EAI Endorsed Transactions
on Scalable Information Systems
Review Article EAI.EU

AI-Enabled Tools: Shaping the Future of Technology

Chinimilli Venkata Rama Padmaja[1], Priyanka Kumari Bhansali[2], J Sirisha Devi[3] Sukanya Ledalla[4], Mary Swarna Latha Gade[5,*]

[1]Dept of Computer Science & Engineering, Institute of Aeronautical Engineering, Hyderabad, India.
[2]Dept of Computer Science & Systems Engineering, Andhra University, Visakhapatnam, India.
[3]Dept of Computer Science & Engineering, Koneru Lakshmaiah Education Foundation, Bowrampet, Hyderabad-500043, India
[4]Dept of Computer Science & Engineering, Koneru Lakshmaiah Education Foundation, Bowrampet, Hyderabad-500043, India
[5]Dept of Computer Science & Engineering, Institute of Aeronautical Engineering, Hyderabad, India.

Abstract

INTRODUCTION: AI-enabled tools are revolutionizing various fields, ushering in a transformative era for technology and industry. These advancements impact diverse sectors, from customer service and industrial design to cybersecurity and computer vision, reshaping human-computer interactions.
OBJECTIVES: This article explores the applications and advancements of AI tools, focusing on chatbots, image and text generation, literature review research, AI-driven coding tools, and emerging applications in cybersecurity and media analysis. It also provides an overview of publicly available AI tools and conducts a comparative analysis of leading chatbots.
METHODS: A comprehensive review and analysis were conducted on tools including ChatGPT, CodeGPT, and AI systems for image and text generation. The study also examined AI applications in spear phishing defense, facial recognition across age variations (FaceNet), and deepfake detection, alongside a comparative analysis of chatbots such as ChatGPT, Google Bard, LLaMA, and MS Bing.
RESULTS: The exploration revealed that chatbots like ChatGPT have redefined customer service, while AI tools for image generation impact art, medical imaging, and industrial design. AI-driven text generation and coding tools enhance content creation and software development efficiency. Additionally, AI applications in cybersecurity, facial recognition, and deepfake detection demonstrate the technology's growing societal relevance. Comparative analysis of chatbots highlighted their distinct capabilities across platforms.
CONCLUSION: AI-enabled tools are shaping the future of technology, driving innovation, and expanding possibilities across industries and societal domains. The findings emphasize the need for continued exploration, ethical application, and responsible deployment to maximize their potential while addressing associated challenges.

Received on 17 December 2024; accepted on 09 October 2025; published on 09 October 2025

Keywords: AI-enabled tools, chatbots, ChatGPT, AI image generation, AI text generation, CodeGPT

doi:10.4108/eetsis.8213

1. Introduction

The rapid advancement of artificial intelligence (AI) has led to the emergence of a wide range of AI-enabled tools that are transforming industries from customer service to software development. These tools leverage machine learning, natural language processing (NLP), and other advanced techniques to perform tasks that traditionally required human expertise. Among them, chatbots such as ChatGPT have become powerful instruments for enhancing communication and user engagement. ChatGPT, developed by OpenAI, utilizes sophisticated NLP models to interpret and respond to user queries in a human-like manner, making it an invaluable asset for customer support and interactive applications [1].

*Corresponding author. Email: cvrpadmaja@gmail.com

Beyond conversational systems, AI tools for image generation have made significant strides in fields as diverse as art, cultural heritage, medical imaging, and industrial design. By harnessing deep learning models, these systems can create, modify, and enhance images—reconstructing historical artifacts, assisting in medical diagnostics, and enabling innovative product design [2, 3]. Such capabilities not only save time and resources but also open new frontiers for creativity and problem-solving.

Text generation is another domain experiencing rapid growth. AI-powered writing systems now support tasks ranging from academic literature reviews to journalism and creative writing. Leveraging large language models, these tools produce coherent, contextually relevant text, thereby reducing the time required for drafting and analysis. For researchers, AI can assist in summarizing extensive bodies of literature and extracting key insights, while for media professionals, it can generate preliminary drafts of reports that are subsequently refined by editors [4].

In software engineering, AI-driven coding assistants such as CodeGPT are reshaping the development lifecycle. These tools provide intelligent code suggestions, error detection, and automated debugging, thereby accelerating productivity and allowing developers to focus on higher-level design and innovation. By learning from vast repositories of existing code, such systems can recommend efficient programming solutions and foster rapid prototyping [5].

