# A Study on Image Generation for Disaster Scenario

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# Contents

# 1 Motivation

## Why is disaster image creation necessary?


for foreigners living in Korea
Disaster safety information app in English

The current disaster message service is only composed of text. This may make it difficult for vulnerable populations, such as individuals with cognitive disabilities, children, the elderly, and foreigners, who may have lower situational judgment and information recognition abilities, to understand the situation through the text message alone.

To overcome this limitation, there is a proposal to introduce a disaster image creation service.

→ Utilizing the most recently popular Diffusion-based Text to Image model.
→ Analysis of the disaster image creation results.

# 1 Motivation

## Why is disaster image creation necessary?


Sang-Lim Ju, Hyunjoo Kang, and Seung-Hee Oh. "Implementation Methods of Cell Broadcast Service Including a Warning Image in 5G Networks"

ISO(International Organization for Standardization) Disaster Symbol

# 1 Motivation

Why is disaster image creation necessary?

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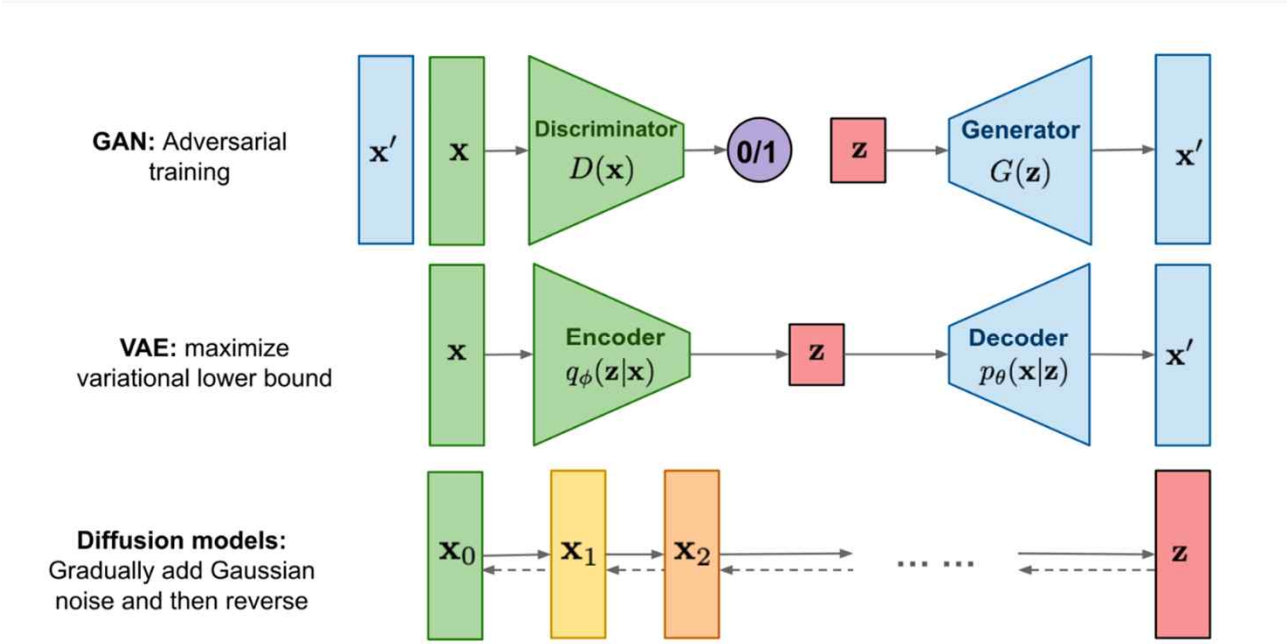
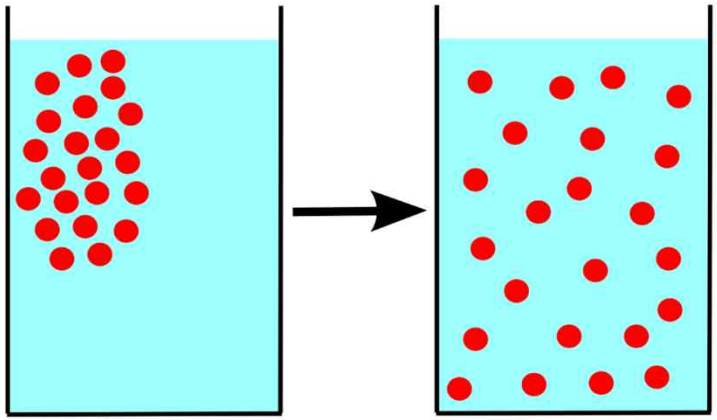
# 2 Related Works

