thinking can no longer be ignored, it has to be thought like one [25]. AI has always been much faster, bigger and smarter than an attacker, but you still have to be vigilant. Firewall, passwords, cybersecurity are all words being shouted between the defenders and adversaries as they embrace intelligent systems, and the next generation of cybersecurity is not only determined by walls and cryptography, but also by algorithms, ethics and vision [26].

## THE INTELLIGENT KITCHEN, THE SAFE DISH: THE UNOBTRUSIVE REVOLUTION OF FOOD PROCESSING WITH AI

Although the role of AI in other fields, such as healthcare and cybersecurity, usually makes the news, its contribution to food processing remains equally disruptive; it just does not make any noise. In the industry where reliability, safety and productivity have become the core values, however, there is the gradual reformation of the system of cultivation, preparation, packaging and delivery of food through AI. Whether through clever sorting systems to predictive maintenance, and now even to AI-based flavor design, the field of food processing is quietly being revamped to the benefit of all [27]. Quality control and detection of contamination presents one of the most important applications of AI in this area. Machine learning trained high-end computer vision systems are already able to detect physical defects, color variations, or spoilage indications on production lines faster and more accurately than any human can. Such systems are able to spot foreign materials or bacterium contamination in real time assisting in minimizing recalls and guaranteeing greater safety levels [28].

AI is also important in predictive analytics in addition to visual inspection. Machine learning models can predict breakdowns in equipment, as well as optimizing cleaning procedures and minimizing downtime by analyzing past production history to predict them in advance through predictive maintenance. This enhances the effectiveness of operations and minimizing wastes; both in raw materials and energy [29]. As an example, through AI, it is possible to have processors determine when a given machine needs a clean, instead of having using set times, which may either be a resource wastage or a possible source of contamination.

AI is also changing how food manufactures respond to changes in the market. Consumer trends are changing fast and new products can be developed through social media and purchase behaviour and feedback analysis under AI. This covers making recipes taste, feel, and/or meet a dietary trend, or finding a way to reduce expenditure and save on flavor. Other companies are going so far as to use AI to develop completely new profiles of flavor, through software analyzing thousands of ingredient


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combinations [30].

The other thing that is coming in are chatGPT and other natural language models, especially in regulatory compliance, and supply chain management. Safety in food entails tight documentation, labeling and tracking of all ingredients used. ChatGPT may assist in developing or auditing the documentation, translate compliance standards between regions, and aid workers with conversational interfaces to handle forefront control, file complaints or access safety procedures without having to dig into thick manuals [31]. Another great frontier relates to sustainability. Artificial intelligence increases food waste with proper demand prediction, packaging, and cold chain logistics. By doing so, it will not only fix environmental objectives but also achieves cost-saving in both the producers and the retailers. A crucial factor that is commonly disregarded is the fact that food processing is one of the areas where AI is secretly keeping our foodstuffs safer, production more sustainable, and consumer decisions more sensitive. And it is not very glamorous, but very resonant- re-inventing the farm to fork experience, with smartness all the way [32].

## CONVERSATIONAL INTELLIGENCE: THE CHATGPT PARADIGM IN PROFESSIONAL WORKFLOWS

As the artificial intelligence advances, the most drastic change it can bring might not be in complicated robotics or deep constituent diagnostics, but in the way it allows us to talk and interact with machines the way we do to other people. This is the paradigm shift large language model (LLM) chatGPT has introduced. Offering a combination of natural language understanding and robust reasoning, ChatGPT is transforming the relationship that professionals in a wide range of industries, including healthcare, cybersecurity, food processing, and many others, have with information, tools, and each other [33].

ChatGPT is becoming a support system of knowledge in cases where action has to be taken within a short time as in cybersecurity. Security analysts may ask ChatGPT about the new vulnerabilities, allow it to clarify the threat indicators, or even conduct phishing email-like exercise to educate the teams. ChatGPT is an ultra-powerful tool that allows non-technical people to get insight into what exactly has happened in the case of a breach or even translate non-technical-speak to layman terms, providing a crucial channel of communication between technical and executive departments [34].