AI technologies are being applied across a wide range of domains, including natural language processing, image and video generation, software development, cybersecurity, and computer vision. For example, AI-based methods have been proposed to enhance spear phishing defense [46], frameworks like FaceNet address facial recognition across age variations [47], and studies on deepfakes explore trends, applications, and detection challenges in synthetic media [48].

Although several studies have investigated individual AI applications—such as deep learning architectures, image recognition models, or generative text systems—there remains a lack of comprehensive analyses that examine publicly available tools across multiple domains. Given the increasing integration of AI technologies into academic, industrial, and creative practices, there is a pressing need to evaluate their capabilities, comparative strengths, and limitations in a structured manner.

This paper makes the following contributions:

- Presents a structured overview of AI tools across five domains: chatbots, image generation, text generation, literature review assistance, and coding support.
- Provides a comparative analysis of leading chatbots (ChatGPT, Google Bard, LLaMA, and MS Bing), highlighting their functionalities, accessibility, and unique strengths.
- Discusses the broader implications of AI tool adoption in research, industry, and education, identifying emerging opportunities and challenges.

By addressing these dimensions, the study seeks to illustrate the transformative potential of AI-enabled tools and contribute to a clearer understanding of their evolving role in shaping future technologies.

2. Chatbots and ChatGPT

Chatbots have significantly evolved over the years, becoming a crucial component of many applications and services. They range from simple rule-based systems to complex AI-driven models capable of understanding and generating human-like text. Early chatbots, such as ELIZA and ALICE, laid the groundwork for modern conversational agents by using scripted responses to simulate conversation [6]. However, the advent of deep learning and natural language processing (NLP) has enabled the development of more sophisticated systems like ChatGPT.

ChatGPT, based on the Generative Pre-trained Transformer (GPT) architecture, is a state-of-the-art language model developed by OpenAI [7]. It leverages massive datasets and transformer networks to generate coherent and contextually relevant text. ChatGPT's architecture represents a significant advancement over earlier models due to its ability to capture complex language patterns and its scalability in handling large datasets [8].

The capabilities of ChatGPT are evident across various domains, including education, healthcare, and customer service. In education, ChatGPT can assist with tutoring, provide explanations, and answer questions [9]. In healthcare, it has been evaluated for tasks such as diagnosing symptoms and providing medical information, although caution is advised due to the need for accuracy and reliability [10].

A key advantage of ChatGPT is its ability to adapt to different conversational contexts and generate diverse responses. This flexibility is crucial for applications requiring dynamic interaction, such as virtual assistants and interactive storytelling [11]. However, ChatGPT has limitations; it may produce incorrect or biased outputs, reflecting the data on which it was trained [12]. Consequently, ongoing research aims to enhance the model's robustness and fairness.

The competition in the chatbot space is intense, with other notable models like Google's Bard and Microsoft's

Table 1. Comparison of ChatGPT (GPT 3.5), Bard, Bing Chat (GPT-4), and Llama-2.

Feature	**ChatGPT (GPT 3.5)**	**Bard**	**Bing Chat (GPT-4)**	**Llama-2**
Accuracy	Popular but less accurate; improved by Bard	Highly accurate; often more precise than ChatGPT	Most accurate of the group	Generally least accurate
Versatility	Highly versatile; excels in text generation, translation, and content creation	Effective in text and conversational tasks	Capable of text generation, language translation, and creative content; less versatile than ChatGPT and Bard	Moderately versatile; better than Bing Chat but not as versatile as ChatGPT and Bard
Company	OpenAI	Google	Microsoft	Meta
Primary Purpose	Creative text production	Conversational AI and interaction	Integrated information retrieval	Text generation and translation
Integration	Standalone model	Standalone model	Integrated with Bing search; more complex user experience	Standalone model
Ease of Use	Intuitive and user-friendly	Simple to use	Less intuitive due to integration complexity	Straightforward and easy to use
Access to Online Data	Limited to pre-2021 data	Yes, real-time access	Yes, provides up-to-date information	Yes, can access current data
Cost	Free version; GPT-4 at $20/month	Free access	Free of charge	Free access
Availability	Open to the public	Publicly available	Publicly available	Publicly accessible
Architecture	Built on GPT (Generative Pre-trained Transformer)	Utilizes Google's PaLM2	Based on advanced GPT architecture	Employs Transformer architecture
Plagiarism Detection	Equipped with plagiarism detection	Lacks a plagiarism detector	No built-in plagiarism detection	Designed to minimize plagiarism risk
Language Support	Supports multiple languages but with varying fluency	Primarily optimized for English; supports other languages	Strong multilingual capabilities	Focuses on major languages, especially English
Customization	Allows for fine-tuning and customization for specific use cases	Limited customization options available	Offers customization through Azure AI services	Customizable for research and specific applications
Response Time	Generally quick response times	Fast and responsive	Typically fast due to integration with Bing search	Variable response times depending on the task
Data Privacy	Data used for training up to 2021; privacy measures in place	Google's privacy policies apply; ongoing improvements	Data handled per Microsoft's privacy standards	Adheres to Meta's privacy guidelines
Limitations	May produce less coherent or accurate content	Less innovative compared to ChatGPT	Can sometimes deliver incomplete information	Smaller dataset may limit topic coverage

