

Realistic 3D Scene Relighting

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<https://sonainjameel.github.io/Realistic-3D-Scene-Relighting/>

Introduction

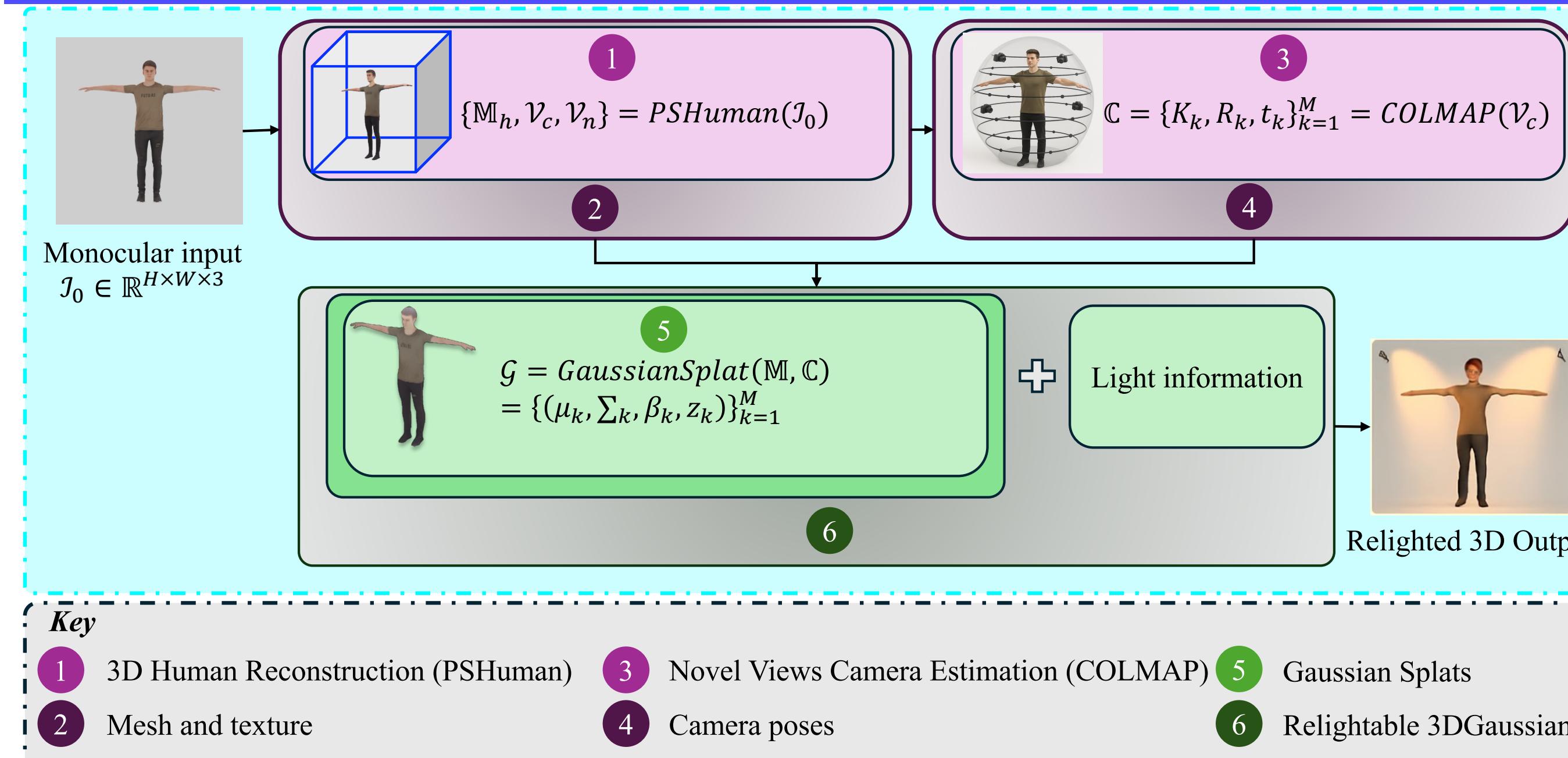
Relighting aims to modify how a scene appears under different lighting. It's essential in vision, graphics, and immersive media, yet remains challenging due to light-material and geometric complexity.

