Assignment: Seamlessly Integrating a Person into a Scene

Objective

The objective of this assignment is to implement a step-by-step process to place a person into a given scene and seamlessly blend them to make the result look photorealistic. You need to do the research and make a plan of action on how this can be achieved. A few of the steps have been provided, follow these steps. Some steps might be missing, add those steps to complete the Algorithm.

Task 1: Capturing and Preparing the Person's Image

Step 1: Capture a High-Quality Image

Capture a front-view image of a person. Ensure the person is positioned directly in front of the camera in a well-lit environment.

Step 2: Remove the Background

Extract the person from the background, leaving only the foreground image of the person. Save the extracted foreground image for further processing. This person will be placed into a background image where blending is required.

Task 2: Analyzing Shadows and Lighting of the BG image

Step 1: Detect and Classify Shadows

Develop a process to detect shadows cast by the person in the given scene. Classify the shadows into:

1. Hard Shadows: Well-defined, sharp shadows.
2. Soft Shadows: Diffuse, ambient shadows.

Generate binary masks for the detected shadows.

Task 3: Determining Light Direction

Step 1: Compute Light Direction for Outdoor Scenes

Detect the shadow cast by the person in the scene. Calculate the 3D direction of the light source based on the shadow's position and the person’s body.

Step 2: Estimate Lighting for Indoor Scenes

Analyze the background scene and estimate the approximate direction of the diffused lighting.

Task 4: Coloring and Blending

Step 1: Document the Missing Steps

Identify the required steps for coloring the person to match the background scene. Provide an explanation of your approach.

Task 5: Generating the Final Output

Choose a background scene of your choice and combine all steps to produce a final photorealistic image where:

- - The foreground person is naturally integrated into the background scene of your choice.
- - Lighting and shadows are correctly aligned.
- - Colors between the person and the background are seamless.

Deliverables

1. Final Composite Image: A photorealistic image of the person seamlessly placed into the scene.
2. Algorithm Documentation: A written document outlining the steps taken, missing steps you identified, and a detailed explanation of the method you used to achieve the final output.
3. No code is required: Only the final blended image and the documentation are required. Use any tools, software, or resources available (free or paid) to complete this task.

Evaluation Criteria

1. Correctness: Each task must be implemented accurately, producing expected outputs.
2. Realism: The final image must look natural, with proper lighting, shadows, and color harmonization.
3. Documentation: The algorithm must be well-documented, detailing the approach taken and tools used.
4. Creativity: Innovative or optimized approaches for any step will earn additional credit.
5. Presentation: The final image and documentation must be clear, organized, and professional.