Indo Asian Journal of Management and Entrepreneurship (IAJOME)
‖ ISSN: 2319-2992, Impact Factor 5.007 ‖
‖ Peer-Reviewed | Open Access | International Journal ‖
‖ Volume: 17 | Issue: 07 | July 2026 | www.iajome.com ‖

A Review on Generative Artificial Intelligence and Its Applications

Mr.J.Jelsteen[1],E.Suriya[2] ,R Shurthi[3]

[1]Assistant Professor,[2,3]Student,

Department of Computer Applications, Sri Krishna Arts and Science College, Coimbatore

Abstract

Leonard Kleinrock pioneered the concept of generative artificial intelligence in 1962. Generative AI is the next frontier of AI, where the machines learn independent of human interaction. There are many different branches of AI, but generative AI stands out because it creates rather than analyzes data or predicts what is possible. The primary goal of generative AI is to make new digital content (text, images, audio, video, and computer code) using complex algorithms to derive new concepts and ideas. Advanced methods of deep learning such as Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs) and Transformer-based models are being developed today, and they are gaining a lot of attention for their ability to perform all types of generative tasks. This paper will provide a concrete overview of the different aspects of generative AI, including the crucial techniques for its implementation, the numerous application areas for generative AI, the benefits of using it, the challenges associated with it, the ethical implications of its use, and where it is heading in the future. Ultimately, the purpose of this paper is to explain clearly and concisely how generative AI plays an important role in many industries and demonstrate why it is now an integral part of modern computing systems.

Keywords

Generative Artificial Intelligence, GANs, Transformers, Deep Learning, Artificial Intelligence, Content Generation, Machine Learning

I. Introduction

Artificial Intelligence (AI) is one of the most important technologies of contemporary computing, and today it is used for a wide range of applications including speech recognition,

Indo Asian Journal of Management and Entrepreneurship (IAJOME)
‖ ISSN: 2319-2992, Impact Factor 5.007 ‖
‖ Peer-Reviewed | Open Access | International Journal ‖
‖ Volume: 17 | Issue: 07 | July 2026 | www.iajome.com ‖

image classification, recommendation systems, and intelligent decision support systems [1]. Traditional AI systems primarily focus on processing and analyzing historical data before being trained to recognize patterns and subsequently make predictions or classifications about future events based on these learned patterns [2].

As a result of advances in deep learning algorithms, availability of large datasets, and improved processing performance, AI systems that can auto-generate large amounts of content have come about within the last few years and referred to as Generative Artifical Intelligence [3]. Generative AI systems produce new samples of data that are similar to the original data (i.e., training data), but have their own unique characteristics [4]. AI can automatically create realistic example text, example images, example music, example speech, and example software code.

With the emergence of user-friendly tools such as Chat GPT for natural language generation, Dall E for image generation, and GitHub Copilot for code generation; real-world examples of the success of Generative AI are present throughout many segments of society [5]. Due to the ability to facilitate content generation and increase efficiency, Generative AI is rapidly establishing itself in education, health care, entertainment, business and computer software [6].

II. Overview of Generative Artificial Intelligence

Generative models are based on probabilistic modelling using deep neural networks, which represent the underlying probability distribution of a data set (3), and provide samples when generated according to that estimated distribution (7). Generative models, therefore, differ from traditional “discriminative models,” which are only focused on either classifying or predicting (2).

Training generative models requires that extensive large data sets be used for example for supervised learning, and therefore, also extensive amounts of computational resources (8). Access to cloud computing, GPUs, and distributed computing technologies have all enabled tremendous advances in generative model research and development (9).