SV-GaSRelight Pipeline

SV-GaSRelight is a lightweight single-image relighting framework that leverages 3D Gaussian Splatting and learned scene priors. Despite relying on just a single RGB input, it achieves perceptual quality comparable to multi-view systems on static human scenes.

- **Input:** Single-view RGB image
- **Output:** Photorealistic 3D scene under novel lighting
- **Pipeline Components:**
 - **PSHuman:** Robust 3D human reconstruction and novel view synthesis
 - **COLMAP:** Sparse feature-based camera pose estimation
 - **Relightable3DGaussian:** View-consistent relighting using radiance-aware 3D Gaussians

Architecture Overview



User Study for SV-GaSRelight Results

Overall User Preference

User preference distribution in the pairwise comparison study.

Model	User Preference [%]
Relightable 3D Gaussian [Gao et al. 2024]	44.5%
SV-GaSRelight (Ours)	55.5%

Dance3DRelight Pipeline

Dance3DRelight extends single-image relighting to dynamic full-scene environments. It integrates intrinsic image decomposition, 3D mesh reconstruction, and real-time relighting using browser-based GLSL rendering.

Key Characteristics:

- Operates from a single-view input
- Outputs a fully relightable scene with human and background geometry
- Capable of real-time, interactive visualization directly in the browser

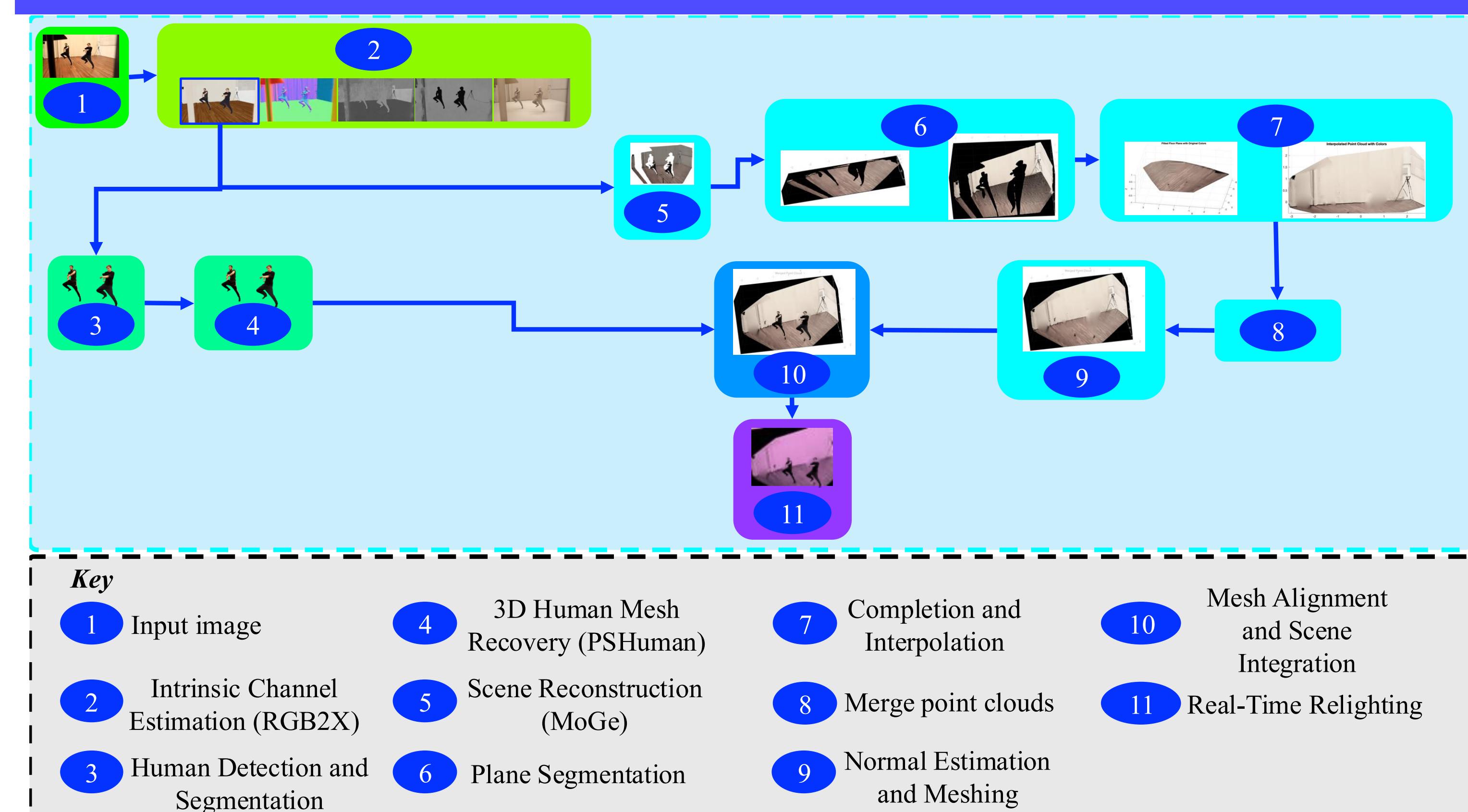
Pipeline Components:

- **RGB2X:** Extracts albedo, shading, and other intrinsic components from the input image, helping separate reflectance from illumination.
- **PSHuman:** Recovers a high-quality 3D human mesh and enables novel view synthesis, ensuring the subject's identity and pose are preserved.
- **MoGe:** Generates the static background stage (scene without the human) using geometry estimation techniques, allowing for spatially consistent relighting.
- **GLSL Shader Renderer:** Integrates all reconstructed components and enables physically plausible lighting manipulation using WebGL in real time.

Evaluation:

- Conducted user studies with dynamic multi-color and white-light scenarios
- Assessed perceptual realism, lighting plausibility, and identity consistency
- Demonstrated robustness under visually challenging and low-information conditions

System Interface



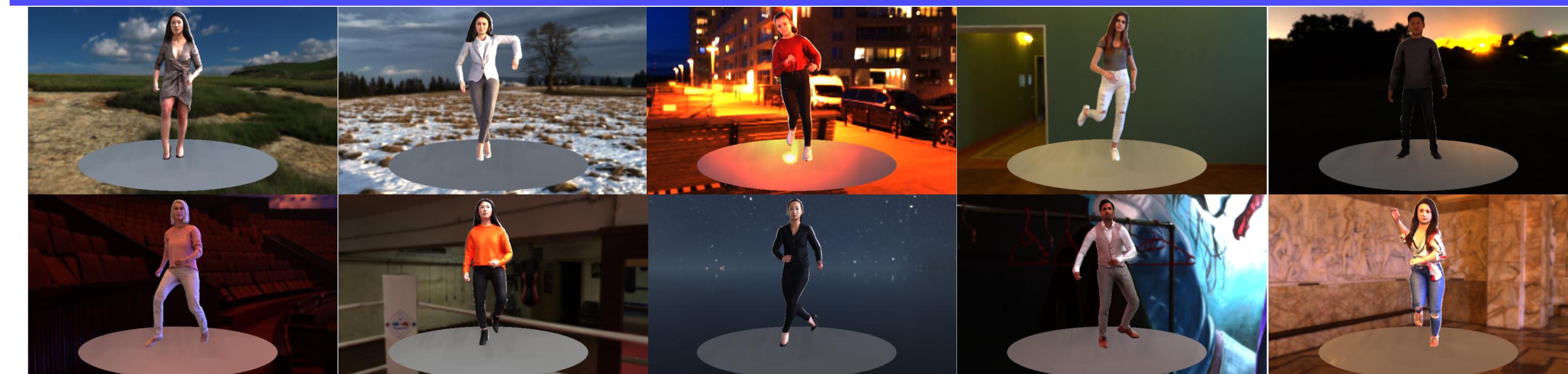
User Studies

Participants rated realism, lighting plausibility, and identity retention. SV-GaSRelight and Dance3DRelight both showed strong subjective performance.

Dataset and Tools

- Custom dataset with varied lighting
- Evaluation tool with side-by-side comparison
- Web-based interface for interactive results

Results



Conclusion

- Single-view relighting is feasible and effective
- SV-GaSRelight and Dance3DRelight cover human and scene-level cases
- Contributions include new dataset, tools, and pipelines

Acknowledgements

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Explore the Project



Scan to view the interactive project page

Access videos, dataset, code, and real-time relighting demos online.