Generative AI

1. What is Generative AI?

Generative AI refers to models that **create new content** (text, images, audio, music, video, code, 3D assets, synthetic data) by learning patterns from existing data and sampling from that learned distribution. Unlike traditional AI that focuses only on recognition or classification, generative AI produces novel outputs such as stories, artwork, speech, or synthetic datasets.

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2. Difference — Generative AI vs Discriminative AI

Feature	Generative AI	Discriminative AI
Definition	Learns to model the data distribution and generate new data similar to it.	Learns the decision boundary between classes to classify input data.
Output	Creates new samples (e.g., text, images).	Predicts labels or categories.
Examples	GPT, DALL·E, Stable Diffusion.	Logistic Regression, Random Forest, SVM.
Use Case	Creative tasks (writing, art, design).	Predictive tasks (spam detection, fraud detection).
Approach	Models joint probability `P(X, Y)`.	Models conditional probability `P(Y

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3. Capabilities of Generative AI

- **Text generation** — articles, dialogue, summaries, code, scripts.
- **Image generation** — illustrations, photorealistic images, concept art, product mockups.
- **Audio generation** — text-to-speech (TTS), voice cloning, speech style transfer, sound effects.
- **Music generation** — instrumentals, backing tracks, adaptive game soundtracks.
- **Video generation** — short clips, synthetic actors, scene generation.
- **Code generation** — autocompletion, debugging, boilerplate creation.
- **Data augmentation** — creating synthetic datasets for training.
- **Multimodal generation** — combining text, image, audio, and video.
- **Personalization** — adaptive content tailored to individual users.

4. Applications of Generative AI

- **Healthcare** – drug discovery, medical imaging synthesis.
- **Education** – AI tutors, auto-generated lessons, narrated materials.
- **Entertainment** – music composition, story writing, voice acting.
- **Business** – marketing copy, customer chatbots, product mockups.
- **Accessibility** – natural TTS, captions, simplified content.
- **Research** – simulation, hypothesis generation.
- **Gaming** – procedural world generation, NPC dialogue, voices.

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5. Tools for Generative AI

- **Text:** ChatGPT, Claude, Bard, LLaMA.
- **Images:** DALL·E, Stable Diffusion, MidJourney.
- **Audio / TTS / Voice Cloning:** ElevenLabs, Descript (Overdub), Replica Studios, Resemble AI.
- **Music:** MusicLM, AIVA, Amper Music.
- **Video:** Runway Gen-2, Synthesia, Pika Labs.
- **Code:** GitHub Copilot, Amazon CodeWhisperer, Tabnine.
- **Frameworks:** PyTorch, TensorFlow, Hugging Face (Transformers, Diffusers).

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6. Hands-On Experience — Prompts to Test the Tools

◇ Text (ChatGPT, Claude, Bard)

1. **Explaining a concept**

```
Explain "diffusion models" in 200–300 words using a simple analogy and list
3 real-world applications.
```

2. **Blog intro + outline**

```
Write a 120-word introduction for a blog titled "Generative AI in Product
Design," then create a 6-section outline.
```

◇ Image (DALL·E, Stable Diffusion, MidJourney)

1. **Concept art**

```
A futuristic city skyline at sunset, neon reflections on wet streets,
cyberpunk style, cinematic wide-angle, highly detailed, realistic, 4K.
```

2. **Product mockup**

```
Minimalist wireless speaker on a wooden desk, soft morning light, realistic materials, no text or logos.
```

◇ Audio (ElevenLabs, Descript, Replica)

1. **TTS voice prompt**

```
Voice: warm, mid-30s female, friendly tone.
Script: "Welcome to today’s session on Generative AI. We'll explore its applications and how it can help you work smarter."
```

2. **Sound effect generation**

```
Generate a 30-second background ambience: café setting, light clinking, soft chatter, espresso machine in the distance.
```

◇ Music (AIVA, Amper, MusicLM)

1. **Podcast intro**

```
Create a 90-second instrumental, lo-fi hip-hop style, soft synth pads and gentle guitar melody, loopable intro for a podcast.
```

◇ Video (Runway Gen-2, Synthesia, Pika Labs)

1. **Product video prompt**

```
Generate a 20-second video ad for a portable solar charger: shots of a commuter using it outdoors, close-up of phone charging, ending with text "Charge anywhere, go further."
```

◇ Code (GitHub Copilot, CodeWhisperer)

1. **Python request**

```
# Write a Python function `generate_text(prompt: str)` using Hugging Face GPT-2
# It should generate up to 100 tokens, temperature=0.7, with error handling.
```

2. **React request**

```
Create a React component `UserCard` that accepts {name, avatarUrl, bio} and renders a styled card with a "Contact" button.
```

◇ Data Augmentation (GANs, VAEs)

Conceptual experiment prompt:

```
Train a simple GAN on a dataset of handwritten digits, then generate 1,000
new synthetic digits and visualize them to check quality.
```

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8. Checklist to Evaluate Outputs

- **Quality:** clarity, realism, creativity.
- **Fidelity to prompt:** follows instructions closely.
- **Bias & safety:** avoids harmful or biased content.
- **Licensing:** check commercial use terms.
- **Diversity:** outputs are varied, not repetitive.

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9. Ethics & Practical Notes

- Obtain consent before cloning voices or using likenesses.
- Check licensing and terms before commercial use.
- Add metadata/watermarks for AI-generated content when appropriate.