Concerns of Ethical and Privacy in the Rapid Advancement of Artificial Intelligence: Directions, Challenges, and Solutions

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***Abstract*—AI is a transformative technology that emulates human cognitive abilities and processes large volumes of data to offer efficient solutions across various sectors of life. Although AI significantly enhances efficiency in many areas, it also presents substantial challenges, particularly regarding ethics and user privacy. These challenges are exacerbated by the inadequacy of global regulations, which may lead to potential abuse and privacy violations. This study provides an in-depth review of current AI applications, identifies future needs, and addresses emerging ethical and privacy issues. The research explores the important roles of AI technologies, including multimodal AI, natural language processing, generative AI, and deepfakes. While these technologies have the potential to revolutionize industries such as content creation and digital interactions, they also face significant privacy and ethical challenges, including the risks of deepfake abuse and the need for improved data protection through platforms like PrivAI. The study emphasizes the necessity for stricter regulations and global efforts to ensure ethical AI use and effective privacy protection. By conducting a comprehensive literature review, this research aims to provide a clear perspective on the future direction of AI and propose strategies to overcome barriers in ethical and privacy practices.**

Keywords—Artificial Intelligence; Ethical; Privacy; Concern; Rapid Advancement.

I. Introduction

Artificial Intelligence (AI) is a branch of computer science focused on creating systems that can mimic human abilities in thinking, learning, and decision-making [1], [2], [3]. AI systems are designed to analyze large volumes of data, identify complex patterns, and offer efficient solutions to real-world challenges [4]. This technology operates using machine learning (ML) algorithms [5], deep learning (DL), neural networks (NN) [6], and various other techniques that enable computers to learn from data without explicit instruction [7], [8], [9], [10].

In recent decades, AI has evolved into one of the most influential technological innovations. It has brought significant transformation across various sectors, such as healthcare [11], [12], transportation [13], [14], [15], education [16], [17], [18], and others [19], [20], [21], [22], [23], [24]. This technology allows for the automation of complex tasks that previously required substantial manpower and time. With its ability to analyze large datasets, detect patterns, and provide accurate solutions, AI enhances efficiency and effectiveness in numerous fields, facilitates decision-making, and offers quicker solutions to real-world problems [25], [26], [27]. The future direction and goals of AI will continue to provide valuable contributions across different aspects of life and industry [28].

However, along with the rapid development of AI, new challenges have emerged with its widespread use. These challenges can be categorized into two main groups: technical and non-technical challenges. Technical challenges include limitations in data processing, biases arising from unrepresentative data, and lack of transparency in how certain algorithms work. Non-technical challenges involve issues such as cost, ethics, privacy, security, the social impact of job automation, and moral responsibility when AI systems make decisions affecting human lives [29], [30], [31].

Additionally, global regulations and standards for AI have not kept pace with technological advancements. This creates a gap where the technology could be misused or produce unintended consequences. Therefore, a major issue in AI development is how to maximize its benefits in practical applications while addressing these barriers. This requires an approach that not only focuses on technical innovation but also considers regulatory, ethical, privacy, and social impacts of AI to ensure its effective and responsible implementation. This literature review encompasses an understanding of AI applications across various sectors, identification of future needs, and evaluation of potential ethical and privacy impacts arising from technological advancements. With a clear overview of the direction and challenges in AI development, proactive measures can be taken to ensure that proposed solutions are relevant and effective in addressing existing challenges.

According to Sukhpal Singh Gill et al. [32], the potential of AI and ML in next-generation computing systems is explored, particularly in integration with cloud, fog, edge, serverless, and quantum computing technologies. Autonomic computing, which aims to create systems capable of self-management, is optimized through AI and ML to enhance performance and autonomy. Current trends include systems that can adapt, self-repair, and self-protect automatically, while Explainable AI (XAI) is also discussed to provide transparency in decision-making. Clayton R. Taylor et al. [33] state that AI has significant potential to transform various industries by improving efficiency, accuracy, and data-driven decision-making. Although AI offers many opportunities, such as process automation and better data analysis, challenges like the need for user trust must be addressed. The future of AI will involve deeper integration into various applications, with a focus on customization and broader acceptance among users and society.

Additionally, research by Jennie C. De Gagne [34] indicates that the future of AI in nursing education will focus on enhancing personalized learning and efficiency through the automation of administrative tasks. AI has the potential to create advanced simulations that help students refine clinical skills and critical thinking. However, key challenges include privacy protection, data security, and ethical considerations. Ethical issues are also addressed by Ke Zhang and Ayse Begum Aslan in their work, which highlights these concerns as vital challenges for the future development of AI [35]. The ethical and privacy concerns of users are supported by several other studies discussing ethics and user privacy security [36], [37], [38], [39], [40], [41], [42], [43], [44].

Based on the brief literature review outlined, this study contributes by mapping the direction and ethical and privacy challenges of AI use in the future and formulating solutions to address these barriers. This research provides a comprehensive perspective on AI development that can be directly applied to everyday life while offering strategies to tackle challenges that may arise in its implementation, particularly in terms of ethics and privacy.

