



Chapter 11

Generative AI


Bani Adam

 <http://orcid.org/0009-0005-9562-862X>
Universitas Esa Unggul, Indonesia

Binastya Anggara Sekti

 <http://orcid.org/0000-0001-5489-4888>
Universitas Esa Unggul, Indonesia

Muhammad Adi Zacky Zahran

 <http://orcid.org/0009-0000-8736-5376>
Universitas Esa Unggul, Indonesia

ABSTRACT

Generative AI represents a significant advancement in machine learning, distinguishing itself from traditional AI by its ability to create new and original content such as text, images, and code. This chapter provides a comprehensive overview of Generative AI, covering its core models like Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs), and transformer-based architectures such as GPT and DALL·E. It explores diverse applications across various sectors, including art, education, and science. Furthermore, the chapter delves into the critical societal implications of this technology, addressing issues like intellectual property, misinformation, and artistic authenticity. By examining both the technical underpinnings and the ethical landscape, this work aims to foster a human-centered and responsible approach to developing and using generative systems.

1. INTRODUCTION

1.1. Definition And Overview of Generative Ai

Generative Artificial Intelligence (Generative AI) refers to a class of AI models capable of producing novel and realistic outputs, such as images, text, audio, and synthetic data, that resemble the data they were trained on. Unlike discriminative AI models, which are designed to classify or predict based on input data, generative models learn the underlying patterns and structures of their training datasets to create new, original content. This capability marks a significant paradigm shift in the field of artificial

DOI: 10.4018/979-8-3693-5638-8.ch011

intelligence, moving beyond mere analysis to active creation. The core principle behind Generative AI lies in its ability to understand and replicate the statistical properties of data, allowing it to generate diverse and coherent samples that are often indistinguishable from real-world data. This transformative power has led to widespread applications across various industries, from automating content creation to enabling advanced scientific research (Fu, Hadid, & Damer, 2025).

1.2. Historical Context and Evolution

The roots of generative AI can be traced back to early statistical modelling and machine learning techniques. However, significant breakthroughs began to emerge in the mid-2010s with the advent of deep learning. One of the most pivotal developments was the introduction of Generative Adversarial Networks (GANs) by Ian Goodfellow and his colleagues in 2014. GANs revolutionized the field by introducing a competitive framework between two neural networks a generator and a discriminator leading to the creation of highly realistic synthetic data (Ahmad, Jaffri, Chen, & Bao, 2025). Following GANs, Variational Autoencoders (VAEs) gained prominence for their ability to generate data while providing a probabilistic framework for understanding the latent space (Akansha Singh & Singh, 2025). More recently, Transformer-based models, initially developed for natural language processing, have demonstrated remarkable generative capabilities, particularly in text generation and later in multimodal tasks. The latest advancements include Diffusion Models, which have achieved state-of-the-art results in image synthesis by gradually transforming noise into coherent images. This rapid evolution highlights a continuous progression from simpler generative methods to increasingly sophisticated and powerful architectures.

1.3. Significance in Modern Ai Landscape

Generative AI holds immense significance in the modern AI landscape due to its profound impact on various sectors. Its ability to create original content has opened new avenues for automation, personalization, and innovation. In creative industries, Generative AI tools are transforming workflows for artists, designers, and content creators, enabling them to generate ideas, prototypes, and final products with unprecedented speed and efficiency. In scientific research, generative models are used for synthetic data generation, accelerating drug discovery, material science, and medical imaging analysis by overcoming data scarcity and privacy concerns. Furthermore, Generative AI is reshaping human-computer interaction, leading to more intuitive interfaces and personalized experiences (Bie et al., 2025). The economic implications are substantial, with projections indicating significant contributions to global GDP. However, its growing influence also necessitates careful consideration of ethical, legal, and societal challenges, making it a critical area of study for policymakers, researchers, and the public alike. The transformative potential of Generative AI positions it as a cornerstone of future technological advancements.

1.4. Scope and Objectives of This E-Book

This e-book aims to provide a comprehensive and balanced overview of Generative AI, addressing both its technical underpinnings and its broader implications. The primary objectives include:

22 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage:

www.igi-global.com/chapter/generative-ai/404022

Related Content

Implementation of Artificial Intelligence in Human Resource Management in Asia-Pacific

Anusha Thakur (2024). *Exploring the Intersection of AI and Human Resources Management* (pp. 30-46).

www.irma-international.org/chapter/implementation-of-artificial-intelligence-in-human-resource-management-in-asia-pacific/336260

Traffic Density Estimation for Traffic Management Applications Using Neural Networks

Manipriya Sankaranarayanan, C. Malaand Snigdha Jain (2024). *International Journal of Intelligent Information Technologies* (pp. 1-19).

www.irma-international.org/article/traffic-density-estimation-for-traffic-management-applications-using-neural-networks/335494

Fingerprint Presentation Attack Detection Using Transfer Learning Approach

Rajneesh Raniand Harpreet Singh (2021). *International Journal of Intelligent Information Technologies* (pp. 1-15).

www.irma-international.org/article/fingerprint-presentation-attack-detection-using-transfer-learning-approach/272008

Opportunities of Public Transport Experience Enhancements with Mobile Services and Urban Screens

Marcus Foth, Ronald Schroeterand Jimmy Ti (2013). *International Journal of Ambient Computing and Intelligence* (pp. 1-18).

www.irma-international.org/article/opportunities-public-transport-experience-enhancements/75567

Enhancing AI-Augmented Classrooms: Teacher-Centric Integration of Intelligent Tutoring Systems and Adaptive Learning Environments

Bhupinder Singh, Christian Kaunert, Sahil Laland Manmeet Kaur Arora (2025). *Fostering Inclusive Education With AI and Emerging Technologies* (pp. 99-130).

www.irma-international.org/chapter/enhancing-ai-augmented-classrooms/360513