Surface-based Background Completion in 3D Scene

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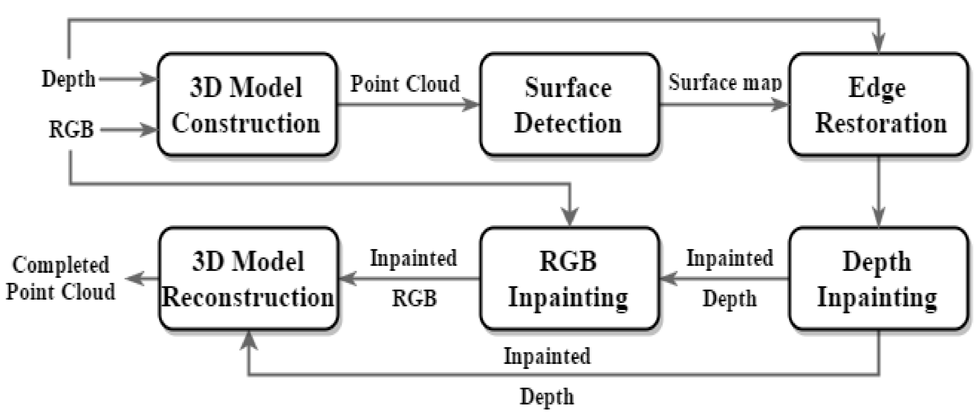
Proposed System

✓ **A surface-based background completion in 3D scene**



Edge Restoration

✓ **Generate the "edge map"**
- Computed automatically using a combination of gradient- and surface-based measures
- Serve as an edge-preserving texture suppression filter

✓ **Determine the order of patch filling**
- Use the data term, which gives preference to linear structure.

$$D(p) = \frac{\left| I_p^{\perp} \cdot n_p \right|}{\alpha}$$

Depth & RGB Inpainting

✓ **RGB inpainting with inpainted depth**
- A more precise similarity calculation between square depth patches

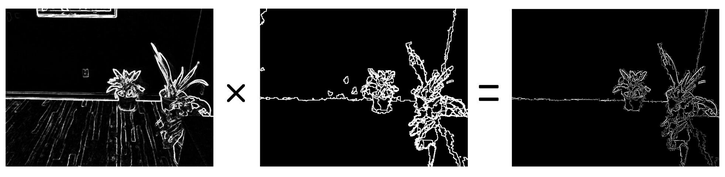
✓ **Concern of parameters and weight**
- Searching range, patch size
- Weight of depth and color

✓ **Smooth the boundary between patches**
- Use Poisson image editing to reduce artifacts caused by overlap of patches.

$$\min_f \iint_\Omega |\nabla f - v|^2 \quad \text{with} \quad f|_{\partial\Omega} = f^*|_{\partial\Omega}$$

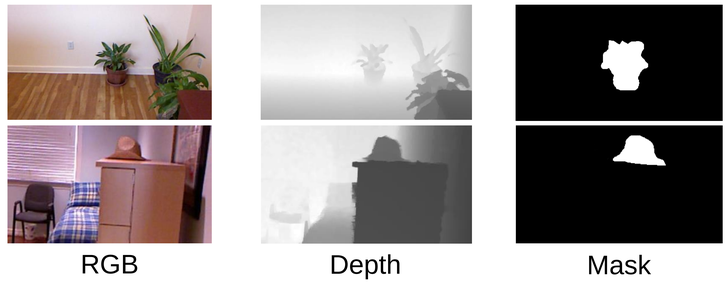
Experimental Results

✓ **Edge map**
- The product of gradient and surface map after contrast enhancement

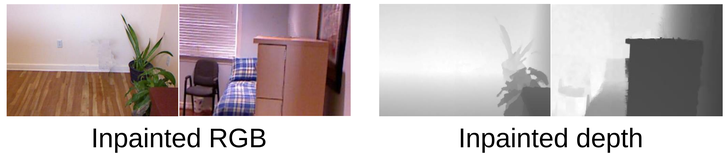


Gradient map | Surface map | Edge map

✓ **Examples of inpainted RGB-D image**

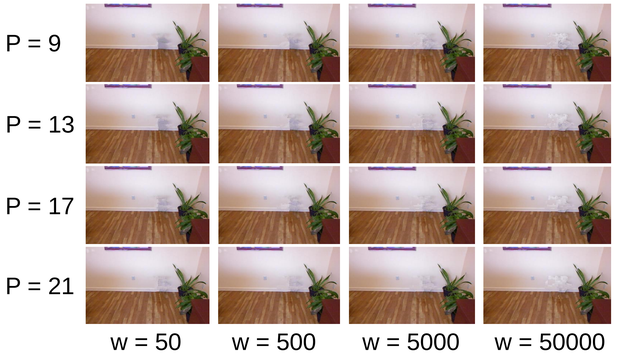


RGB | Depth | Mask

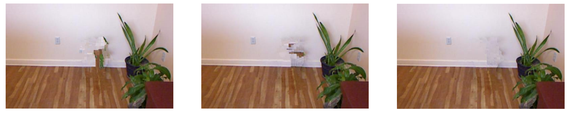


Inpainted RGB | Inpainted depth

✓ **Concern of parameters**
- Searching range : 50 pixels
- Independent variable : patch size, weight of depth

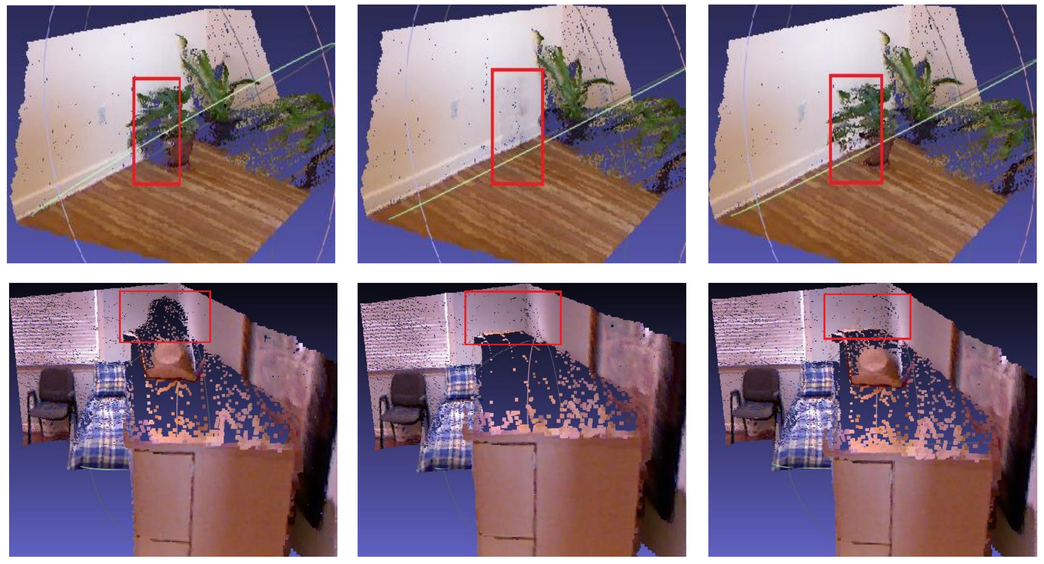


✓ **Comparison of RGB inpainting methods**
- Higher accuracy comparing to using original depth and surface map



Based on original depth | Based on original surface map | Based on inpainted depth

✓ **Reconstructed 3D point cloud models from NYU datasets**
- Built from single-view RGB-D photos
- The ability of our approach to produce ideal results
- Achieve a more comprehensive visualization



Original | Restored background | Reconstructed 3D model