II. AI IN GENERAL

A. Brief History of AI

In the beginning, the idea of a machine that could think like a human was confined to the realm of science fiction. However, in 1950, a British mathematician and computer scientist named Alan Turing introduced a concept that changed everything. In his paper titled “Computing Machinery and Intelligence,” Turing posed a fundamental question: “Can machines think?” To answer this question, he created what is now known as the Turing Test, a test designed to determine whether a machine could mimic human behavior in conversation without the person interacting with it realizing it was a machine [45], [46]. This test became the first major milestone in the field of AI and marked the beginning of serious exploration into the capabilities of machines to think.

A few years later, in 1956, the term “Artificial Intelligence” was officially introduced at a conference held at Dartmouth College in New Hampshire, USA [47], [48], [49]. The conference was led by John McCarthy, along with scientists such as Marvin Minsky, Claude Shannon, and Allen Newell [50]. They proposed that machines could be programmed to mimic human intelligence, and optimism for the development of AI was high. During this time, the foundations for AI were laid with experiments in logic and symbolic processing, but the technological limitations of the time hindered AI's full potential.

The high optimism of the 1950s and 1960s began to fade in the 1970s. AI faced significant challenges in solving real-world problems. Early AI systems that used rule-based and logic approaches could not handle the complexity of the real world. Although there were advancements in expert systems rule-based programs designed to make decisions in specific domains AI still failed in many aspects, such as natural language understanding and pattern recognition [51]. As a result of excessive expectations and disappointing outcomes, the field of AI experienced a major decline in funding and interest during the 1970s and 1980s, a period known as the “AI Winter.” Many AI projects were either halted or scaled back, and research focus shifted to other fields. This was a time when AI was considered overhyped and impractical for real-world problems.

Entering the 1990s, AI began to show signs of resurgence. One of the most historic moments in AI occurred in 1997, when IBM's supercomputer Deep Blue defeated world chess champion Garry Kasparov. This victory demonstrated that machines could outperform humans in games that required deep and complex strategic thinking. It was a major triumph for AI and renewed interest in the field, particularly in the development of more advanced algorithms and more powerful computing. Additionally, advancements in ML and NN began to gain attention. The backpropagation algorithm, used to train artificial neural networks (ANN) [52], [53], [54], started being applied more widely, allowing machines to learn from data more efficiently. This marked the beginning of a modern AI revival driven by the ability to process and analyze large amounts of data.

The 2010s became a pivotal era in AI history with the rise of DL, a subfield of ML that uses layered ANN to process large-scale data. In 2012, a team led by Geoffrey Hinton won the ImageNet competition using Convolutional Neural Networks (CNNs), a NN architecture specifically designed for image recognition. Their victory in this competition marked a turning point in AI's ability to understand and analyze visual data. DL not only revolutionized image recognition but also paved the way for major advances in speech recognition, natural language processing (NLP), and computer vision. DL algorithms have been used in various commercial applications, such as virtual assistants (e.g., Siri and Google Assistant), recommendation systems (like those used by Netflix and YouTube), and the development of autonomous vehicles.

The year 2018 marked a significant step forward for AI towards Generative AI with the emergence of models like GPT (Generative Pre-trained Transformer) from OpenAI, starting with GPT-1 in 2018, which utilized semi-supervised training and had 117 million parameters. GPT-2, launched in 2019, increased the number of parameters to 1.5 billion and used the 40 GB WebText dataset. GPT-3, introduced in 2020, featured 175 billion parameters and was trained on large datasets, including Wikipedia and WebText. Its improved version, GPT-3.5, employed Reinforcement Learning from Human Feedback (RLHF). The latest version, GPT-4, was released in March 2023, introducing image input processing capabilities and demonstrating more advanced abilities than its predecessors, although details about its parameters and dataset have not been disclosed. The development history of GPT since 2018 is shown in Fig. 1.

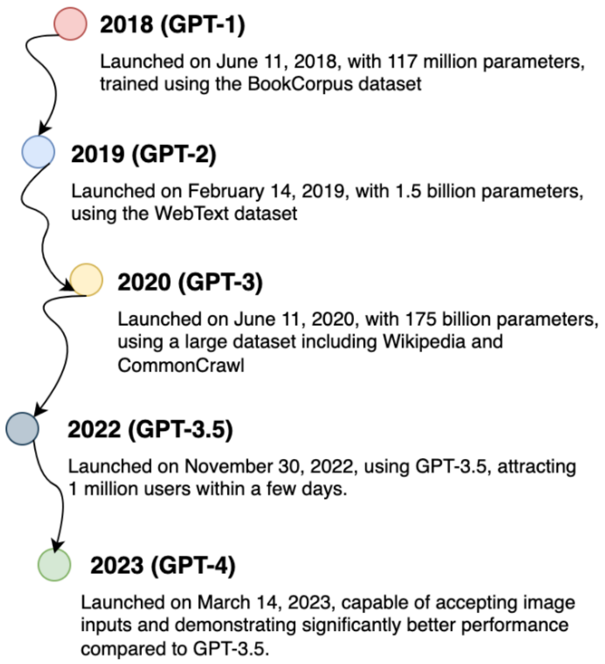

Fig. 1. Development history of GPT since 2018

B. *Recent Developments in AI*

Currently, the development of AI has advanced far beyond previous achievements, encompassing various fields with innovations that transform the way we work, communicate, and understand the world. Text-to-image technology has made rapid strides through models like DALL·E 2 and Stable Diffusion [55], [56]. DALL·E 2 uses diffusion-based generative techniques to create high-quality images from text descriptions, opening new possibilities in graphic design and digital art. Stable Diffusion, as an open-source alternative, offers greater flexibility in generating images based on text, expanding the boundaries of visual creativity.