In addition to the needs above, generative models can be used for a wide variety of applications such as data augmentation, simulation, and generating synthetically generated data, all of which can enhance other machine learning applications' performance (7). In particular, generating additional samples for training generative models can reduce the

Indo Asian Journal of Management and Entrepreneurship (IAJOME)
‖ ISSN: 2319-2992, Impact Factor 5.007 ‖
‖ Peer-Reviewed | Open Access | International Journal ‖
‖ Volume: 17 | Issue: 07 | July 2026 | www.iajome.com ‖

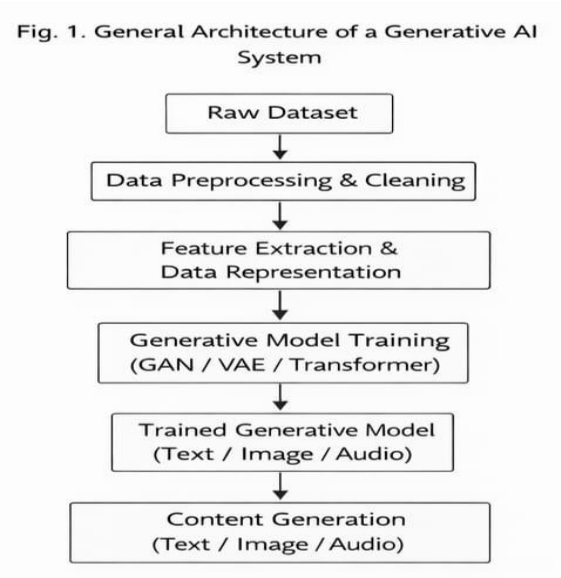
excessively high level of over--fitting, and therefore, increase the generalisability of models trained using these techniques (10).

III. Architecture of a Typical Generative AI System

A. General Architecture

A typical Generative AI system consists of data collection, preprocessing, model training, generation, and evaluation stages [7]. Figure 1 shows a general architecture of a Generative AI system.

Figure 1: General Architecture of a Generative AI System



This pipeline shows how raw data is converted into useful generated outputs. The preprocessing step ensures data quality, while the training step allows the model to learn important patterns [8].

B. Training and Inference Phases

The two phases required by Generative AI systems are the training of the generative model and the creation of new samples using that model (i.e., inferences). During the training phase, approximately millions or billions of adjustable parameters are optimized with the help of numerous pieces of data, while the inference phase creates new samples based on pre-trained models on large sets of data. Both phases are necessary to ensure that Generative AI systems provide dependable results.

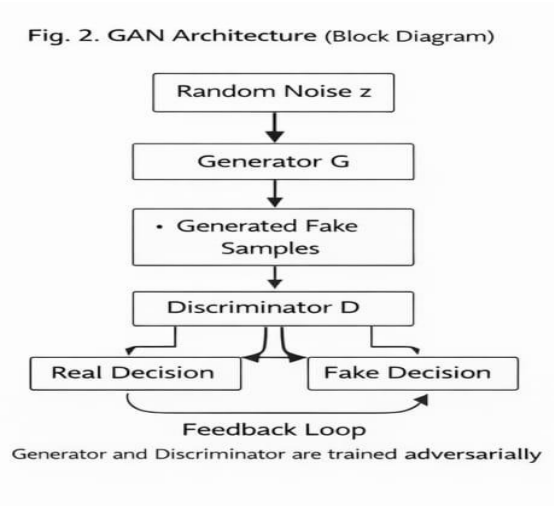
IV. Key Techniques Used in Generative AI

A. Generative Adversarial Networks (GANs)

Indo Asian Journal of Management and Entrepreneurship (IAJOME)
‖ ISSN: 2319-2992, Impact Factor 5.007 ‖
‖ Peer-Reviewed | Open Access | International Journal ‖
‖ Volume: 17 | Issue: 07 | July 2026 | www.iajome.com ‖

The Generative Adversarial Networks, introduced by Goodfellow and co-workers, are made up from 2 neural networks: a generator and a discriminator. The generator produces "fake" data sample(s), and the discriminator tries to determine whether the image(s) are real or not. The two networks train each other through their adversarial relationship, which allows for continual improvement in both generators and discriminators ([1], [7]).