## What is Diffusion Model?



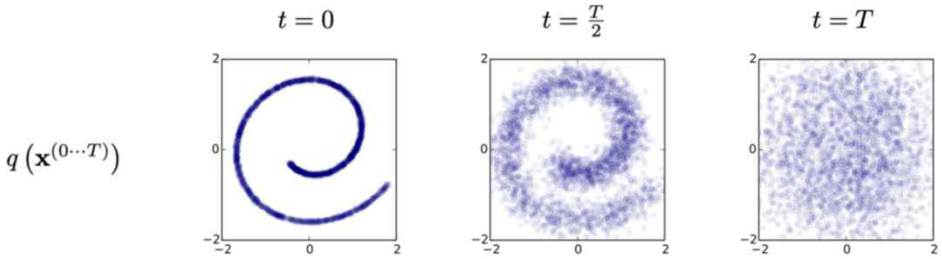
# 2 Related Works

## What is Diffusion Model?



Thermodynamics : In thermodynamics, the phenomenon where molecules that make up a substance move and spread into other substances on their own due to molecular motion.

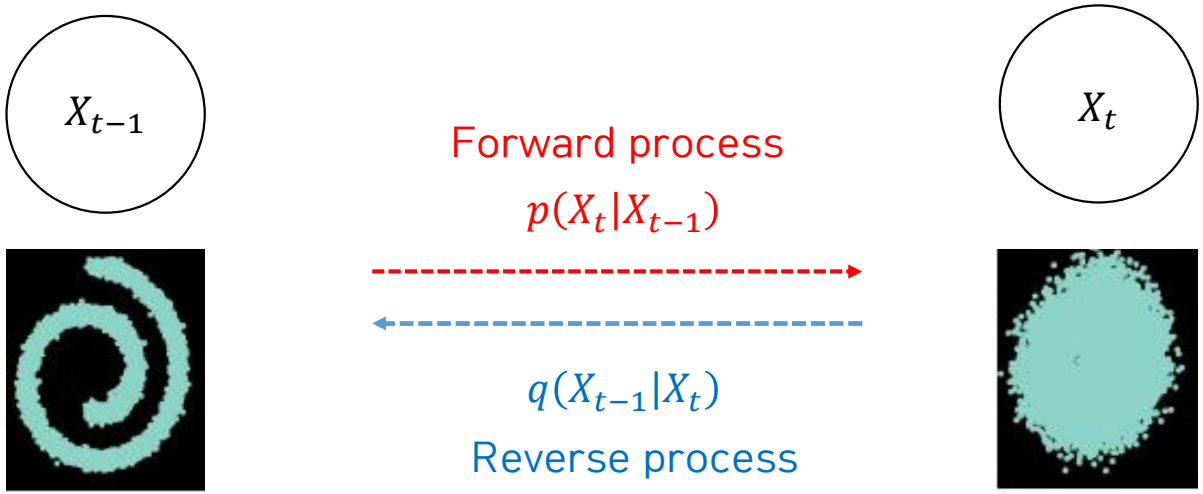
In "Deep Unsupervised Learning using Nonequilibrium Thermodynamics (2015, ICML)", it was first utilized for unsupervised learning.




In artificial intelligence, the use of Diffusion: The process of destructing a specific data pattern through a gradual progression.