On the other hand, text-to-video is an emerging area with models such as Phenaki and Make-A-Video. Although this technology is still in its early stages, it shows great potential to revolutionize video content creation by enabling faster and more efficient video generation from text descriptions. Beyond images and videos, AI has also expanded into text-to-code, with models like Codex from OpenAI simplifying software development by generating code from text instructions, enhancing programming efficiency [57], [58].

Text-to-sound and music generation technologies, such as those developed by Jukedeck and Amper Music, allow for the creation of musical compositions from text descriptions, opening new opportunities in music and audio production [59], [60]. Additionally, GPT-4 has introduced multimodal capabilities, enabling the understanding and creation of content involving both text and images, thus broadening AI's applicability from text generation to visual analysis [61], [62], [63].

Meanwhile, DeepMind's MuZero marks a significant advance in AI's ability to understand and simulate complex environments without requiring an explicit environmental model, a crucial step towards more autonomous and adaptive AI systems. In biotechnology, DeepMind's AlphaFold 2 has accelerated drug discovery by accurately predicting protein structures, while IBM Watson for Genomics uses AI to analyze genomic data and support precision medicine.

Quantum computing combined with AI, as developed by IBM Quantum and Google's Sycamore, offers the potential to solve complex problems that classical computers cannot handle, paving the way for advancements in molecular simulation and cryptography. In robotics, companies like Boston Dynamics have developed robots such as Atlas and Spot, which use AI to perform complex physical tasks with high precision. AI has also been applied in mental health through chatbots like Woebot, which offers emotional support and AI-based cognitive behavioral therapy. In translation and language understanding, Google's MUM can comprehend information from various formats and sources, enhancing search capabilities and contextual understanding.

In cybersecurity, AI is used to quickly and accurately detect threats, as seen with Darktrace and CrowdStrike. AI for Climate Change leverages ML models to monitor and predict the impacts of climate change, while Microsoft's HoloLens and Meta's Quest integrate AI into mixed reality to create more immersive and interactive experiences. However, alongside these advancements, ethical concerns about AI are emerging. Questions about privacy, algorithmic bias, and responsible AI use are becoming global discussion topics. Many governments and international organizations are beginning to formulate regulations and guidelines to ensure that AI is used ethically and does not harm society. The history of AI from 1950 to the present (2024) is illustrated in Fig. 2.

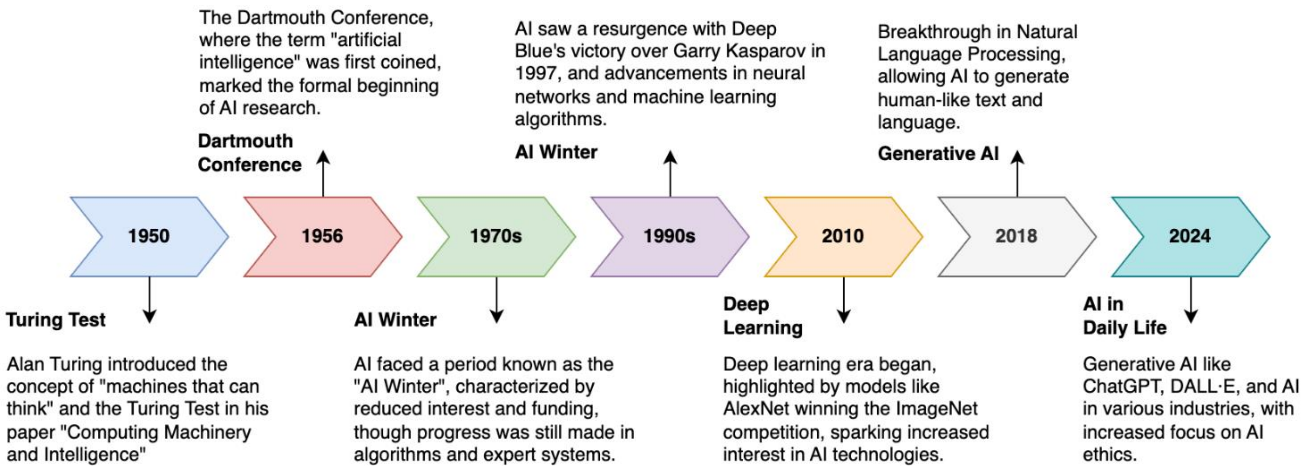

Fig. 2. History of AI from 1950 to the present (2024)

C. AI Architecture

AI is a broad field encompassing various technologies and methods designed to enable machines and computer systems to mimic and function in ways similar to human intelligence [64]. AI includes capabilities such as understanding natural language, recognizing images, making decisions, and learning from experience. Within AI, many small components work together to achieve advanced breakthroughs in life [65], [66]. These small components in AI are generally shown in Fig. 3. In AI, ML is one of the key approaches that allows systems to learn from data and improve performance without being explicitly programmed [67], [68]. ML focuses on developing algorithms that can analyze data, discover patterns, and make predictions or decisions based on the available data [69], [70], [71], [72].