Figure 2: GAN Architecture (Block Diagram)



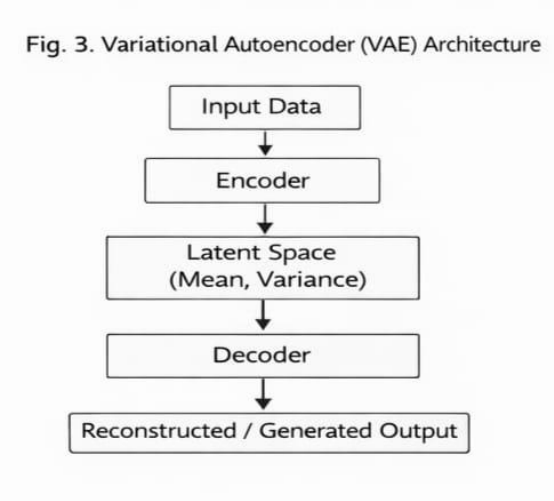
GANS have been used to achieve state-of-the-art results in several visual generation tasks, including realistic image generation, face synthesis, image-to-image translation and super-resolution [8]. However, GANs are very difficult to train, possibly suffering from instability, mode collapse problem [7].

B. Variational Autoencoders (VAEs)

Variational Autoencoders are probabilistic generative models that learn a latent representation of input data and use it to reconstruct and generate new samples [4]. Common applications of VAEs include image generation, anomaly detection, and data compression [10].

Figure 3: VAE Architecture (Block Diagram)

Indo Asian Journal of Management and Entrepreneurship (IAJOME)
‖ ISSN: 2319-2992, Impact Factor 5.007 ‖
‖ Peer-Reviewed | Open Access | International Journal ‖
‖ Volume: 17 | Issue: 07 | July 2026 | www.iajome.com ‖



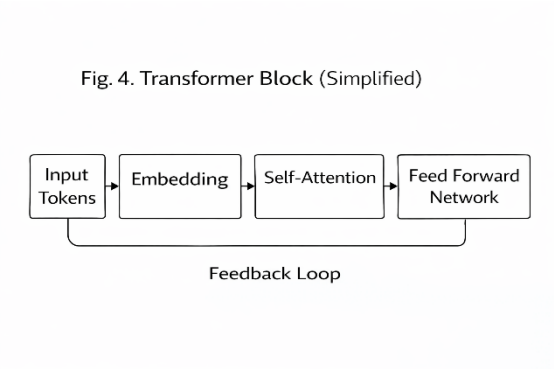
VAEs provide stable training but may produce less sharp outputs compared to GANs [7].

C. Transformer-Based Models

Models Built Upon Transformers

Transformers such as GPT use mechanisms called "self-attention" to create long-distance dependencies in texts [3]. Together with other models, they make up the major driving force behind state of the art language generation [5].

Figure 4: Transformer Block (Simplified)



Transformers enable large-scale pre-training and transfer learning, making them highly flexible and powerful [9].

V. Applications of Generative AI

A. Generating Text and Content

Generative AI is being used to create written material such as articles, emails, marketing content, reports, and most forms of creative writing. Producing this type of content has saved

Indo Asian Journal of Management and Entrepreneurship (IAJOME)
‖ ISSN: 2319-2992, Impact Factor 5.007 ‖
‖ Peer-Reviewed | Open Access | International Journal ‖
‖ Volume: 17 | Issue: 07 | July 2026 | www.iajome.com ‖

time and energy by increasing productivity levels [5] and reducing the amount of manual labor involved in the process [6].

B. Generating Images and Videos

Graphics design, video games, animation, and movie productions are among the areas where generative models have been applied. Using generative models has sped up, simplified, and lowered costs for creating visual content [8], [9].

C. Applications in Healthcare

Generative AI is applicable in creating medical images for use in drug discovery and supporting clinical decision making [13],[14].