The ChatGPT is emerging as a spoken overlay of complicated data systems in the food process arena. It can be used by supply chain managers, quality control technicians or even compliance officers to create regulatory documents, translate safety standards into executable forms or even troubleshoot machine problems using natural language requests [35]. Instead of sending employees to look up charts or grapple with cumbersome computer systems, teams can just say, When should this batch be


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stored at? or, What are the laws that require all labels on this product to be exported to the EU?

And the key aspect of what makes the ChatGPT transformative is its availability. You do not have to be a programmer or a data scientist in order to use it. Such democratization of AI enables both technical and non-technical professionals to use the powerful features of AI in their daily jobs. ChatGPT serves as a digital companion to anything that requires fine-tuning statements, summary of reports, generation of learning content, or thinking of solutions [36]. Nonetheless, its integration has the additional considerations, namely, reliability, data privacy, and context-awareness. ChatGPT should be operated with a sense of responsibility in adversarial situations. It is designed to aid rather than to substitute the human expertise, jeho listen best when controlled and verified by the specialists in the field [37]. ChatGPT is more than a tool, of course--it is infiltrating the infrastructure of thinking and communicating. Because it percolates into professional processes, it is changing how expertise is retrieved, decisions are reached, and issues are resolved, and it is transforming talk into a novel means of intelligence [38].

## WORLDS COLLIDE: INTER DISCIPLINARY SYNERGIES AND ETHICAL FRICTION: EXPERIENCES SHARED BY MARROW RESEARCHERS IN JAPAN AND THE USA

Artificial intelligence (AI) does not grow in a societal vacuum rather it grows at inter-junctures. Along with AI spreading into various spheres, such as healthcare, cybersecurity, and food processing, a new type of innovation is born: interdisciplinary synergy. The phenomenon of AI-powered algorithms does not really regard the industry dividing, and in this respect, this is their main strength, in a way. Nonetheless convergence brings complexity [39]. With ethics, legal concerns, and issues of accountability and control come issues of ethics and friction at the system and project levels, as well as the legal uncertainties and murkiness.

The cross-pollination of AI tools is one of the most profitable illustrations of synergy. It is then that techniques utilized in a single field are swiftly cross-applied in another. As an example, anomaly detection algorithms in cybersecurity to detect anomalous behavior in the network are getting used in healthcare to detect anomalies in patient vitals or imaging scans. In the same way, predictive maintenance models applied on food processing equipment are getting into application in hospitals and intelligent medical devices [40].

These can be brought together by the use of natural language models such as ChatGPT. Critical as it may be, the same underlying architecture can be utilized in many sectors such as summarizing cybersecurity logs, generating food safety compliance reports or helping a doctor read complex data to interpret medical indications. Such common technological base decreases redundancy, speeds up development and creates more integrated innovation ecosystem [41]. Nevertheless, these cross-overs


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generate serious ethical and working issues. The example of data privacy is one of them. The data in healthcare is shielded by law with high standards such as HIPAA, and cybersecurity operations concern sensitive information of companies or national security [42].

In case of the identical AI models accessing or processing various data sets across the industries, the borders of security, compliance, or ethics may become obscure. As an example, can a language model, trained with the anonymized patient data, be permitted to aid in food safety records? How are powers and balances established to respect the boundaries in which insights are not employed? The greatest concern is bias. Certain results generated by an AI system trained mostly on data in a specific area or demographic can be biased or unsafe when deployed in a different area. This may result in misdiagnosis in healthcare. In the cyber security, it might imply threats that are missed. A reliable AI implementation would require assuring context awareness and tuning in specific fields [43].

The interdisciplinary AI confronts the prevailing forms of governance, as well. The majority of these regulations focus on a single domain and they do not properly deal with AI systems, which operate in a cross-boundary way. Holistic policies that factor in not only what AI can do in a certain sector are needed as there is more of a need to factor in how AI links with, and affects, others. There are these frictions notwithstanding, convergence of AI in different industries have provided chances of transformative growth [44]. It requires the new way of thinking namely, the one that highly appreciates collaboration, transparency, and adaptability. When done carefully, interdisciplinary AI will address difficult issues on which no industry can make a dent by itself, and it will establish an example of ethical and responsible development [45].