Within ML, there are various types of algorithms and techniques used to process data and make predictions. One particularly important approach is NN [73]. NN are inspired by the structure and function of the human brain and consist of units called neurons that are interconnected. These NN can process data by combining and modifying inputs through interconnected layers: the input layer, hidden layers, and output layer [74]. NN rely on weights and biases that are updated through a training process using optimization algorithms like Gradient Descent.

In NN, there is DL, which is a subcategory of ML involving the use of very deep NN, known as Deep Neural Networks (DNNs) [75]. DL utilizes many hidden layers to extract complex features from data. One well-known architecture in DL is CNNs, which are highly effective in processing image and video data [76]. CNNs use convolutional layers to extract visual features from images, followed by pooling layers that reduce data dimensions to improve computational efficiency [77], [78]. Algorithms used in CNNs include Convolutional Layers for feature extraction and ReLU (Rectified Linear Unit) as an activation function to add non-linearity.

Additionally, Recurrent Neural Networks (RNNs) [79] are another type of NN specifically designed for processing sequential data, such as text or time signals. RNNs have the capability to retain information from previous inputs through recurrent connections. More advanced variations of RNNs include Long Short-Term Memory (LSTM) and Gated Recurrent Units (GRUs), which address the vanishing gradient problem and allow the model to handle long-term dependencies in sequential data [80], [81], [82].

The Transformer architecture represents a major innovation in DL introduced to improve the model's ability to handle sequential data more efficiently. Transformers use self-attention mechanisms to allow the model to pay different levels of attention to various parts of the input, enabling a better understanding of context. Notable transformer-based models include BERT (Bidirectional Encoder Representations from Transformers) and GPT (Generative Pre-trained Transformer) [83], [84], [85], [86]. BERT uses a bidirectional approach to understand context from both directions in the text, while GPT focuses on generating coherent text using a unidirectional architecture.

Generative Adversarial Networks (GANs) are another type of NN consisting of two competing models: Generator and Discriminator [91], [92]. The Generator creates synthetic data that mimics real data, while the Discriminator tries to distinguish between real and synthetic data. This adversarial training process enhances the quality of the generated data, and GANs are used in various applications such as image, video, and music generation. Relations between AI, ML, NN, and DL are shown in Fig. 4 [93], [94], [95].

III. Result and Discussion

A. AI Applications in Various Sectors of Life

AI has touched nearly every aspect of human life, bringing profound revolution to the way people work, interact, and live daily. With rapid technological advancements, AI has not only become a supportive tool but also a major catalyst for change across various sectors. The application of AI in different fields has enhanced efficiency, productivity, and innovation, facilitating smarter and more adaptive solutions to modern challenges. From healthcare to transportation, retail to agriculture, AI technology has opened new opportunities, modernized existing processes, and provided previously unimaginable insights. With the ability to process and analyze vast amounts of data quickly, AI enables us to make better and more informed decisions while offering more personalized and relevant experiences. The adoption of AI across these sectors not only improves performance and service quality but also drives innovations that can transform how we perceive and address issues. Let us explore some of the significant AI applications across various sectors to understand its extensive and profound impact.

In the healthcare sector, AI has brought major transformations, from diagnostics to treatment [96]. AI-based systems such as DeepMind's AlphaFold have demonstrated extraordinary capabilities in predicting protein structures, which can accelerate drug discovery and therapy development. Diagnostic tools like IBM Watson for Health can analyze medical images to detect diseases such as cancer with high accuracy. Additionally, AI-powered chatbots, such as Ada Health or Babylon Health, assist patients with preliminary medical advice and personal health management.

In the financial sector, AI is used for risk analysis, fraud detection, and portfolio management. Automated trading algorithms leveraging AI can analyze markets and make investment decisions within seconds. Fraud detection systems used by companies like Mastercard or Visa utilize ML to identify suspicious transactions and prevent fraud. AI chatbots and virtual assistants in banking also provide faster and more efficient customer service.

Furthermore, AI has improved efficiency and safety in the transportation sector. Autonomous vehicles developed by companies like Tesla and Waymo use a combination of cameras, sensors, and DL algorithms to drive without human intervention. AI-based traffic management systems can optimize traffic flow and reduce congestion. Additionally, AI is used in demand forecasting for public transportation systems, enhancing schedules and routes to better serve users.

In retail and e-commerce, AI is utilized for personalizing customer experiences, demand forecasting, and inventory management [97]. Personalized product recommendations, such as those used by Amazon or Netflix, leverage AI algorithms to analyze user preferences and suggest relevant products or content. AI chatbots also help in providing rapid and effective customer support, addressing questions and resolving issues efficiently.