D. Applications in Education

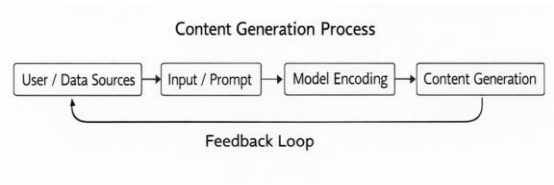
Adapting to the individual needs of each learner is accomplished by providing customized materials to each student using generative AI technology on an adaptive learning platform [11], [15].

E. Applications in Software Development

Tools such as GitHub Copilot allow developers to generate code, debug existing code, or document their code using the assisted coding capabilities available through generative AI applications [6], [16].

VI. Flowchart of Generative AI Content Creation Process

Figure 5: Flowchart of Content Generation Process



This flowchart shows the iterative nature of Generative AI development and deployment [7], [9].

VII. Comparative Analysis of Generative Models

Table I: Comparison of Major Generative Models

Model Type	Strengths	Weaknesses	Common Applications
GANs	High-quality images	Training instability	Image synthesis
VAEs	Stable training	Blurrier outputs	Anomaly detection
Transformers	Excellent for text	High compute cost	NLP, chatbots

Indo Asian Journal of Management and Entrepreneurship (IAJOME)
‖ ISSN: 2319-2992, Impact Factor 5.007 ‖
‖ Peer-Reviewed | Open Access | International Journal ‖
‖ Volume: 17 | Issue: 07 | July 2026 | www.iajome.com ‖

This table highlights the trade-offs among different generative techniques [7], [10].

VIII. Performance Metrics for Generative AI

There exist several ways of evaluating the generative model. Some of them include Inception score, Fréchet inception distance, BLEU, ROUGE, and evaluation by humans [8]; [10]. These are used for assessing the quality and effectiveness of the generated data.

IX. Advantages of Generative AI

The generative AI benefits include automated content creation, productivity, creativity, and reduced human interventions [6]. It also aids in data augmentation and simulation, which improves machine learning [7].

X. Challenges and Ethical Issues

Challenges include the issue of data privacy, biased training data, deep fakes, misinformation, and copyright problems [12], [17], [18]. Guidelines/regulations on ethical use of AI are necessary for the responsible use of Generative AI technology [15], [17].

XI. Future Scope & Research Directions

The future of this kind of research would be centered on further reducing biases, increasing explainability, reducing computation costs, and building trust in AI systems [15]. AI generative would be very instrumental in scientific discoveries, digital twins, and human-computer interaction [14],[16].

Some of the emerging research ideas in this field point towards new multimodal generative models that can handle text, images, audio, and videos simultaneously in a single system [5], [9]. This new type of multimodal generation system will usher in a new generation of free and natural interactions between humans and machines. Also, the field is now shifting towards few-shot and zero-shot learning for generative models, which can perform and handle the same functions even without the use of large datasets for training purposes [3].

Yet another significant direction in this field is the notion of Controllable Generation, in which users can control or influence the style, tone, sentiment, or even form of the generated text or content [7]. Such a feature is crucial from a professional standpoint as well, including fields like law, medicine, and finance [15].

XII. Generative AI Applications in Different Industries

A. Generative AI Applications in Media and Entertainment

Indo Asian Journal of Management and Entrepreneurship (IAJOME)
‖ ISSN: 2319-2992, Impact Factor 5.007 ‖
‖ Peer-Reviewed | Open Access | International Journal ‖
‖ Volume: 17 | Issue: 07 | July 2026 | www.iajome.com ‖

The application of generative artificial intelligence by mainstream media companies typically includes help with scripting, generating subtitles, graphics and animation for visual special effects (VSEs) and assisting in the creation of various forms of media content [8], [12]. The use of generative AI technologies in media production allows for faster development times and lower production costs through the rapid generation of AI-generated characters and background images. Major streaming video services also provide customized video trailers, video previews and promotional material to promote the video content with the assistance of generative AI [9].