## WAY PAST THE BUZZ: PLOTTING A COURSE TO A FUTURE OF AI-POWERED COLLABORATION

With the shift in artificial intelligence (AI) as isolated tools to integrated systems in healthcare, cybersecurity, food processing and in various other industries, people are set to enter into an age of AI dominated collaboration, not only between machines and humans but across industries, institutions and even national borders [46]. AI buzzing is no longer associated with speculation and hype but it is all regarding infrastructure, scalability, and sustainability of integrating AI. There is a long road to go with the need to analyze the ways of future-proofing AI systems, promoting innovation across sectors, and remaining ethical and human-focused [47].

The initial movement towards the next stage is a standard and interoperability. This is particularly contrasted with the situation in the new reality, where AI systems tend to be created in isolation- they are tailored to any single purpose or to any particular firm, and compatibility with a broader scope is generally not a priority. However, what by now is meant by actual AI collaboration is to develop


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platforms and protocols that enable information and insights to traverse systems freely. Consider an AI program with the ability to detect foodborne pathogens in plants and their data behavior patterns with AIs overseeing outbreaks in the healthcare industry [48]. Or cybersecurity devices that identify the intrusion into a hospital network and notify in real-time the healthcare AI platform that stores information about patients. Interconnectivity is the actual strength.

Such language models as ChatGPT will find themselves as the focal point of this connectivity. Being capable of adjusting to the needs of various professionals in different industries, they could best serve as interfaces between compliance drivers and clinicians aiming to communicate with their patients, as well as a non-technical executive who needs to comprehend the complex nature of threat intelligence. In the future, such models as ChatGPT can transform into domain-sensitive assistants, which can jump between contexts, e.g., from medical to legal, technical to industrial language, and enhance safety and relevance [49].

