

# OpenSource Diffusion Models Analysis Report

## Introduction

This report presents an in depth analysis of various Open Source Diffusion models for generating photorealistic images based on given prompts. The evaluation criteria include execution time, CPU and RAM usage, photorealism, steerability, and resource optimization. The goal is to identify the most effective pipeline for producing high quality images efficiently.

## Diffusion Models

Diffusion models are a type of artificial intelligence (AI) model used for generating realistic images from textual prompts. These models work by gradually adding details to an image, starting from a low-quality version and refining it over multiple steps. By doing so, diffusion models can create high-quality, photorealistic images that closely match the given text description. They are particularly useful in various applications, such as generating images for storytelling, creating visual content for marketing, and enhancing image search capabilities.

## Experimentation Process

We conducted experiments using four AI models: **runwayml/stablediffusionv15**, **stabilityai/stablediffusionxlbase1.0**, **ehristoforu/dalle-3xl-v2**, and **prompthero/openjourney**. Each model was tested on four different prompts, and the results were analyzed based on the mentioned criteria.

**Prompt 1:** Stylish young man in casual attire against urban backdrop: jeans, tee, denim jacket.

**Model:** runwayml/stablediffusionv15

- Execution Time: 1.07 Seconds
- Memory Usage: 31.46 MB
- CPU Usage: 38.70 %
- Observation: The image is wellgenerated, but the face is cut off. Overall, it looks realistic.

**Model:** stabilityai/stablediffusionxlbase1.0

- Execution Time: 1.03 Seconds
- Memory Usage: 15.22 MB
- CPU Usage: 28.40 %
- Observation: The image is great, but the face lacks clarity, giving it a slightly cartoonish appearance.

**Model:** ehristoforu/dalle-3xl-v2

- Execution Time: 1.14 Seconds
- Memory Usage: 20.30 MB
- CPU Usage: 75.55 %
- Observation: The image is excellent, with clear clothing details. However, it appears slightly blurry, resembling a cartoon.

**Model:** prompthero/openjourney

- Execution Time: 1.01 Seconds
- Memory Usage: 15.85 MB
- CPU Usage: 28.85 %
- Observation: The image is superb, closely resembling a real photo. The colors and person's figure are accurate, making it the best image for this prompt.

**Prompt 2:** Confident mid20s woman in chic floral dress in sunlit garden.

**Model:** runwayml/stablediffusionv15

- Execution Time: 2.67 Seconds
- Memory Usage: 79.22 MB
- CPU Usage: 76.30 %
- Observation: The image is good, but slightly blurry, detracting from its realism.

**Model:** stabilityai/stablediffusionxlbase1.0

- Execution Time: 2.80 Seconds
- Memory Usage: 24.73 MB
- CPU Usage: 49.30 %
- Observation: The image is excellent, with everything perfectly aligned. However, the image quality could be improved.

**Model:** ehristoforu/dalle-3xl-v2

- Execution Time: 1.13 Seconds
- Memory Usage: 0.00 MB

- CPU Usage: 29.35 %
- Observation: The image is amazing, but gives off a slightly cartoonish vibe, reducing its realism.

**Model:** prompthero/openjourney

- Execution Time: 1.08 Seconds
- Memory Usage: 0.12 MB
- CPU Usage: 30.15 %
- Observation: The image is awesome and looks real. Everything from the clothes to the background is perfect, although the image quality could be improved.

**Prompt 3:** Cheerful 8yearold boy in colorful hoodie, denim jeans, sneakers at playground.

**Model:** runwayml/stablediffusionv15

- Execution Time: 1.04 Seconds
- Memory Usage: 0.00 MB
- CPU Usage: 28.65 %
- Observation: The image is very good, resembling a real photo.

**Model:** stabilityai/stablediffusionxlbase1.0

- Execution Time: 1.51 Seconds
- Memory Usage: 0.25 MB
- CPU Usage: 46.50 %
- Observation: This is one of the best images generated, resembling a real photo in every aspect.