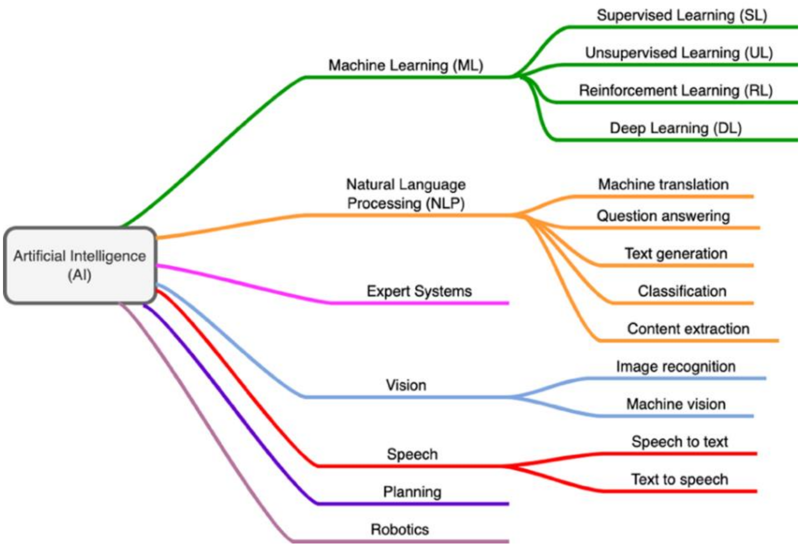

Fig. 3. AI and its subcomponents in general [87]

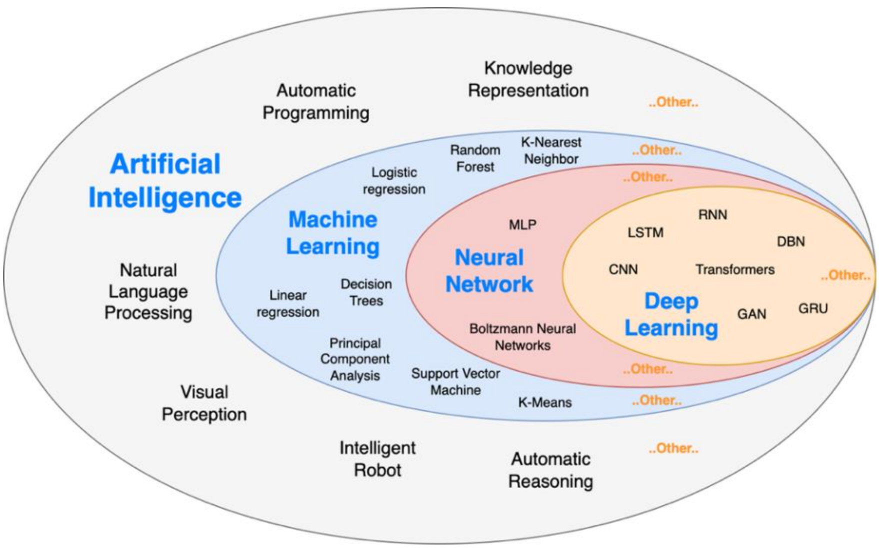

Fig. 4. Relations between AI, ML, NN, and DL [88], [89], [90]

Moreover, AI has introduced various innovative tools in education, such as adaptive learning platforms that adjust instructional materials based on student needs [86]. AI-based systems can analyze student progress and provide personalized feedback. Virtual assistants and chatbots are also used to answer student questions and assist with learning materials. AI education analytics can help institutions understand learning patterns and design more effective curricula. AI has also made significant strides in other fields such as agriculture [98], with monitoring systems and drones equipped with sensors to track plant health and identify diseases. AI-based weather predictions help farmers plan agricultural activities and optimize crop yields. Agricultural automation uses robots and AI-powered tools to perform tasks such as planting, fertilizing, and harvesting with higher efficiency.

In the energy sector, AI is used for energy management and network optimization. AI-based systems can monitor and analyze energy consumption to optimize distribution and reduce waste. Renewable energy generation, such as wind turbines and solar panels, also leverages AI to improve efficiency and generate energy optimally. AI-based energy demand forecasting aids in planning and managing energy supply.

In the entertainment sector, AI plays a role in content production, user experience personalization, and trend analysis. AI systems are used to generate music, write scripts, and even create films with the help of DL technology. Streaming platforms like Spotify and YouTube utilize AI algorithms to recommend relevant and engaging content to users based on their preferences. Beyond what has been described, there are still many real-world applications of AI today. However, the main focus of this research is to map the future directions and challenges of AI and to seek solutions for existing challenges. Therefore, we do not discuss or review much about the current implementation of AI.

B. Directions, Challenges, and Solutions for Ethics and Privacy in AI Implementation

The role of AI in the present, which is becoming increasingly powerful, indicates that AI will play a more important role in various sectors in the future with far more intelligent, autonomous, and interactive capabilities. One of the key trends that will emerge is AI's ability to better understand social, emotional, and linguistic contexts, especially through the development of multimodal AI and natural language processing. Concrete implementations of this technology include more intuitive virtual assistants, support in healthcare management through medical data analysis, personalized education through AI tutors that can tailor materials to students' needs, and other concrete applications [86].