# 2 Related Works

## What is Diffusion Model?

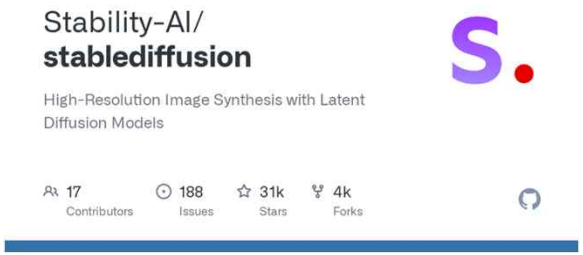



The Diffusion model serves as a Generative model, producing patterns from the learned data.

To learn the process of pattern generation, it deliberately disrupts the pattern (Noising),
Forward process
and then learns the conditional probability distribution to restore it (Denoising).
Reverse process

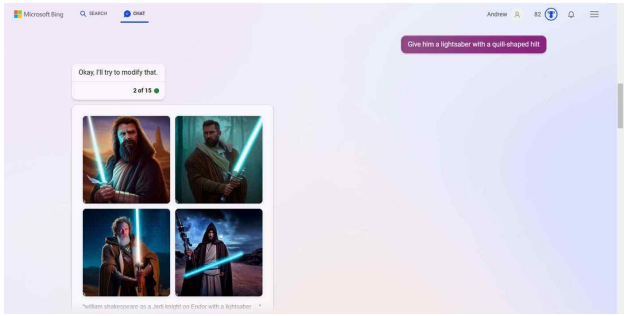
# 2 Related Works

## Text to image models – Diffusion based models




Stable Diffusion

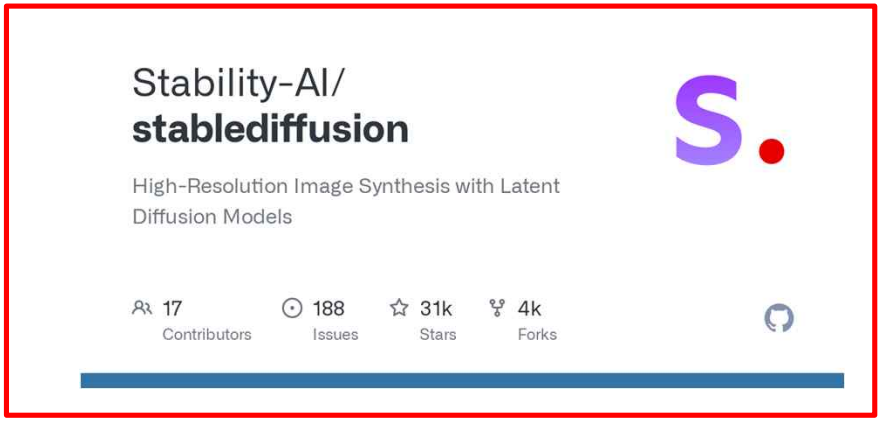

DALL·E 2




Bing Image Creator

# 2 Related Works

## Text to image models – Diffusion based models




VS

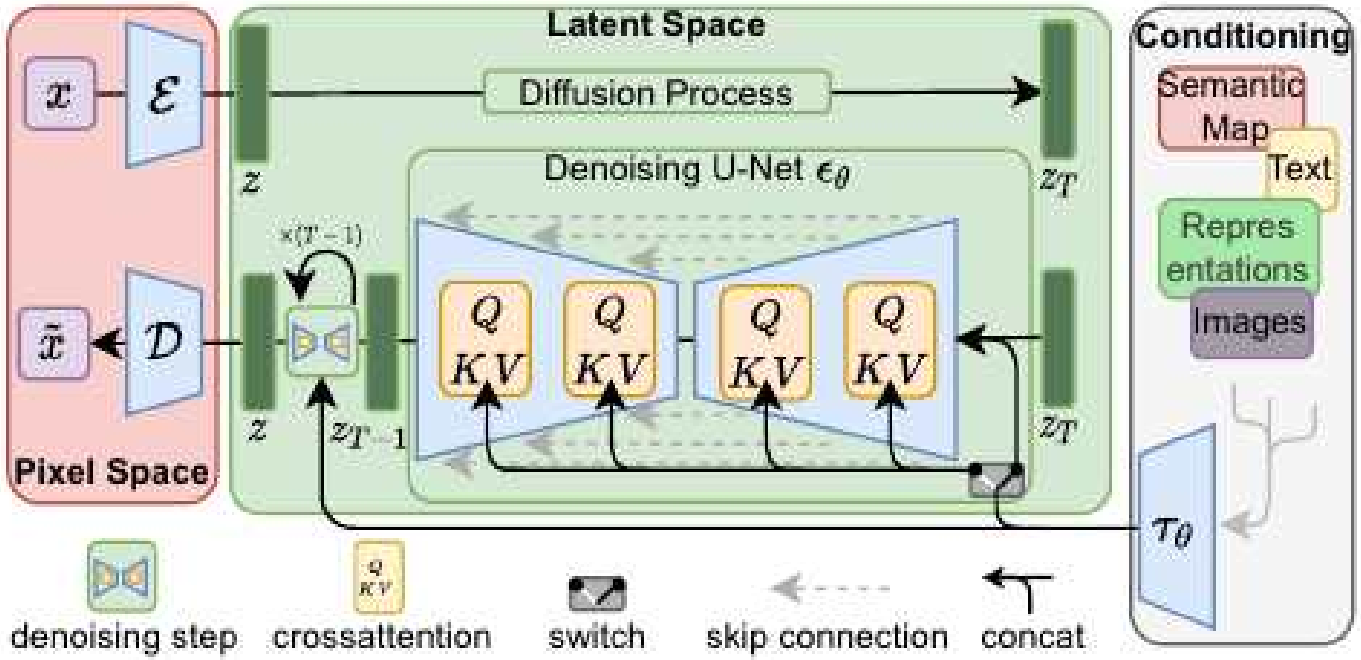

Stable Diffusion

DALL·E 2

Decided to use the open-source model, Stable Diffusion, which allows the application of various technologies.