Bing Chat (GPT-4) offering distinct features and capabilities [9]. Bard focuses on delivering concise and accurate responses by leveraging Google's vast search infrastructure [?], while Bing Chat integrates seamlessly with Microsoft's ecosystem, providing a powerful tool for retrieving and summarizing information [13].

As highlighted in Table 1, each model exhibits unique strengths and weaknesses. For instance, while ChatGPT is known for its versatility and creative text generation, Bing Chat excels in accuracy and integration with search functionalities. Such comparisons are essential for understanding the relative capabilities of these advanced AI models [11].

The development of open and efficient language models like LLaMA-2 further emphasizes the trend towards accessible AI technologies [14]. LLaMA-2 aims to democratize AI by offering a model that can be easily deployed and adapted for various applications, highlighting the significance of open-source initiatives in the AI community [6].

As the field of AI continues to advance, the role of chatbots and models like ChatGPT is expected to expand, with potential applications in areas such as legal assistance, content creation, and beyond [15]. Ensuring the ethical use and continuous improvement of these technologies remains a priority for developers and researchers alike.

3. AI Tools for Image Generation

The advancement of artificial intelligence (AI) has significantly impacted various fields, including image and video generation. This section explores AI tools used in image generation, with a focus on diffusion models, traditional image generation techniques, and the latest developments in video generation from text.

3.1. Diffusion Models

Diffusion models have emerged as a powerful approach for generating high-quality images. These models work by iteratively adding noise to an image and then learning to reverse this process, ultimately generating a coherent image from random noise. Notable examples include the work by Ho et al. [16], who developed cascaded diffusion models to enhance image fidelity, and Dhariwal and Nichol [17], who demonstrated that diffusion models outperform Generative Adversarial Networks (GANs) in image synthesis. Recent advancements, such as Stable Diffusion [18], utilize latent space representations to achieve efficient and high-quality image generation, reducing computational requirements while maintaining impressive results.

3.2. Image Generation

AI tools for image generation have made substantial progress in recent years. Generative Adversarial Networks (GANs) have been instrumental in this domain. Variants such as StyleGAN and BigGAN have set benchmarks for high-resolution image synthesis and manipulation. For example, StyleGAN2 allows for the generation of highly realistic images with fine-grained control over attributes [19]. In addition to GANs, diffusion models developed by Kim et al. [20] and Nichol et al. [21] have shown promising results in generating detailed images from textual descriptions. These tools enhance capabilities in fields ranging from art and design to historical image reconstruction.

AI applications also extend to scientific and medical domains. For instance, DeepMind's AlphaFold predicts protein structures, which are essential for understanding diseases. Convolutional neural networks (CNNs) improve medical image registration and segmentation [21]. Tools for reconstructing historical artifacts and artworks, such as neural style transfer and super-resolution algorithms, enhance and restore historical images, revealing previously obscured details [22]. Additionally, interactive tools like Drag Your GAN allow real-time image manipulation, enabling users to achieve desired results without extensive technical expertise [**?**].

Cross-modal generation models, such as DALL·E and CLIP, facilitate the generation of images from text and vice versa, expanding content creation possibilities across different formats [19].

3.3. Video Generation from Text

The ability to generate videos from textual descriptions represents a cutting-edge development in AI. Text-to-video models create dynamic visual content based on input text. For instance, Li et al. [23] explored foundational techniques for video generation from text. Recent advancements include Make-A-Video [24], which generates videos without relying on paired text-video datasets, and VideoDirectorGPT [25], which guides multi-scene video generation using large language models (LLMs). These innovations broaden the possibilities for creating and manipulating video content across various applications.