Moreover, generative AI will also play a major role in the future by creating original content such as text, images, music, and even videos. This trend is evident in generative AI applications like GPT and DALL·E, which continue to be developed to produce high-quality content in various fields such as entertainment, design, marketing, and more. Another example is Vidu.AI, a platform that allows the creation of high-quality videos from text and image inputs. Such technology has the potential to revolutionize the way content is produced in the media and marketing industries, but it also presents new challenges related to privacy and ethics. There are many more examples of AI applications that make ethical and privacy concerns vital issues going forward.

Ethical and privacy violations in the use of AI are critical issues that arise as the adoption of this technology continues to expand. AI has the ability to analyze large-scale data, including sensitive information such as personal data, credentials, health records, and photos or videos. One of our main concerns as authors is that the data entered by users, whether consciously or not, may be stored by AI and reused without explicit permission from the user. This risk increases if the data collected by AI is not masked or processed properly to protect privacy. For example, sensitive information sent through queries could be stored and used for future learning, which carries the risk of being exposed in unwanted contexts.

The use of AI in processing Big Data offers significant benefits. Big Data refers to large and complex datasets that are difficult to analyze manually, and AI plays a role in accelerating this analysis. However, ethical issues arise when AI can reveal new personal information from this data that individuals may not want to share. If used improperly, Big Data and AI can cause serious harm. Big Data has four key characteristics: Volume (the large amount of data), Velocity (the speed of analysis), Variety (the diverse types of data), and Veracity (the accuracy of the data). This is explained by Levin et al. [42] in their study titled "Data, Big Data, and Metadata in Anesthesiology".

On this subject, Srihita et al. also explain similar issues regarding the personal data of social media users. They describe how AI directly interacts with users' personal data. AI collects, analyzes, and utilizes data such as search history, preferences, and online behavior to deliver personalized content. While this can enhance the user experience, there is a risk of privacy violations if AI is not managed ethically. They emphasize the importance of respecting individuals' privacy boundaries, avoiding data misuse, and ensuring that AI algorithms do not intrude on protected aspects of privacy [99].

In addition to privacy risks, emerging technologies like deepfakes, where AI can generate realistic images or videos from a few input photos, add complexity to the issue. Platforms such as Vidu.AI, for example, allow users to combine photos and create realistic-looking videos. Although this innovation can be beneficial for creativity and entertainment, there are significant ethical risks if this technology is misused. AI-generated videos can be manipulated to create false situations, potentially leading to defamation, fraud, or the spread of fake news. Ordinary users often do not realize that the content they create using AI can be modified and distributed in harmful ways, making them vulnerable to the misuse of this technology.

This makes AI one of the contributing factors to the spread of hoaxes if not managed wisely. Creating new videos without knowing the real context could become a serious ethical issue. The most vulnerable victims are ordinary people who have limited understanding and may not have any knowledge of how AI works at all. In our opinion, there is a need for new AI innovations to differentiate between real and AI-generated videos to help mitigate this ethical issue. We analyze that there are algorithms used to generate videos, and AI also has the potential to read the algorithms used. This could create an opportunity for AI to detect and distinguish between AI-generated videos and genuine ones.

Furthermore, the input used by users to generate content also presents a new risk, as explained by Srihita et al. [99]. It must be acknowledged that one of the biggest challenges in ethics and privacy is transparency in data usage. Many AI platforms do not clearly inform users about how their data is used, whether it is stored, or even used for future model training. In this context, users should be given full control over their data, including the right to delete their data from the system and ensure that the data will not be reused by AI without their consent, as explained by [41] in their writing. Moreover, AI platforms should ensure data anonymization, especially when it involves sensitive personal information, to prevent potential misuse.

On the other hand, regulatory measures can also be designed to address AI ethical issues. These regulations must be crafted more strictly and comprehensively to ensure that AI developers comply with existing rules. The regulations should not only cover personal data protection mechanisms but also address the ethical use of AI technology, such as how data is processed, stored, and used in algorithm development. Such regulations are important to minimize the risk of technology misuse, both in terms of privacy and security, ensuring that developers do not have the freedom to overlook these critical aspects.

From an ethical perspective, the responsibility to prevent privacy violations and the misuse of AI technology does not rest solely on users, but also on developers and the companies that provide AI services. They must proactively comply with existing regulations, safeguard data security, and ensure that their technology is not misused. This could include requirements for independent audits of AI systems, strict oversight of data collection practices, and clear sanctions for violators. If regulation, transparency, and ethics are not prioritized, the potential for violations by AI will continue to increase, especially against ordinary users who may not fully understand the risks of using this technology.

However, when discussing regulations, a major question arises regarding whether current AI platforms truly comply with existing privacy and data protection rules. Many developers or tech companies operating globally often cross national jurisdictional boundaries, making it difficult to enforce laws in specific regions. For example, how can local authorities enforce their policies on large tech companies based abroad? Additionally, current privacy regulations are often seen as inadequate to address the scale and complexity presented by AI. This highlights the need for a dynamic and cross-border regulatory approach to anticipate the rapid development of technology while protecting individual privacy rights in the digital age.