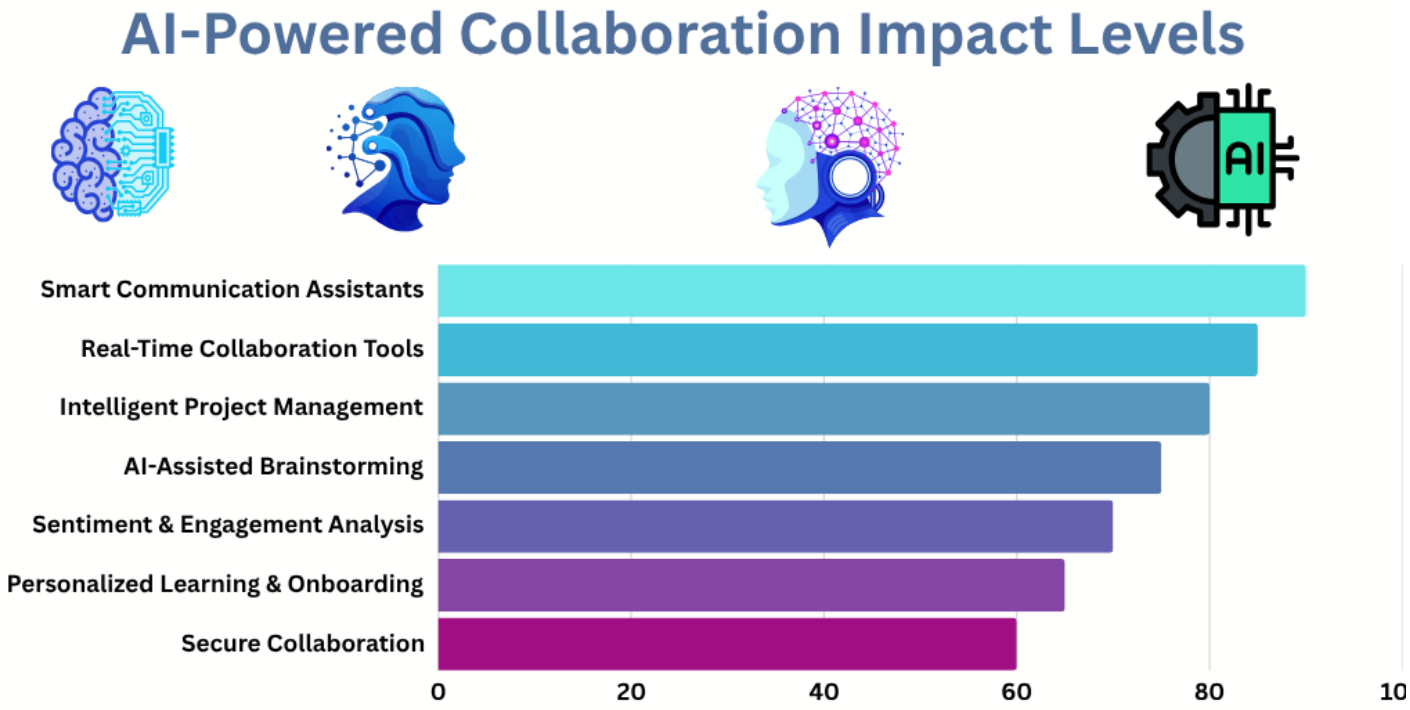


Figure: 3 showing Ai powered collaboration impact levels

Nevertheless, with the increasing integration, government becomes more important. In the possible future, AI systems will require well-defined transparency, accountability, and control. To which party does the data belong? What happens in the case of a mistake by AI? What can we do to make sure that AI will not violate human rights in different jurisdictions and across various applications? These questions are becoming increasingly imminent as AI becomes more free [50]. The other important part of the road forward is collective AI development. Corporate, academic and government


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institutions cannot foresee or fix all of the AI problems on their own. The desired change is the community system of innovation, where open research, moral rules, and community-based problem solving are embraced over the protoclap. Such collaborations with the other sectors, AI sandboxes to experiment, and global regulatory partnerships will be essential during this stage [51].

Literacy in education and AI will also be a defining part. Following the integration of AI systems into daily processes, every specialist, not only data scientists, should be aware of its possibilities and constraints. Empowering doctors to operate with diagnostic AI, or empowering plant operators to learn about predictive maintenance algorithms, would guarantee that AI would not become a tool of removing humans but rather to empower them. we should not forget about human values [52]. The way forward will have to contain rooms where we can pay our respects to empathy, creativity and ethical decision-making, as we further automate our choices and simplify our processes. AI must not kill the human touch, rather it must improve on it. AI enabled collaboration does not mean the end of expertise; instead, they build on expertise, in a responsible and fair way. And as we move out of the buzz, our task is not only to construct more intelligent systems--but better systems [53].

## CONCLUSION

Since artificial intelligence has already spread its tentacles in healthcare, cybersecurity, food processing industry, and business communication professionals, there is one thing that one can undoubtedly say: AI is not just one revolution, it is a galaxy of them. The domains use AI differently, but they represent a larger shift-as smart systems, such as ChatGPT and other models, change the way we think, behave, and work in the digital era.

In healthcare, AI is increasing the accuracy of diagnostics, optimizing the clinically related processes and providing patients with an easily accessible source of information. In cybersecurity it doubles up as defense and weapon: forecasting assaults as well as assisting analysts make smart fast decisions. In the food industry, AI can guarantee the security of the food chain, as well as efficiency, including what happens to the machines, to the contamination checking. In all these disciplines, ChatGPT can be seen as a unifying property: an interface that can connect both complicated systems and a conversational language that is easy to understand.

The fact that this moment in the history of AI is characterized by the sheer range of what it applies to is not the only extraordinary aspect of it; it is also defined by the richness of integration. A combination of computer capacity with human intent is taking place. ChatGPT, as an example, does not just print text, it cooperates: it composes medical notes, produces security briefs, writes compliance on food, or helps in multilingual business communication. Its flexibility indicates a wider trend: AI is shifting out of the tool toward the partner in thought.


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The solution is in engineering an ethical AI, an architecture-ethical version of the system, where fairness, privacy, and inclusion have become a fundamental feature of these systems. It also involves collaborative governance where multiple parties are involved, including policymakers who have the mandate to craft such standards that are changeable, open-ended, and even progressive. In the future, the most characteristic traits of the technological advancement will be the synergy between the domain expertise and AI. No AI tool, no matter how sophisticated, has the ability to become a surrogate of the instinctiveness of a good physician, the ethics of a cybersecurity specialist, or the sensing knowledge of a food safety inspector. Rather, AI is required to enhance our best capabilities and conquer our ignorance gaps and to robotize the dull in order that we can concentrate on what issues.

So in a way the story of AI is no longer about machines learning to think like humans--but machines helping us humans learn to think. AI is the unseen collaborator in the smarter, safer, more connected world, whether it is in diagnosis or data defense, farm to fork, keyboard to conversation.

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