The integration of advanced AI tools for image and video generation continues to drive innovation and creativity across multiple domains. From diffusion models and GANs to cutting-edge text-to-video techniques, these tools are reshaping how visual content is created and manipulated.

4. AI Tools for Text Classification

Text classification is a critical component of natural language processing (NLP) that involves assigning predefined categories to textual data. Various tools and models have been developed to enhance the accuracy and efficiency of text classification, playing a pivotal role in applications such as sentiment analysis, spam detection, and topic categorization.

NLTK (Natural Language Toolkit) is one of the earliest and most comprehensive libraries for text processing in Python. It provides a wide range of tools for text classification, including tokenization, stemming, tagging, parsing, and semantic reasoning. NLTK is widely used in educational settings for teaching NLP concepts, and it remains a valuable resource for both beginners and experienced developers [26].

spaCy is another popular library for NLP that offers a modern and efficient approach compared to NLTK. Designed for industrial use, it provides features such as tokenization, part-of-speech tagging, dependency parsing, named entity recognition, and support for deep learning models. spaCy is particularly known for its speed and ease of integration into larger applications [27].

The introduction of transformer-based models has revolutionized text classification. Hugging Face's Transformers library provides access to state-of-the-art models such as BERT, RoBERTa, and ALBERT, which have significantly improved the performance of text classification tasks. These models are pre-trained on large corpora and can be fine-tuned for specific tasks, making them highly versatile and effective in various NLP applications [28–30].

ALBERT is a variant of BERT designed to be more memory-efficient and faster while maintaining high accuracy. It achieves this by reducing the number of parameters and using cross-layer parameter sharing, making it particularly useful in scenarios where computational resources are limited but high performance is required [29].

RoBERTa is another enhancement of the original BERT model, focused on improving training efficiency and robustness. By utilizing more data and larger batch sizes during training, RoBERTa has achieved state-of-the-art results on various NLP benchmarks. It is a robust and optimized model for text classification tasks, offering higher accuracy and faster inference times compared to its predecessors [30].

Text classification tools also play a crucial role in AI education. For instance, research by Reddy et al. explores the use of text classification to enhance AI education, helping students understand and apply NLP concepts effectively [31]. Such educational tools are vital for building the next generation of AI professionals.

Overall, the landscape of text classification has evolved significantly with the advent of advanced tools and models. Libraries like NLTK and spaCy provide foundational support for NLP tasks, while transformer-based models such as BERT, ALBERT, and RoBERTa offer state-of-the-art solutions for more complex text classification challenges.

5. AI Tools for Literature Review Research

The integration of artificial intelligence (AI) into the literature review process has emerged as a transformative approach, streamlining tasks that traditionally required significant manual effort. AI tools have become invaluable for researchers by automating the identification of relevant literature, extracting key information, and generating summaries, thereby enhancing both the efficiency and thoroughness of reviews [32, 33].

One such tool exemplifying this shift is PDFGPT [34], which leverages the advanced capabilities of the GPT-3 model. PDFGPT can process and extract data from PDF documents, respond to user inquiries with detailed answers, and generate concise summaries. Its ability to handle large volumes of text and distill it into actionable insights represents a significant advancement in managing academic literature.

In addition to PDFGPT, platforms such as Elicit.org have introduced further innovations in automating literature reviews. Elicit.org provides a suite of features that assist researchers in locating relevant studies, summarizing findings, and visualizing data, facilitating a more comprehensive understanding of the literature landscape.

However, the adoption of AI tools in research is not without challenges. A critical concern is the generation of fake references and citations, particularly when using language models like ChatGPT [35, 36]. Due to the generative nature of these models, they can produce text that appears to be a valid citation, but the references may be entirely fabricated. This occurs because the model may generate text that mimics the structure and style of academic citations without corresponding to actual published sources [37].

The implications of such inaccuracies are significant. Fake citations can undermine the credibility of research, lead to erroneous conclusions, and potentially compromise the integrity of the scientific process. Additionally, spurious references obscure the true sources of information, complicating efforts to replicate or verify findings [38].

To mitigate these concerns, researchers must implement strategies to ensure the accuracy and reliability of AI-generated citations. Quality control mechanisms need to be rigorously applied, and tools must be continually refined to minimize the risk of generating misleading information. One promising development in this area is the WebChatGPT extension, which enhances citation accuracy by using algorithms designed to detect and eliminate false references [39]. This tool represents a step forward in ensuring that AI-assisted research remains credible and trustworthy.

