

# What is Generative AI?

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Generative AI is a type of artificial intelligence designed to create new content such as text, images, music or even code by learning patterns from existing data. These models generate original outputs that are often indistinguishable from human-created content. These models use techniques like deep learning and neural networks to generate output. Unlike discriminative AI which focuses on classifying data into categories like spam vs. not spam, generative AI creates new data such as text, images, audio or video that resembles real-world examples. **How Generative AI Works** 1.

**Core Mechanism (Training & Inference):** Trained on large datasets using deep learning networks to generate output based on learned patterns and prompts. 2. **By Media Type:** - Text: Large Language Models (LLMs) generate coherent text. - Images: Diffusion models like Stable Diffusion, DALL-E produce visuals. - Speech: Text-to-speech models generate realistic voices. - Video: Multimodal systems like Sora generate short video clips. 3. **Agents in Generative AI:** Autonomous components that reason, plan, act, and integrate LLMs for tasks like retrieval and APIs. 4. **Training and Fine-Tuning:** Pre-trained models adapted with LoRA, QLoRA, PEFT, RLHF, Distillation. 5.

**Retrieval-Augmented Generation (RAG):** Enhances factual accuracy by retrieving documents at query time and grounding responses. **Types of Generative AI Models** 1. Transformers or Autoregressive Models (e.g., GPT). 2. Diffusion Models (e.g., Stable Diffusion, DALL-E). 3.

Variational Autoencoders (VAEs) and Generative Adversarial Networks (GANs). 4.

Encoder-Decoder Models (e.g., T5, BART). **Evaluation of Generative AI** - Fact Accuracy & Hallucination Avoidance. - Quality Metrics: BLEU, ROUGE, METEOR, FID, IS. - Efficiency & Accuracy Trade-offs (LoRA, QLoRA). - Resilience to Retrieval Noise. - Creativity & Diversity. - Bias & Fairness (BBQ, StereoSet). - User Experience and Usefulness. **Relationship Between Humans and Generative AI** Generative AI enhances human creativity, productivity, and decision-making. It augments rather than replaces humans, raising ethical, authorship, and dependency questions.

**Generative AI Vs AI** - Purpose: Generative AI produces new content; AI covers broader tasks. - Application: Generative AI (art, text, video); AI (predictions, automation). - Learning: Generative AI (unsupervised, RL); AI (supervised, semi-supervised, RL). - Output: Generative AI creates new data; AI classifies or decides. - Complexity: Generative AI uses complex models like GANs; AI spans from regression to deep learning. - Data Requirement: Generative AI needs large datasets; AI varies. **Applications of Generative AI** - Text: Chatbots, assistants, content creation, code (e.g., Copilot). - Images: Digital art, design, advertising, medical imaging. - Audio & Speech: Voice assistants, dubbing, music, cloning. - Video: Animation, VFX, gaming, simulations. - Business: Customer support, RAG knowledge discovery, drug discovery, finance, decision-making.

**Advantages** - Accelerates R&D.; - Improves personalization. - Empowers non-experts. - Drives economic growth. **Disadvantages** - Data dependence. - Limited control over outputs. - High computational requirements. - Ethical and legal concerns (deepfakes, misinformation).