B. Generative AI Applications in Healthcare/Biotechnology

The pharmaceutical industry has begun to leverage generative AI for new molecular design, predicting protein structure and simulating drug reaction [14]. An example of this is the application of AlphaFold for using generative and deep learning models to revolutionize biological research [14]. Hospitals can also use synthetic medical images to train their diagnostic systems and maintain patient confidentiality [13].

C. Generative AI Applications in Business | Finance/Business

In finance, businesses have adopted generative AI to create synthetic financial records for risk assessment and fraud detection [17]. As an example of how businesses are using generative AI to support automated report writing, the use of customer service chat bots, and the creation of personalized marketing efforts, these tools contribute to improved customer satisfaction and operational efficiency [6].

XIII. Datasets Commonly Used in Generative AI Research

When it comes to training generative models, large-scale datasets are absolutely essential [7]. Some of the most commonly used datasets include ImageNet for generating images, COCO for tasks involving image captioning, Common Crawl for powering large language models, and LibriSpeech for generating speech [3], [8].

Table II: Common Datasets for Generative AI

Dataset	Domain	Typical Use
ImageNet	Images	Image synthesis
COCO	Images + Text	Caption generation

Indo Asian Journal of Management and Entrepreneurship (IAJOME)
‖ ISSN: 2319-2992, Impact Factor 5.007 ‖
‖ Peer-Reviewed | Open Access | International Journal ‖
‖ Volume: 17 | Issue: 07 | July 2026 | www.iajome.com ‖

Common Crawl	Text	Large language models
LibriSpeech	Audio	Speech synthesis

These datasets enable training of large-scale generative systems and benchmarking of research results [7], [9].

XIV. Security & Privacy Considerations

Privacy and security considerations have become increasingly relevant for Generative AI systems [12], [17]. The data used to train Generative AI systems can sometimes contain highly sensitive personally identifiable information (PII). There is a concern that large models may be able to memorize this information and leak it back out through model predictions; this concern has been supported by evidence in the literature [18]. To mitigate these privacy risks, researchers are exploring two techniques: differential privacy and federated learning [15].

In addition to being able to generate potentially sensitive PII, Generative AI can also be Misused through things such as social engineering, phishing, and impersonation attacks [12]. Therefore, to help prevent malicious use of Generative AI, researchers are focusing on deploying and monitoring Generative AI in a way that is security-aware. Researchers are also investigating techniques such as watermarking and content detection methods to detect generated media [17].

XV. Environmental and Computational Impact

Training large generative models requires large amounts of energy and computational resources [9], which can cause environmental impacts such as carbon emissions and energy consumption. To reduce the environmental impact of Generative AI, researchers are investigating several new strategies, including model compression, parameter-efficient fine-tuning, and energy-aware training techniques [15].

Researchers are also working on creating smaller and more efficient models for deployment on edge devices like smartphones and embedded systems [16]. This will enable the use of Generative AI in low-resource environments.

XVI. Collaboration of Humans and AI

Generative AI is increasingly being used as a collaborative tool rather than a replacement for humans in [6]. It assists designers, writers, and artists with ideas and drafts that humans can

Indo Asian Journal of Management and Entrepreneurship (IAJOME)
‖ ISSN: 2319-2992, Impact Factor 5.007 ‖
‖ Peer-Reviewed | Open Access | International Journal ‖
‖ Volume: 17 | Issue: 07 | July 2026 | www.iajome.com ‖

build upon in creative industries [8]. Similarly, AI assists a developer to write better and faster code in software engineering [16].

This human-AI collaboration model aims to improve productivity while still retaining control and creativity by the human user. Future systems will shift design focus toward increasing explainability and trust among its users to ensure effective collaboration.

XVII. Limitations of Current Generative AI Systems

Despite this rapid progress, some limitations still remain concerning the current generative AI systems. Among these are the hallucination of incorrect information, a lack of proper understanding, susceptibility to biased training data, and inability to reason on complex real-world situations [5], [17].

Then there is also a possibility for models to generate text with confidence but factually incorrect. This attracts the need for human supervision in critical domains: health, law, and education [15]. Addressing these limitations is a major focus of ongoing research.