6. CodeGPT and AI-Assisted Code Generation Tools

The emergence of AI-assisted code generation tools has significantly impacted the software development landscape, with various models and platforms aiming to streamline the coding process. Among these, CodeGPT and similar tools such as GitHub Copilot, Amazon CodeWhisperer, and Code Llama have garnered substantial attention for their potential to enhance productivity and code quality.

CodeGPT exemplifies a new generation of AI-driven coding assistants. Built on advanced language models, CodeGPT assists developers by generating code snippets, offering suggestions, and providing explanations for code segments. Leveraging large-scale models, it understands and produces human-like code based on contextual inputs from developers, simplifying the coding process and reducing development time.

GitHub Copilot is another major player in this domain, extensively evaluated for its impact on code quality. Research indicates that while Copilot can accelerate coding by suggesting completions and generating boilerplate code, its effectiveness depends on producing high-quality, contextually relevant output. Studies report mixed results, with some showing significant productivity gains and others highlighting potential issues with code reliability and correctness [40].

Amazon CodeWhisperer offers a complementary approach by integrating into various development environments to suggest code completions and identify potential issues in real-time. This tool enhances developer efficiency by supporting faster and more accurate coding practices.

Code Llama, another notable model, leverages open foundation models to generate code. By adapting to multiple programming languages and frameworks, Code Llama addresses diverse coding needs and reflects the growing trend of using large language models for complex software development tasks [41].

AI-assisted tools are also impacting end-user website generation. By leveraging large language models, these tools enable users—both technical and non-technical—to generate and customize functional, aesthetically pleasing websites without extensive programming knowledge [42].

Despite their advantages, AI-assisted coding tools face several challenges. Evaluations often reveal mixed outcomes, ranging from improved efficiency to concerns about code quality and reliability [43]. The integration of AI into the software development process requires continuous assessment and refinement to ensure these tools fulfill their potential without introducing new issues. Table 2 provides a collection of publicly available AI/LLM tools designed for various applications.

7. AI Applications in Security, Vision, and Media

AI is increasingly being leveraged beyond general-purpose tools, with applications in cybersecurity, computer vision, and media analysis.

Cybersecurity and Spear Phishing Detection: Targeted phishing attacks pose a growing threat in the digital landscape. AI-based solutions have been explored to enhance spear phishing defense by detecting malicious content, predicting attack patterns, and providing automated response strategies. The study "Enhancing Spear Phishing Defense with AI: A Comprehensive Review and Future Directions" [46] provides a detailed overview of AI methods for identifying and mitigating spear phishing threats, highlighting current capabilities and research gaps.

Facial Recognition and Age Variation: Computer vision has seen significant advancements with AI frameworks such as FaceNet [47], which generates robust facial embeddings for recognition across age variations. FaceNet's approach allows for accurate identity verification, age estimation, and clustering, demonstrating the power of deep learning models in handling complex visual recognition tasks.

Deepfake Detection and Analysis: The emergence of synthetic media, particularly deepfakes, has raised concerns about content authenticity. A bibliometric analysis of deepfakes [48] examines trends, applications, and challenges in this area, highlighting AI-based techniques to detect manipulated videos and images. Such research underscores the dual role of AI in both enabling advanced media creation and addressing the risks associated with synthetic content.

8. Conclusion and Future Directions

The rapid advancement of AI technologies has introduced transformative tools across multiple domains, including text generation, image creation, text classification, literature surveys, code generation, cybersecurity, computer vision, and media analysis. Chatbots such as ChatGPT have revolutionized natural language processing, enabling more intuitive human-computer interactions. AI-driven image generation tools are expanding creative capabilities, offering novel methodologies for artists and designers. Text classification tools have significantly improved the efficiency and accuracy of data processing, facilitating the management and interpretation of large datasets.

In academic research, AI tools for literature surveys have demonstrated great promise in automating the identification, extraction, and summarization of scholarly content. However, the emergence of fabricated references generated by AI underscores the necessity of rigorous validation processes to maintain the integrity of academic work. Similarly, AI-powered code generation tools like GitHub Copilot and CodeGPT have shown potential in streamlining software development, though they also raise challenges related to code quality, security, and ethical considerations.

AI has also made significant contributions in cybersecurity, computer vision, and media analysis. Recent studies have demonstrated AI-based methods for enhancing spear phishing defense [46], frameworks like FaceNet for age-invariant facial recognition [47], and deepfake detection approaches that address trends, applications, and challenges in synthetic media [48]. These applications illustrate the growing reach of AI technologies and the importance of addressing associated risks and ethical considerations.

