

■ My Study Notes

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1. Quick Summary

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****Study Summary: Generative AI Models and Applications****

****Introduction****

Generative AI models have revolutionized the way we interact with technology, enabling applications such as chatbots, image generation, and speech synthesis. This summary will cover the key concepts of zero-shot, few-shot, and chain-of-thought prompting, as well as the structure and benefits of major Generative AI models, including LLMs, GANs, and Diffusion Models. Additionally, we will examine various Generative AI applications and their underlying foundational models.

****Key Points****

* **Zero-shot Prompting**:

+ The model is given only the instruction and must complete the task using its pre-trained knowledge.

+ No examples or demonstrations are provided in the prompt.

+ Works best for common tasks like translation, classification, summarization, or factual Q&A.;

* **Few-shot Prompting**:

+ The user provides a few examples showing how the task should be done.

+ Helps the model learn formatting, style, specialized logic, or domain-specific patterns.

+ Useful for niche tasks where zero-shot may confuse the model.

* **Chain-of-thought Prompting**:

+ Encourages the model to show step-by-step reasoning before giving the final answer.

+ Very effective for math, logic, planning, multiprocess, or multi-step problems.

+ Reduces errors by forcing the model to reason clearly.

* **LLMs (Large Language Models)**:

+ Based on Transformer architecture.

+ Uses self-attention layers to understand relationships between words.

+ Trained on large text datasets for language understanding and generation.

* **GANs (Generative Adversarial Networks)**:

+ Consists of two neural networks trained together: Generator and Discriminator.

+ The two networks compete, improving each other.

* **Diffusion Models**:

+ Based on denoising diffusion process.

+ Training: add noise to images in many steps.

+ Generation: start from noise → gradually remove noise → final image.

Definitions

* **Zero-shot Prompting**: The model is given only the instruction and must complete the task using its pre-trained knowledge.

* **Few-shot Prompting**: The user provides a few examples showing how the task should be done.

* **Chain-of-thought Prompting**: Encourages the model to show step-by-step reasoning before giving the final answer.

* **LLMs (Large Language Models)**: Based on Transformer architecture, trained on large text datasets for language understanding and generation.

* **GANs (Generative Adversarial Networks)**: Consists of two neural networks trained together: Generator and Discriminator.

* **Diffusion Models**: Based on denoising diffusion process, used for image generation.

Examples

* **Zero-shot Prompting**: Translate "Good morning" into French.

* **Few-shot Prompting**: Food: Pizza → Category: Fast food, Food: Dosa → Category: South Indian, Task: Food: Sushi → Category: ?

* **Chain-of-thought Prompting**: A shop had 30 apples, then bought 20 more. How many now? Explain your steps.

* **LLMs (Large Language Models)**: Trained on large text datasets for language understanding and generation.

* **GANs (Generative Adversarial Networks)**: Used for deepfakes, art generation, super-resolution, face synthesis, style transfer.

* **Diffusion Models**: Used for image generation, video synthesis, design tools, character creation, animation.

Equations/Formulas

* **Self-Attention Mechanism**: $q = Wq * x$, $k = Wk * x$, $v = Wv * x$, $\text{attention} = \text{softmax}(q * k^T / \sqrt{d})$

* **Denoising Diffusion Process**: $x_t = x_{t-1} + \epsilon_t$, where ϵ_t is noise added to the image at step t.

Short Quiz

1. What is the primary difference between zero-shot and few-shot prompting?
 - a) Zero-shot uses pre-trained knowledge, while few-shot uses examples.
 - b) Zero-shot uses examples, while few-shot uses pre-trained knowledge.
 - c) Zero-shot is used for common tasks, while few-shot is used for niche tasks.
 - d) Zero-shot is used for math problems, while few-shot is used for language tasks.

Answer: a) Zero-shot uses pre-trained knowledge, while few-shot uses examples.

2. What is the main benefit of chain-of-thought prompting?
 - a) Reduces errors by forcing the model to reason clearly.
 - b) Increases the speed of generation.
 - c) Improves the quality of the output.
 - d) Reduces the need for human intervention.

Answer: a) Reduces errors by forcing the model to reason clearly.

3. What is the primary use case for Diffusion Models?
 - a) Language understanding and generation.
 - b) Image generation and video synthesis.
 - c) Speech recognition and synthesis.
 - d) Text classification and summarization.

Answer: b) Image generation and video synthesis.