XVIII. Societal Impact of Generative AI

The impact of generative AI on society is great, including impacts on the role of work, the role of education, and the role of creative industries [6], [17]. Though AI can replace human labor in performing a great number of routine tasks, AI offers great potential in the number of high skill jobs related to AI development, data science, and AI governance [15].

Even within the educational sector, changes are being made to the course syllabus to ensure that students are made aware of AI literacy and how it can be used responsibly [11]. Governments and policymakers are coming up with legislation to ensure that society reaps the advantages of using Generative AI, considering the consequences of its usage [17].

XIX. Standardization and Regulatory Frameworks

International organizations and governments are establishing standards and regulations for AI systems [15]. Such regulations address parameters such as fairness, transparency, accountability, and safety. Standardization of AI is essential for the smooth deployment of Generative AI technologies [17].

Organizational compliance with regulation standards is increasingly gaining prominence for organizations using Generative AI to develop commercial applications. [18]

XX. Extended Conclusion

Indo Asian Journal of Management and Entrepreneurship (IAJOME)
‖ ISSN: 2319-2992, Impact Factor 5.007 ‖
‖ Peer-Reviewed | Open Access | International Journal ‖
‖ Volume: 17 | Issue: 07 | July 2026 | www.iajome.com ‖

Notably, Generative Artificial Intelligence is a revolutionary technology that is drastically changing the world of digital content creation, scientific research, and human-computer interactions [1], [3]. The above-mentioned review discussed the topic of Generative AI, including architectures, methods, applications, datasets, examples, ethical concerns, the environment, and future directions.

Thus, if properly developed, ethically governed, and continuously innovative, Generative AI will have the promise to provide long-term benefits to the field of education, healthcare, business, etc., and society as a whole, as found in the research articles [15], [17].

In the future, the focus will be on reducing bias, increasing explanations, lowering the cost of computerization, and building trust in AI systems [15]. AI generation also has a key role in the future in scientific research, digital twins, and human-computer interaction [14] and [16].

Conclusion

"Generative Artificial Intelligence" is changing the way digital content is created and how a human interacts with a computer [1], [3]. In this paper, architectures, techniques, applications, advantages, challenges, and future of Generative AI are discussed. It can bring benefits to society and computer science as a whole with proper use and research of the subject in the future [15], [17].

References

[1] I. Goodfellow et al., “Generative Adversarial Nets,” NeurIPS, 2014.
[2] T. Mitchell, Machine Learning, McGraw-Hill, 1997.
[3] A. Vaswani et al., “Attention Is All You Need,” NeurIPS, 2017.
[4] D. P. Kingma and M. Welling, “Auto-Encoding Variational Bayes,” ICLR, 2014.
[5] OpenAI, “GPT Models and Applications,” Technical Report, 2023.
[6] M. Allamanis et al., “A Survey of Machine Learning for Big Code,” ACM CSUR, 2018.
[7] I. Goodfellow, Y. Bengio, and A. Courville, Deep Learning, MIT Press, 2016.
[8] T. Karras et al., “StyleGAN,” CVPR, 2019.
[9] J. Dean et al., “Large Scale Distributed Deep Networks,” NIPS, 2012.
[10] A. Doersch, “Tutorial on VariationalAutoencoders,” arXiv, 2016.
[11] R. Luckin et al., AI in Education, Pearson, 2016.
[12] H. Farid, Digital Image Forensics, MIT Press, 2016.
[13] G. Litjens et al., “Deep Learning in Medical Image Analysis,” Medical Image Analysis,

2017.

[14] J. Jumper et al., "AlphaFold," Nature, 2021.

[15] European Commission, "Ethics Guidelines for Trustworthy AI," 2019.

[16] GitHub, "GitHub Copilot Overview," 2022.

[17] S. Floridi et al., "AI4People," Minds and Machines, 2018.

[18] P. Samuelson, "Copyright and Artificial Intelligence," CACM, 2020.