Table 2. Publicly Available AI / LLM Tools

Tool	Function	Availability
ChatGPT	Conversational AI Chatbot	Both
RoomGPT	Redesign your room in eight different themes	Public
HomeGPT	Redesign your home and office	Subscription based
PDFGPT.IO	Turns PDF into the knowledge base for a ChatGPT type interface	Subscription based
TexGPT	Harnesses GPT-3's power to help you write in Overleaf	Public
AcademicGPT	Write and review scientific papers, critical analysis	Public
DiagramGPT	Creating scientific diagrams and flow charts	Public
BloombergGPT	Large Language Model for Finance	NA
AutoGPT	Auto-prompting without user intervention	Public
AgentGPT	Autonomous AI agent in the browser	Public
HuggingGPT	A framework to connect various AI models	Public
XrayGPT	Automated analysis of chest radiographs	Public
Video-ChatGPT	Vision language model for video understanding	Public
ClimateGPT	Conversation about climate in English and Arabic	Public
CodeGPT	AI assistant for coding	Public
Code Llama	Open Foundation Models to generate and discuss code	Public
MiniGPT-4	Multi-modal model for various tasks, including image generation	Public
BiomedGPT	Unified Biomedical Generative Pretrained Transformer	Public
SkinGPT	Interactive Dermatology Diagnostic System	Public
PatientGPT	AI engine for healthcare navigation	Subscription based
SentimentGPT	Sentiment analysis using GPT	Public
DrugGPT	GPT-based model for drug design	Public
Elicit	AI research assistant for automated literature reviews	Public
Citation AI	AI research assistant for evidence-based answers	Subscription based
Midjourney AI	Tool for creating synthetic images	Subscription based
DALL.E2	Create realistic images and art from text descriptions	Subscription based
VALL-E	Audio synthesization tool	Public
Gen-2	Video generation using text, images, and videos	Public
AI Avatar	Avatar generation	Public
Langchain	Building applications with LLMs through composability	Public

As AI continues to evolve, its integration across sectors demands a careful balance between leveraging benefits and mitigating risks. Ensuring responsible and ethical use of these technologies is essential for maximizing their potential while safeguarding the quality and credibility of outputs. Moving forward, a multidisciplinary approach that combines technological innovation with ethical oversight will be critical in harnessing AI's full capabilities for the betterment of society.

Future research should focus on enhancing the robustness, transparency, and ethical frameworks governing AI tools to ensure their responsible integration across domains. By addressing these challenges, the full potential of AI can be realized, fostering innovation, efficiency, and integrity across multiple disciplines.

References

[1] OpenAI (2023) *Introducing ChatGPT* (Retrieved from https://www.openai.com/chatgpt)

[2] A. Elgammal, B. Liu, M. Elhoseiny and M. Mazzone (2017) *CAN: Creative Adversarial Networks, Generating "Art" by Learning About Styles and Deviating from Style Norms* (arXiv preprint arXiv:1706.07068)

[3] D. Shen, G. Wu and H. I. Suk (2018) *Deep learning in medical image analysis* (Annual Review of Biomedical Engineering), vol. 19, pp. 221-248.

[4] A. Radford, J. Wu, R. Child, D. Luan, D. Amodei and I. Sutskever (2019) *Language models are unsupervised multitask learners* (OpenAI Blog), vol. 1, no. 8, pp. 9.

[5] M. Chen, J. Tworek, H. Jun, Q. Yuan, H. P. de Oliveira Pinto, J. Kaplan, ... and W. Zaremba (2021) *Evaluating large language models trained on code* (arXiv preprint arXiv:2107.03374)

[6] E. Adamopoulou and L. Moussiades (2020) *Chatbots: History, technology, and applications* (Machine Learning with Applications, vol. 2, p. 100006).

[7] Ö. Aydin and E. Karaarslan (2023) *Is ChatGPT leading generative AI? What is beyond expectations* (What is Beyond Expectations).

[8] H. Trng (2023) *ChatGPT in education—a global and Vietnamese research overview*.