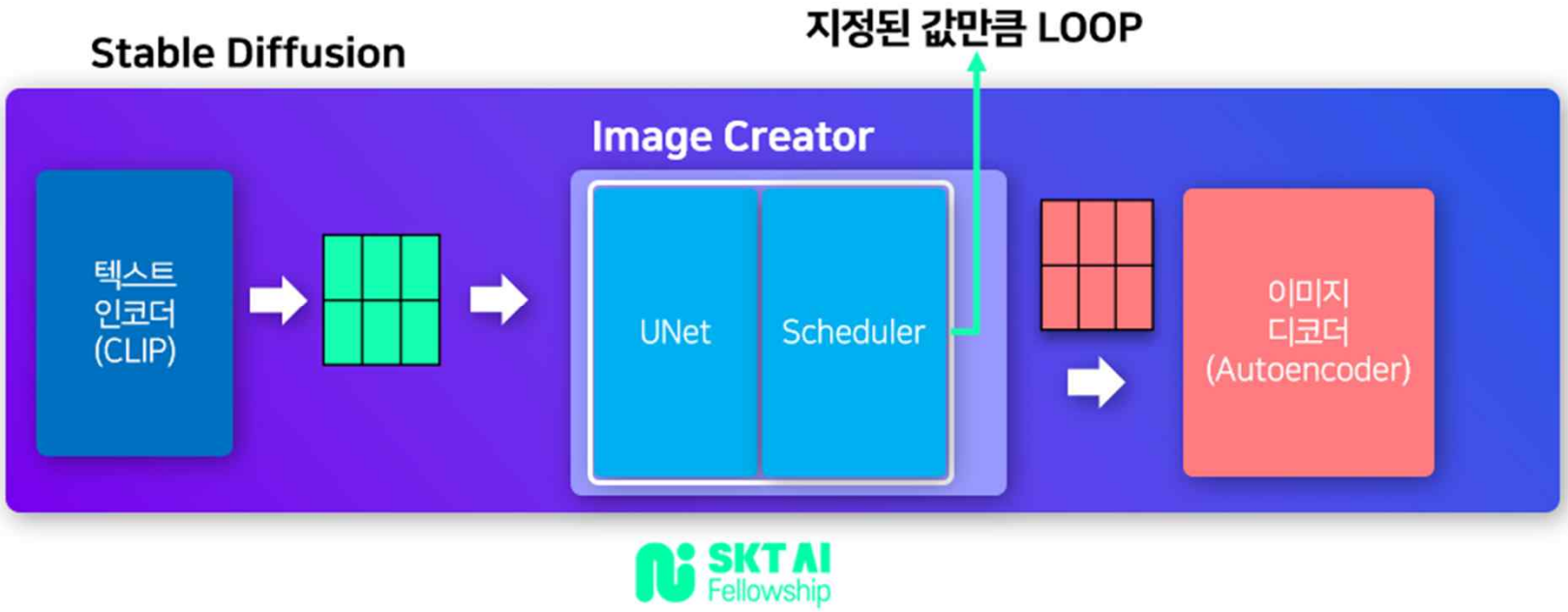
# 2 Related Works

Text to image models – Stable Diffusion



# 2 Related Works

## Text to image models – Stable Diffusion



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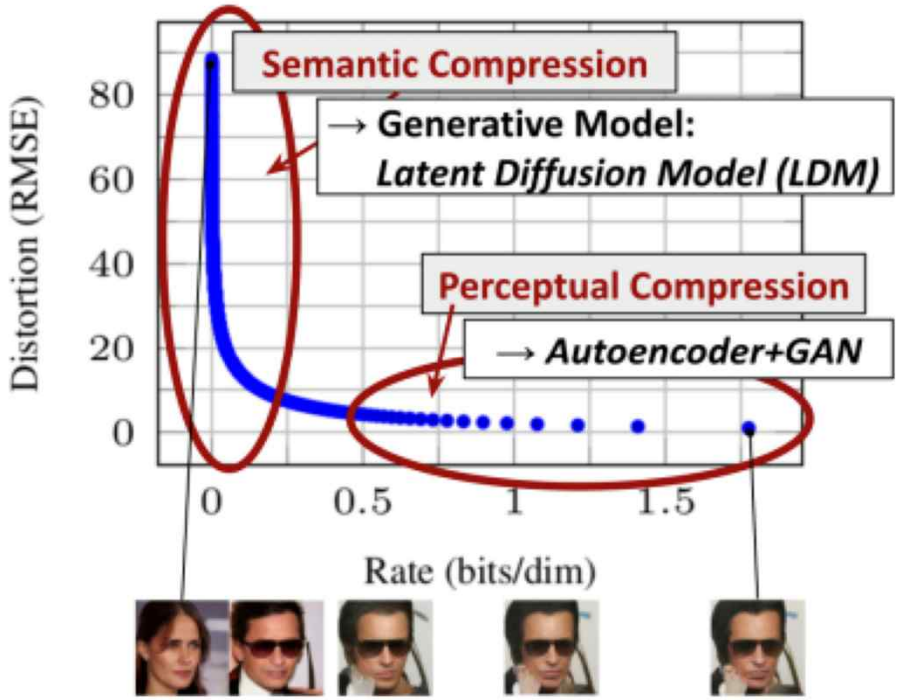



GAN | **Diffusion Model** | VAE

# 3 Results of Experiments

Analysis of disaster image generation results

| | Stable Diffusion | DALL·E 2 | Bing Image Creator |
|---|---|---|---|
| Input text : landslide |  |  |  |
| Input text : A building with a fire. |  |  |  |

# 3 Results of Experiments

## Analysis of disaster image generation results

| | Stable Diffusion | DALL·E 2 | Bing Image Creator |
|---|---|---|---|
| Input text : The Han River has flooded. |  |  |  |
| Input text : People are evacuating to avoid the typhoon. |  |  | Failed to Generate |

# 3 Results of Experiments

## Analysis of disaster image generation results

Stable Diffusion

DALL·E 2

Bing Image Creator

Input text : At 08:27, a magnitude 4.3 earthquake occurred in a region 12km northeast of Gochang-gun, Chungbuk.

Conclusion: Current Diffusion-based image generation models do not adequately represent domestic terrains and omit specific keywords from the input text.

