

Generative Artificial Intelligence and Large Language Models

Category: Technical Report

Name: Mohamed Tazeem R

Register Number: 25012330

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Goal of the Report

The goal of this report is to provide an educational and technical overview of Generative Artificial Intelligence, its models, modern AI tools (2024), Large Language Models (LLMs), and the evolution of Artificial Intelligence.

Core Topic Covered

- Generative AI fundamentals
- Generative models and their types
- AI tools in 2024
- Large Language Models (LLMs)
- Evolution of Artificial Intelligence

Abstract

This report briefly explains the foundational concepts of Generative AI, types of generative models, popular AI tools in 2024, the working and architecture of Large Language Models, and the historical evolution of Artificial Intelligence. The report aims to give beginners a clear understanding of modern AI technologies.

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Introduction

Artificial Intelligence (AI) is the simulation of human intelligence by machines. With advances in Machine Learning and Deep Learning, AI systems can now generate new content such as text, images, audio, and code. This capability is known as Generative AI.

Introduction to AI and Machine Learning

AI enables machines to think and act intelligently. Machine Learning allows systems to learn from data without explicit programming, while Deep Learning uses multi-layered neural networks for complex tasks.

What is Generative AI?

Generative AI refers to AI systems that can create new data similar to real-world data by learning patterns from large datasets. Examples include text generation, image creation, and voice synthesis.

Types of Generative AI Models

- GANs (Generative Adversarial Networks): Use generator and discriminator networks to create realistic data.
- VAEs (Variational Autoencoders): Encode and decode data to generate variations.
- Diffusion Models: Generate data by gradually removing noise, commonly used in image generation.

Large Language Models (LLMs)

Large Language Models are deep learning models trained on massive text data to understand and generate human-like language. Examples include GPT, BERT, Gemini, and Claude.

Architecture of LLMs

LLMs are based on Transformer architecture. Key components include tokenization, self-attention mechanisms, positional encoding, and neural network layers. GPT models generate text autoregressively, while BERT provides bidirectional understanding.

Limitations and Ethical Consideration

Bias in training data

High computational cost

Data privacy concerns

Risk of misinformation

Use Cases and Applications

Chatbots and virtual assistants

Content generation

Code completion

Education and research

Future Trends

Multimodal AI (text + image + video)

More efficient and smaller models

Responsible and ethical AI development

Evolution of Artificial Intelligence

Year	Milestone
1950	Turing Test proposed
1956	AI term coined
1980s	Expert systems
1997	Deep Blue defeats Kasparov
2012	Deep Learning breakthrough
2017	Transformer architecture
2020	GPT-3
2022	ChatGPT
2024	Multimodal Generative AI

Conclusion

Generative AI and LLMs represent a major advancement in Artificial Intelligence. With powerful models and tools available in 2024, AI is transforming industries and education. Understanding these concepts is essential for future engineers.

References

- OpenAI Documentation
- Google AI Blog
- Deep Learning by Ian Goodfellow
- Research papers on Transformer models