[9] J. Rudolph, S. Tan, and S. Tan (2023) *War of the chatbots: Bard, Bing Chat, ChatGPT, Ernie and beyond. The new AI gold rush and its impact on higher education* (Journal of

Applied Learning and Teaching, vol. 6, no. 1).
[10] M. J. Ali (2023) *ChatGPT and lacrimal drainage disorders: Performance and scope of improvement* (Ophthalmic Plastic and Reconstructive Surgery, vol. 39, no. 3, p. 221).
[11] S. Bhardwaz and J. Kumar (2023) *An extensive comparative analysis of chatbot technologies - ChatGPT, Google Bard and Microsoft Bing* (in 2023 2nd International Conference on Applied Artificial Intelligence and Computing (ICAAIC), pp. 673–679).
[12] T. Wu, S. He, J. Liu, S. Sun, K. Liu, Q.-L. Han, and Y. Tang (2023) *A brief overview of ChatGPT: The history, status quo and potential future development* (IEEE/CAA Journal of Automatica Sinica, vol. 10, no. 5, pp. 1122–1136).
[13] R. Thoppilan, D. De Freitas, J. Hall, N. Shazeer, A. Kulshreshtha, H.-T. Cheng, A. Jin, T. Bos, L. Baker, Y. Du, et al. (2022) *LaMDA: Language models for dialog applications* (arXiv preprint arXiv:2201.08239).
[14] X. Amatriain (2023) *Transformer models: An introduction and catalog* (arXiv preprint arXiv:2302.07730).
[15] H. Touvron, T. Lavril, G. Izacard, X. Martinet, M.-A. Lachaux, T. Lacroix, B. Rozière, N. Goyal, E. Hambro, F. Azhar, et al. (2023) *Llama: Open and efficient foundation language models* (arXiv preprint arXiv:2302.13971).
[16] L. Zhang (2023) *Four tax questions for ChatGPT and other language models*.
[17] J. Ho, C. Saharia, W. Chan, D. J. Fleet, M. Norouzi, and T. Salimans (2022) *Cascaded diffusion models for high fidelity image generation* (The Journal of Machine Learning Research, vol. 23, no. 1, pp. 2249–2281).
[18] P. Dhariwal and A. Nichol (2021) *Diffusion models beat gans on image synthesis* (Advances in neural information processing systems, vol. 34, pp. 8780–8794).
[19] S. AI (2022) *Stablediffusion2.1 release* (Accessed on August 3, 2023) [Online]. Available: https://stability.ai/blog/stablediffusion2-1-release7-dec-2022
[20] M.-Y. Liu, X. Huang, J. Yu, T.-C. Wang, and A. Mallya (2021) *Generative adversarial networks for image and video synthesis: Algorithms and applications* (Proceedings of the IEEE, vol. 109, no. 5, pp. 839–862).
[21] C. Saharia, W. Chan, H. Chang, C. Lee, J. Ho, T. Salimans, D. Fleet, and M. Norouzi (2022) *Palette: Image-to-image diffusion models* (ACM SIGGRAPH 2022 Conference Proceedings, pp. 1–10).
[22] A. Nichol, P. Dhariwal, A. Ramesh, P. Shyam, P. Mishkin, B. McGrew, I. Sutskever, and M. Chen (2021) *Glide: Towards photorealistic image generation and editing with text-guided diffusion models* (arXiv preprint arXiv:2112.10741).
[23] J. R. Hershey and P. A. Olsen (2007) *Approximating the Kullback-Leibler divergence between Gaussian mixture models* (in 2007 IEEE International Conference on Acoustics, Speech and Signal Processing-ICASSP'07, vol. 4, pp. IV-317–IV-320, IEEE).
[24] X. Pan, A. Tewari, T. Leimkühler, L. Liu, A. Meka, and C. Theobalt (2023) *Drag your gan: Interactive point-based manipulation on the generative image manifold* (ACM SIGGRAPH 2023 Conference Proceedings, pp. 1–11).
[25] Y. Li, M. Min, D. Shen, D. Carlson, and L. Carin (2018) *Video generation from text* (Proceedings of the AAAI Conference on Artificial Intelligence, vol. 32).
[26] U. Singer, A. Polyak, T. Hayes, X. Yin, J. An, S. Zhang, Q. Hu, H. Yang, O. Ashual, O. Gafni, et al. (2022) *Make-a-video: Text-to-video generation without text-video data* (arXiv preprint arXiv:2209.14792).
[27] H. Lin, A. Zala, J. Cho, and M. Bansal (2023) *Videodirectorgpt: Consistent multi-scene video generation via llm-guided planning* (arXiv preprint arXiv:2309.15091).
[28] E. Loper and S. Bird (2002) *NLTK: The natural language toolkit* (arXiv preprint cs/0205028).
[29] Y. Vasiliev (2020) *Natural language processing with Python and spaCy: A practical introduction* (No Starch Press).
[30] T. Wolf, L. Debut, V. Sanh, J. Chaumond, C. Delangue, A. Moi, P. Cistac, T. Rault, R. Louf, M. Funtowicz, et al. (2019) *Huggingface's transformers: State-of-the-art natural language processing* (arXiv preprint arXiv:1910.03771).
[31] Z. Lan, M. Chen, S. Goodman, K. Gimpel, P. Sharma, and R. Soricut (2019) *ALBERT: A lite BERT for self-supervised learning of language representations* (arXiv preprint arXiv:1909.11942).
[32] Y. Liu, M. Ott, N. Goyal, J. Du, M. Joshi, D. Chen, O. Levy, M. Lewis, L. Zettlemoyer, and V. Stoyanov (2019) *RoBERTa: A robustly optimized BERT pretraining approach* (arXiv preprint arXiv:1907.11692).
[33] T. Reddy, R. Williams, and C. Breazeal (2021) *Text classification for AI education* (SIGCSE, p. 1381).
[34] J. Pachouly, S. Ahirrao, K. Kotecha, G. Selvachandran, and A. Abraham (2022) *A systematic literature review on software defect prediction using artificial intelligence: Datasets, data validation methods, approaches, and tools* (Engineering Applications of Artificial Intelligence, vol. 111, p. 104773).
[35] E. A. Van Dis, J. Bollen, W. Zuidema, R. van Rooij, and C. L. Bockting (2023) *ChatGPT: Five priorities for research* (Nature, vol. 614, no. 7947, pp. 224–226).
[36] K. Nguyen-Trung, A. K. Saeri, and S. Kaufman (2023) *Applying ChatGPT and AI-powered tools to accelerate evidence reviews*.
[37] N. Gleason (2022) *ChatGPT and the rise of AI writers: How should higher education respond?* (Times Higher Education).
[38] G. Cooper (2023) *Examining science education in ChatGPT: An exploratory study of generative artificial intelligence* (Journal of Science Education and Technology, vol. 32, pp. 444–452).
[39] Z. Epstein, A. Hertzmann, I. of Human Creativity, M. Akten, H. Farid, J. Fjeld, M. R. Frank, M. Groh, L. Herman, N. Leach, et al. (2023) *Art and the science of generative AI* (Science, vol. 380, no. 6650, pp. 1110–1111).
[40] L. Skavronskaya, A. H. Hadinejad, and D. Cotterell (2023) *Reversing the threat of artificial intelligence to opportunity: A discussion of ChatGPT in tourism education* (Journal of Teaching in Travel & Tourism, vol. 23, no. 2, pp. 253–258).
[41] J. Huang and K. C.-C. Chang (2023) *Citation: A key to building responsible and accountable large language models* (arXiv preprint arXiv:2307.02185).
[42] B. Yetiştiren, I. Özsoy, M. Ayerdem, and E. Tüzün (2023) *Evaluating the code quality of AI-assisted code generation tools: An empirical study on GitHub Copilot, Amazon CodeWhisperer, and ChatGPT* (arXiv preprint