According to the authors, one concrete solution that could be adopted by countries worldwide is to establish a global framework for AI regulation and data protection. This could take the form of international agreements or cross-border regulatory standards, similar to how regulations like the General Data Protection Regulation (GDPR) [38] in Europe and the California Consumer Privacy Act (CCPA) in the United States have become global benchmarks. The GDPR and CCPA are regulations that explicitly protect user data, requiring clear consent before data can be used for other purposes. These regulations strictly govern who is permitted and prohibited from adopting sensitive data. Article 15 of the GDPR grants data subjects the right to know how their data is being used, who has access to it, and how long it is stored [41]. Policies like this should at least be referenced by all continents and even countries that provide specific privacy laws to protect user data from being disseminated or adopted, especially by AI, which could potentially generate new information from such sensitive data.

In the context of GDPR, individuals have the right to withdraw their consent for data processing at any time. This is outlined in Article 7(3) of the GDPR, which states that while individuals may withdraw their consent at any moment, such withdrawal does not affect the legality of the data processing carried out based on their consent before it was withdrawn. In other words, when someone consents to their data being processed, for example, for marketing purposes or use on digital platforms, they still retain the right to revoke this consent later. This right is crucial as it provides individuals with greater flexibility and control over their personal data. Although the data might have been processed before the withdrawal, the platform or company holding the data must cease further processing after consent has been revoked, as reviewed by several studies [36], [37], [44].

It is also important to note that when consent is given as part of a larger document (e.g., within a contract or terms and conditions), the GDPR mandates that the request for consent must be presented clearly and separately from other elements in the document, using language that is simple and easy to understand. This ensures that users fully comprehend what they are agreeing to and that they can easily withdraw their consent at any time without complication. In the case of minors, the right to withdraw consent also applies, but there are additional challenges related to the level of understanding among children and the potential manipulation of their consent, especially in online environments where data is often exploited for commercial purposes.

Regarding privacy, research [39], [41] also proposes that the use of personal data for commercial and administrative purposes could be regulated through “soft governance”, similar to the role of Human Research Ethics Committees (HREC), which review research involving human participants. These committees aim to ensure that the policies proposed by tech companies and institutions meet ethical standards. In Australia, for instance, while research involving humans is strictly regulated, the collection of administrative data, such as student data, is less controlled. There is a need for a similar committee responsible for reviewing policies on the use of personal data in other sectors [39]. Additionally, research [41] suggests replacing standard consent forms with illustrated contracts to enhance individuals' understanding and protect their rights. However, they emphasize that this proposal requires further testing.

Research by Ilham Gemiharto and Dwi Masrina [100] highlights that developed countries have adopted advanced privacy protection measures through robust digital infrastructures. On the other hand, Indonesia, despite making progress, faces challenges with technological infrastructure, particularly in remote and rural areas. Their research also emphasizes the importance of compliance with Indonesia's Personal Data Protection Law (UU PDP), which provides a clear legal framework for data protection. However, even though such regulations exist, enforcement is often suboptimal, especially as AI technology develops rapidly and across international borders. AI tends to evolve much faster than the regulatory framework, creating legal gaps that AI platform developers can exploit. Nevertheless, having these regulations is still better than having none at all.

Furthermore, the study [101] reviews and proposes PrivAI as an alternative solution, a decentralized platform specifically designed to protect privacy in the use of personalized AI services. PrivAI addresses privacy challenges arising from the need to share personal data by limiting the distribution of users' raw data while still enabling AI personalization through the sharing of common models and community updates. PrivAI uses a cloud-based approach for model training, local personalization, and intellectual property protection through trusted execution environments. Experiments conducted showed that PrivAI is effective and performs comparably to existing traditional methods.

PrivAI is one of the implementations of Privacy-Enhancing Computation (PEC) that leverages technologies such as differential privacy, federated learning, and homomorphic encryption to safeguard individual privacy while allowing data analysis. PrivAI enables companies to harness big data without compromising individual privacy. One of PrivAI's primary focuses is to avoid disclosing sensitive information while still allowing AI to perform useful analyses. This is crucial given the growing concerns about data breaches and misuse of personal information in the digital era. Regarding Private AI, Khowaja et al. [102] proposed a federated learning and encryption-based private (FLEP), offering double security for data and model parameters. While this method enhances security, it slightly increases execution time. The study also highlights the challenges in fully realizing the FLEP framework. Besides FLEP, research [103] also suggests another alternative by using differential privacy (DP) to address the leakage of sensitive information from training data, particularly in medical imaging.

The research by [43] offers an approach to strengthen the methodology and substantive impact of AI ethics. One way to achieve this is by adopting tools from other fields, such as systems theory, safety research, impact assessment, and change theory, which can enhance decision quality and desired outcomes in AI development. The authors emphasize that current AI ethics approaches, often based on applied ethical principles, are frequently ineffective due to limitations in their real-world application. They propose that AI ethics can be methodologically strengthened by integrating resources from other disciplines, similar to how bioethics has been successfully applied in medical contexts. The study also highlights the need for more comprehensive and practical ethical guidelines to improve the impact and sustainability of ethics in AI system development and implementation.