# 3 Analysis of disaster image generation results

## Analysis of image generation results

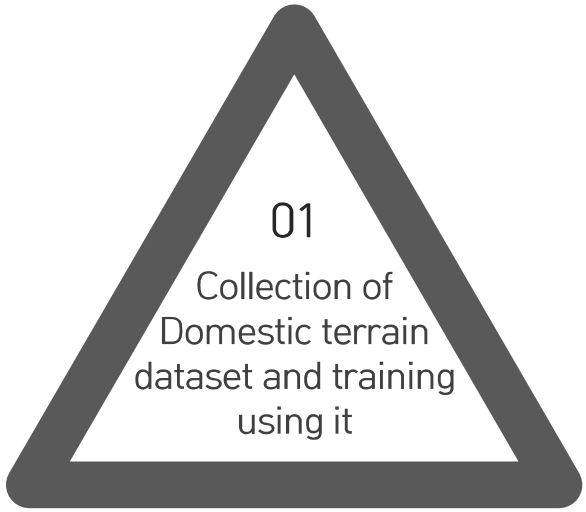
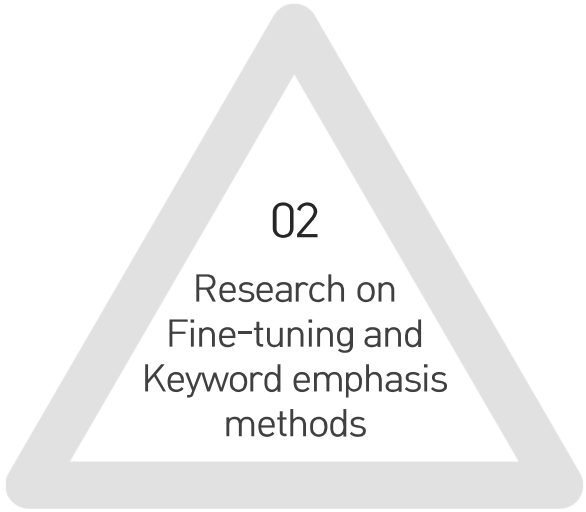
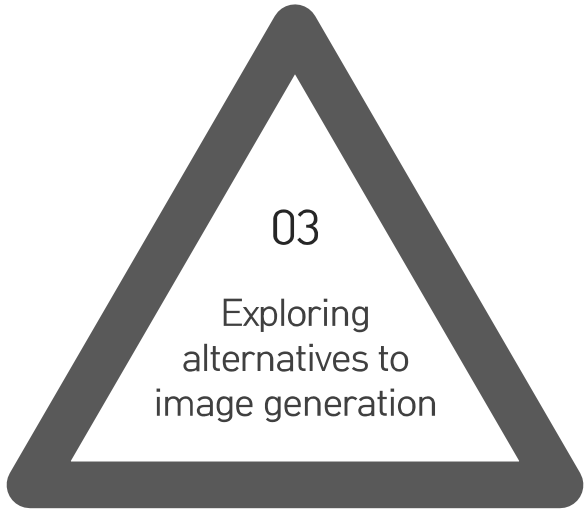



Image models trained with overseas image datasets have limitations.

Therefore, we plan to collect domestic terrain image data and use it to train the model.




In order to prevent the omission of specific keywords, further research on fine-tuning and emphasizing methods by adjusting keyword weights will be conducted.




Instead of image generation technologies, we are currently researching editing techniques such as modification and synthesis.

# 4 Conclusion

## Summary & Future Works

**[Summary]**

- The goal of this research is to generate disaster images using image generation models.

- Among the current image generation models, diffusion-based models exhibit superior performance.

- The most widely used diffusion-based model is the open-source Stable Diffusion.

- Diffusion-based models sometimes struggle to accurately represent the terrain or may omit keywords, making them currently unsuitable for disaster image generation.

**[Future Works]**

- Collection of domestic terrain image datasets.

- Attempting fine-tuning of image generation models.

- Exploring editing and synthesis techniques rather than image generation.

# Thank you

Q&A