arXiv:2304.10778).

[43] B. Rozière, J. Gehring, F. G. Baptiste, and J. G. e. a. (2023) *Code Llama: Open foundation models for code* (arXiv preprint arXiv:2304.10778).

[44] T. Calò and L. De Russis (2023) *Leveraging large language models for end-user website generation* (International Symposium on End User Development, pp. 52–61, Springer).

[45] A. M. Dakhel, V. Majdinasab, A. Nikanjam, F. Khomh, M. C. Desmarais, and Z. M. J. Jiang (2023) *GitHub Copilot AI pair programmer: Asset or liability?* (Journal of Systems and Software, vol. 203, p. 111734).

[46] M. Mohamed, N. Nachaat, H. Taherdoost, and M. Madanchian (2025) *Enhancing Spear Phishing Defense with AI: A Comprehensive Review and Future Directions* (EAI Endorsed Transactions on Scalable Information Systems, vol. 12, no. 1).

[47] C. H. Chethana, et al. (2025) *FaceNet – A Framework for Age Variation Facial Digital Images* (EAI Endorsed Transactions on Scalable Information Systems, vol. 12, no. 1).

[48] D. Garg and R. Gill (2024) *A Bibliometric Analysis of Deepfakes: Trends, Applications and Challenges* (EAI Endorsed Transactions on Scalable Information Systems, vol. 11, no. 6).