Additionally, the Institute of Electrical and Electronics Engineers (IEEE), a global organization, plays a role in providing ethical AI standardization guidelines. IEEE focuses on the ethical alignment of AI design through its global initiative, the "Global Initiative on Ethics of Autonomous Intelligent Systems." The organization has set five main goals to ensure that autonomous AI systems are developed with consideration for human rights, welfare, accountability, transparency, and the reduction of misuse risks. Furthermore, IEEE seeks to strengthen these standards by translating documents into various languages and developing globally agreed-upon assessment tools, although these remain guidelines without legal enforcement.

Moreover, if deemed necessary and viewed as a critical issue by nations, countries could collaborate through international organizations such as the United Nations (UN) to draft widely adopted regulations. This cooperation should include effective enforcement mechanisms across jurisdictions, such as mandatory audits and transparency obligations for global tech companies. Nations could also form alliances to support the exchange of information related to AI security and privacy, thereby creating stricter oversight of technologyplatforms that violate privacy rights. Regular discussion forums could also be held to update policies in line with technological advancements, ensuring that regulations remain relevant and adaptive to changes. According to the authors, such efforts would encourage the world to build a safer and fairer AI ecosystem, where user privacy is more optimally protected without compromising technological innovation. A summary of the challenges and solutions regarding AI ethics and user privacy concerns is shown in Fig. 5.

IV. CONCLUSION

The rapid advancement in AI technology presents serious challenges related to ethics and privacy, as AI becomes increasingly involved in nearly every aspect of human life, from healthcare and transportation to retail, energy, education, and even entertainment. The use of AI to analyze large and sensitive data, such as personal and health records, raises the risk of privacy breaches if the data is not properly managed. Trends like generative AI and deepfakes add complexity to this issue with the potential for misuse that can lead to fraud, defamation, and the spread of false information. To address these challenges, it is crucial to implement stringent and transparent regulations, such as GDPR and CCPA, which provide individuals with greater control over their personal data and ensure that data is not misused. Additionally, the development of technologies like PrivAI and the application of privacy security principles in AI models can help protect personal information while still leveraging the power of data analysis. Global regulations and international cooperation are also essential to create consistent and effective standards for protecting privacy worldwide.

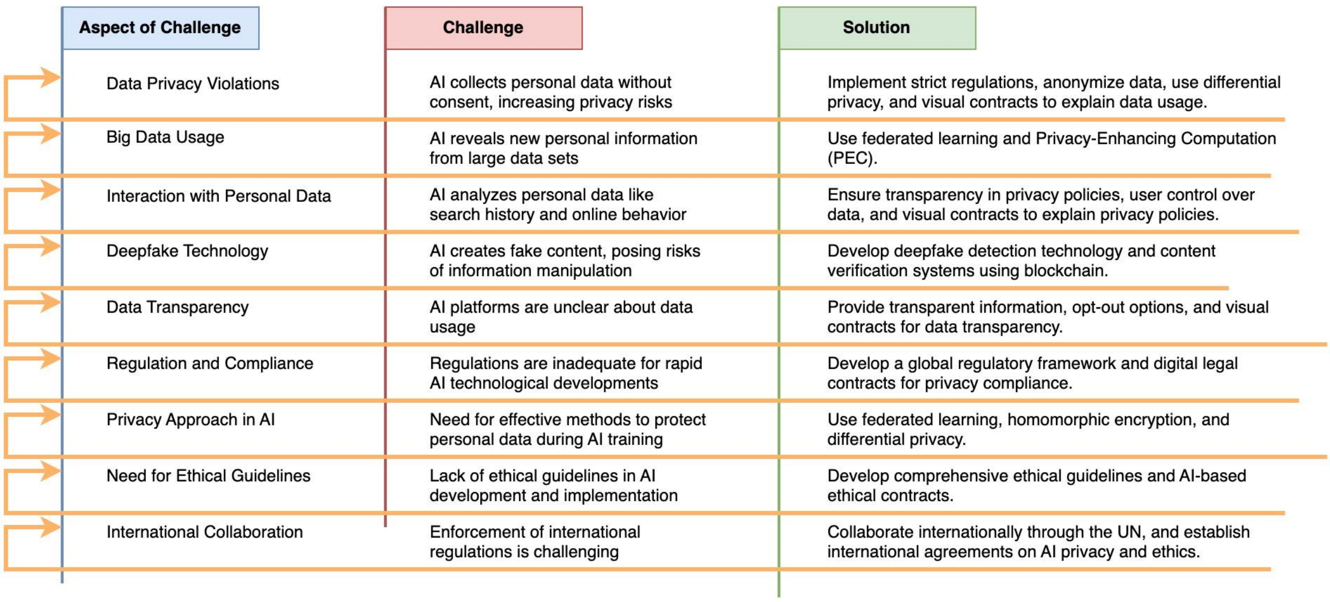

Fig. 5. Challenges and solutions for concerns about AI user ethics and privacy

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