**Model:** ehristoforu/dalle-3xl-v2

- Execution Time: 1.47 Seconds
- Memory Usage: 0.09 MB
- CPU Usage: 94.05 %
- Observation: The image is elegant, but gives off a slightly animated vibe.

**Model:** prompthero/openjourney

- Execution Time: 0.98 Seconds
- Memory Usage: 0.53 MB
- CPU Usage: 29.70 %
- Observation: The image is really great and realistic, although the quality could be improved.

**Prompt 4:** Create a vivid image of a charming, playful 6yearold girl wearing a patterned dress, leggings, and ballet flats, inside a whimsically decorated bedroom.

**Model:** runwayml/stablediffusionv15

- Execution Time: 1.03 Seconds
- Memory Usage: 0.00 MB
- CPU Usage: 29.60 %
- Observation: The image is decent, but the girl's face is not visible and there are some flaws in the figure.

**Model:** stabilityai/stablediffusionxlbase1.0

- Execution Time: 1.01 Seconds
- Memory Usage: 0.06 MB
- CPU Usage: 79.55 %
- Observation: The image is excellent, with the girl looking real and the background detailed. However, there is some blurriness in the background and the girl.

**Model:** ehristoforu/dalle-3xl-v2

- Execution Time: 1.10 Seconds
- Memory Usage: 0.25 MB
- CPU Usage: 28.10 %
- Observation: The image is perfect, with the girl looking like a real kid and the background being excellent.

**Model:** prompthero/openjourney

- Execution Time: 1.51 Seconds
- Memory Usage: 3.69 MB
- CPU Usage: 99.35 %
- Observation: The image is good, but there are issues with the girl's face and figure, making it less realistic.

## Observations and Inferences

### Model Performance:

- prompthero/openjourney consistently produced the most photorealistic images with accurate details.
- stabilityai/stable-diffusion-xl-base-1.0 performed well in generating realistic images but sometimes lacked in image quality.
- ehristoforu/dalle-3-xl-v2 generated high-quality images but occasionally appeared slightly blurry, giving a cartoon-like effect.

- runwayml/stable-diffusion-v1-5 produced good images but occasionally cut off important parts like faces.

#### **Execution Time:**

- prompthero/openjourney and runwayml/stable-diffusion-v1-5 had relatively lower execution times, while stabilityai/stable-diffusion-xl-base-1.0 and ehristoforu/dalle-3-xl-v2 showed slightly higher execution times.

#### **Resource Usage:**

- prompthero/openjourney and runwayml/stable-diffusion-v1-5 had moderate to low memory and CPU usage, making them efficient choices.
- stabilityai/stable-diffusion-xl-base-1.0 and ehristoforu/dalle-3-xl-v2 exhibited higher memory and CPU usage, which could impact scalability and resource optimization.

#### **Image Quality and Steerability:**

- prompthero/openjourney demonstrated superior image quality and steerability, closely matching the given prompts.
- stabilityai/stable-diffusion-xl-base-1.0 and runwayml/stable-diffusion-v1-5 produced decent images but sometimes lacked clarity or cut off important parts.
- ehristoforu/dalle-3-xl-v2 had good image quality but appeared slightly blurry, affecting its realism.

## **Conclusion**

- In conclusion, the experimentation with various AI models for image generation has provided valuable insights. While models such as prompthero/openjourney showed promising results in terms of photorealism and accuracy, it's worth noting that there are better-performing models available in the market, albeit at a cost. These premium models offer enhanced capabilities in generating high-quality images with better steerability and resource optimization.
- To further improve image quality and resolution, exploring techniques like Super-Resolution Generative Adversarial Networks (SR GAN) could be beneficial. Additionally, reframing prompts and experimenting with different model configurations may also lead to better results. It's essential to continuously evaluate and adapt the AI pipeline to leverage the latest advancements in the field for optimal performance.

## Recommendations

- Explore premium AI models available in the market for better image generation results.
- Experiment with SR GAN to enhance image resolution.
- Reframe prompts to improve image quality and steerability.
- Continuously evaluate and adapt the AI pipeline to incorporate the latest advancements in the field for optimal performance.