

Seamlessly Integrating a Person into a Scene

Rakshith Pradeep Pagolu

Roll No: B210576CS

National Institute of Technology Calicut

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1 Introduction

In this project, the objective was to create a photorealistic composite image by seamlessly integrating a person into a background scene. The challenge involved aligning lighting, shadows, and color tones to ensure that the final image appears natural.

This document outlines the methodology followed to achieve convincing results using open-source tools and Python-based image manipulation libraries.

2 Methodology

The integration was completed in multiple stages:

2.1 1. Asset Preparation

As a cricket enthusiast, I wanted the composite to reflect a sense of grandeur and familiarity. I imagined placing the person in front of an iconic global landmark and, after evaluating a few options, I chose the **Christ the Redeemer** in Rio de Janeiro. Its dramatic perspective, open environment, and lighting made it ideal for photorealistic blending. To extract the person cleanly from the original

photo, we used the pre-trained **U²-Net** deep learning model, which produces high-quality alpha mattes for background removal. This ensured the resulting cutout preserved fine details like hair and edges, making it suitable for realistic compositing.



Figure 1: Background Scene – Christ the Redeemer



Figure 2: Person – Rohit Sharma

The scene (background image) and the person cutout were imported and converted to **RGBA** format. The alpha channel in the person image allowed for clean compositing and shadow generation.

- The person image was resized using a manual scale factor to match the perspective and depth of the background.
- The position of the person was manually adjusted to ensure proper alignment with the ground plane and to match the scale of the monument.



Figure 3: Initial placement of the person into the scene before lighting and shadow adjustments.

2.2 Shadow Construction

To improve realism and anchor the person to the scene, a soft projected shadow was constructed beneath the figure. This involved the following key steps:

1. **Silhouette Generation:** The alpha channel from the RGBA person image was extracted and used to create a black semi-transparent silhouette to serve as the shadow base.
2. **Vertical Flip:** The silhouette was flipped vertically to mimic a mirrored projection onto the ground plane beneath the person.
3. **Forward Projection:** To simulate the perspective of ground projection, additional transparent canvas space was added below the flipped silhouette. An affine transformation was then applied to skew the shadow forward and slightly rightward, in accordance with the background's lighting direction.
4. **Softening:** The resulting shadow was blurred using a Gaussian filter to create soft edges, imitating natural light diffusion. Opacity was further reduced to blend seamlessly into the scene.
5. **Resizing:** The shadow was vertically compressed to simulate a shallow contact on the surface.
6. **Positioning:** The final shadow was manually positioned slightly offset from the person's feet, ensuring spatial coherence with the lighting geometry.

Final Composite with Clean Alpha, Soft Shadow, and Color Grading



Figure 4: Final shadow projected and composited beneath the person.

To enhance photorealism, the person cutout was subtly repositioned to align with the base of the shadow, giving the impression of natural ground contact and lighting interaction.

2.3 Color and Tone Harmonization

To integrate the person naturally into the scene, we applied color and tone adjustments to match the lighting and ambient temperature of the background. The original cutout was shot under a different lighting setup, so harmonizing tones was crucial for realism.

1. **Saturation Enhancement:** The saturation of the person was slightly increased using the `ImageEnhance.Color` method from PIL to add vibrancy and match the visual richness of the scene.
2. **Cool Blue Tint:** A subtle blue overlay was blended with the person to match the cooler color temperature of the scene. This reduced warm tones and introduced coherence with the environment.
3. **Brightness Adjustment:** A slight decrease in brightness was applied to tone down the person's exposure and help them blend better with the shadowed parts of the background.
4. **Alpha Cleanup:** The alpha channel was cleaned by thresholding low-opacity pixels to remove edge artifacts from the cutout process. This ensured the boundaries were clean and crisp without unwanted halos.



Figure 5: Person after tone matching and alpha cleanup, prepared for final compositing.

2.4 Final Composition and Realism Enhancements

Once the person and shadow were independently adjusted and tone-matched to the scene, the final composite was constructed by layering the shadow and person onto the background. To further enhance realism and unify the composite visually, several finishing effects were applied:

1. **Layered Compositing:** The person was pasted above the shadow layer at the designated position. The order of layering ensured proper depth perception.
2. **Photo Filter Overlay:** A soft semi-transparent bluish overlay was applied across the full image using alpha compositing. This acted like a photographic filter, unifying the tones and slightly cooling the overall image.
3. **Radial Vignette:** A Gaussian-blurred circular vignette was created and multiplied over the image. This helped to draw the viewer's attention toward the center, reducing visual distractions near the edges.
4. **Noise/Grain Addition:** Subtle noise was added using a randomly generated grain pattern. This mimicked camera sensor grain and made the composite feel more cohesive by reducing the overly digital appearance of different layers.
5. **Brightness Adjustment:** As a final step, the brightness of the composite was slightly increased to lift shadows and improve visual clarity while preserving the natural tone.



Figure 6: Final blended image with vignette, photo filter, and grain.

The combined use of tonal matching, shadow realism, and photographic finishing effects contributed to a final output that feels natural and visually cohesive, aligning well with the ambient qualities of the background.

3 Final Image Output

After completing all harmonization and realism enhancements, including shadow placement, color correction, alpha cleanup, and photographic blending, a final brightness adjustment was applied. This +20% brightness boost lifted the shadows and improved clarity, especially around the subject and ground contact areas.



Figure 7: Final composite after brightness enhancement. The person now appears naturally embedded into the scene with consistent lighting, tone, and depth.

The final image looks realistic, with the person naturally fitting in the background. This shows that careful use of image editing tools, such as layering, color adjustment, and small touch-ups, can create a high-quality result using code.

4 Challenges & Solutions

While working on the composite image, several problems came up. Each challenge was solved using simple and effective image editing techniques. The table below shows the main issues and how they were fixed:

Challenge	Solution
The lighting on the person didn't match the background	Changed brightness and added a cool color tint to match the scene
Rough or hard edges around the person	Cleaned up the edges using alpha mask filtering
The shadow didn't look realistic	Created a soft shadow by flipping, skewing, and blurring a silhouette
The person looked separate from the background	Added grain and a photo filter to make everything look more natural together
The final image looked a bit dark in places	Increased the brightness slightly to make the image clearer

These steps helped solve the problems and made the final image look more realistic and well-balanced.

All the steps in this project were carried out using Python. We used tools like `Pillow`, `NumPy`, and `OpenCV` to edit and combine the images. To cut out the person from the original photo, we used a pre-trained deep learning model called `U2-Net`. These tools, along with careful adjustments to lighting, shadows, and colors, helped create a final image that looks realistic and naturally blended into the background.