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*Poster*

# Color3d: Photorealistic texture mapping for 3D mesh

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**Abstract**

*3D reconstruction plays a significant role in various fields, including medical imaging, architecture, and forensic science, in both research and industry. The quality of color is one of the criteria that determine reconstruction performance. However, the predicted color from deep learning often suffers from low quality and a lack of details. While traditional texture mapping methods can provide superior color, they are restricted by mesh quality. In this study, we propose Color3D, a comprehensive procedure that applies photorealistic colors to the reconstructed mesh, accommodating both static objects and animations. The necessary inputs include multiview RGB images, depth images, camera poses, and camera intrinsic. Compared to traditional methods, our approach replaces face colors directly from the texture map with vertex colors from multiview images. The colors of the faces are obtained by interpolating the vertex colors of each triangle. Our method can generate high-quality color for different objects, and the performance remains strong even when the input mesh is not perfect.*

**CCS Concepts**

• ***Computing methodologies*** → ***Texturing; Image processing; Computer graphics; Mesh models;***

## 1. Introduction

3D reconstruction is a longstanding and fundamental topic in computer vision. Successful reconstruction necessitates high-quality meshes and accurate color representation. In this study, our focus lies on the coloration of meshes. While deep learning methods have demonstrated impressive performance in color generation, issues of versatility and computational time persist. In addition, the colored meshes generated by deep learning methods often exhibit blurriness or artifacts. Furthermore, the training process demands a substantial amount of diverse data, which can be challenging to acquire. Traditional texture mapping methods have the potential to offer high-quality color, but they also come with their own set of challenges that can be difficult to solve. These issues include distortion due to surface deformation, texture stretching, and compression. To address these challenges, we proposed a multiview texture mapping procedure for coloring. By utilizing a input uncolored mesh and multiview RGBD images of the colored object, along with known camera poses and intrinsic details, our method can generate photorealistic color for the mesh. Notably, our method does not require extensive training or data preparation, enabling a fast and effective application.

## 2. Related work

In the realm of 3D reconstruction, numerous methods have been proposed. Approaches like NeRF [MST*21] represent scenes through neural radiance fields, utilizing Multiview images as their input. These techniques require a substantial number of images and are generally trained on a per-scene basis. Reconstruction from point cloud could be more intuitive for representing objects or scenes but also presents a challenge due to their lack of volume. Among the various 3D reconstruction methods from point clouds, reconstruction via implicit fields is one of the most popular method. Notably, the Implicit Feature Network (IF-Net) [CAPM20] falls short in predicting color information, although a texture extension variant has been proposed [CPM20]; the predictions remain deficient in capturing details.

## 3. Method

Figure 1 is the illustration of our pipeline. Initially, we extract all vertices in world coordinates from the provided or predicted mesh. Subsequently, using camera matrices, we calculate the corresponding pixel coordinates in the Multiview images. By further employing camera matrices, the depth values of vertices could be computed in each camera coordinate system. We then compare the differences between the computed depth and the values from depth images. If the difference exceeds a specified threshold, it indicates that the position of this vertex significantly deviates from the ideal colored mesh, rendering the vertex invalid. Each valid pixel coordinate, supervised by depth differences, corresponds to a specific color in the image. This color is then projected back onto the corresponding vertex of the mesh. Subsequently, the colors of the faces are obtained through interpolation from the vertex colors of each triangle.



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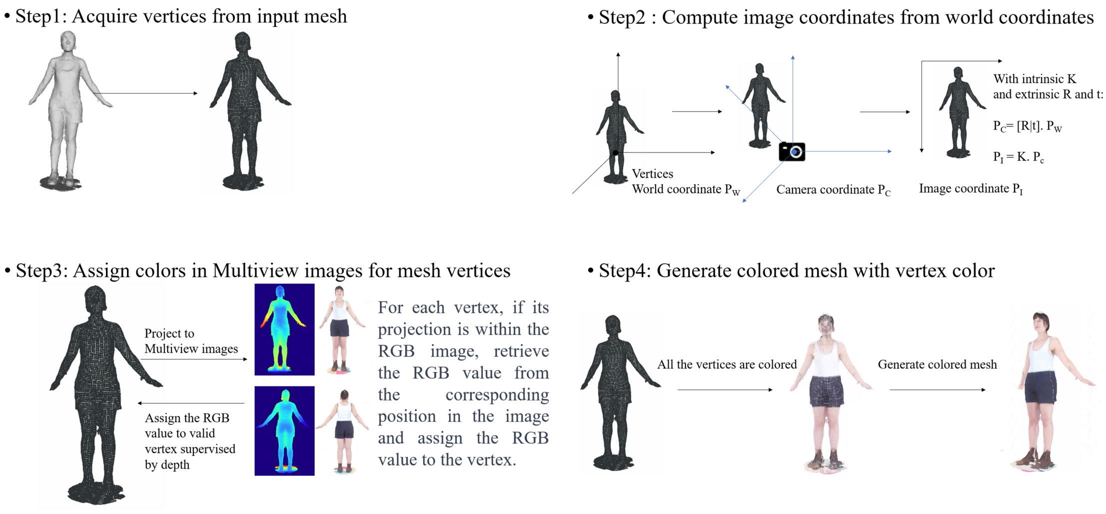


**Figure 1:** *The pipeline of our proposed texture mapping method.*

## 4. Results

Figure 2 illustrates the input mesh, the mesh colored by our method, the ground truth, and the mesh colored by UV texture mapping. While the input mesh is not identical to the ground truth, our method still produces high-quality color and fine details. Our method also outperformed UV texture mapping method. Figure 3 displays several results from different frames in an animation file featuring a sequence of continuous poses. From these observations, we can conclude that our method is not restricted to human poses and could be used in coloration for mesh in animation.

**Figure 2:** *An illustration for input mesh, result from our method, ground truth, and result from UV mapping.*

**Figure 3:** *Texture mapping results for animation data.*

## 5. Conclusion

The presented method effectively generates photorealistic-colored meshes from uncolored meshes using multiview RGBD images, camera poses and camera intrinsic. Its applicability extends to both static objects and animations. In our future work, we aim to broaden the scope of our method to encompass more diverse categories of data, with the objective of applying it to more complex indoor scenes containing multiple objects. The success of this novel approach paves the way for further investigations and applications like real-time RGB mesh in augment reality (AR).

## 6. Acknowledgments

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