

# Real Time Ray Tracing Denoise Combined with Super Resolution

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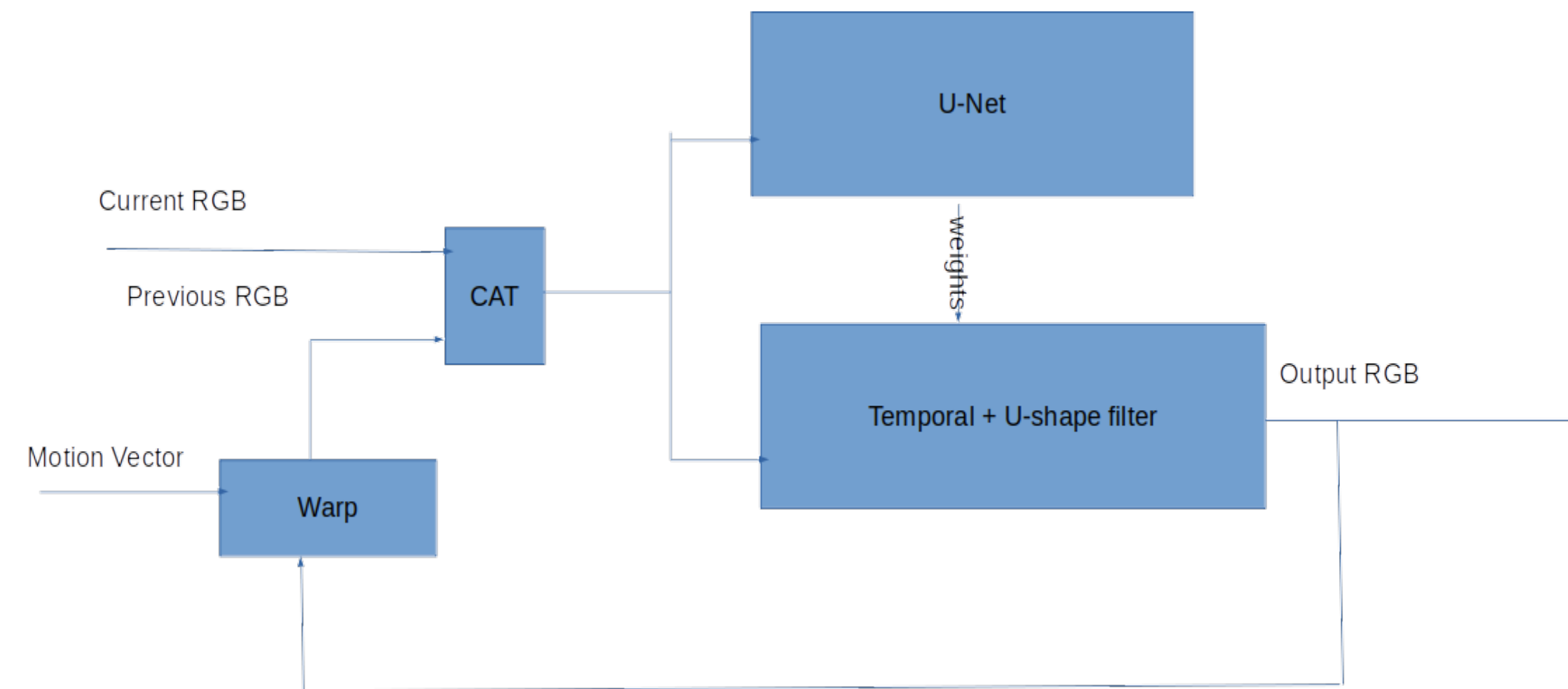
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## Introduction

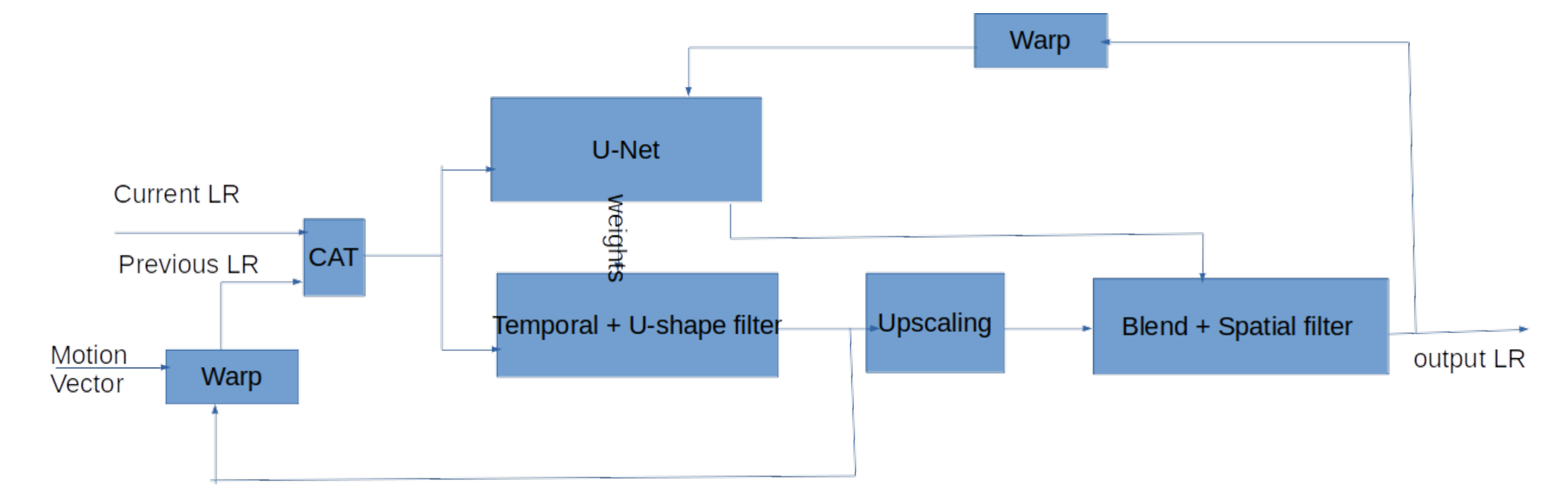


The demand of computation and bandwidth are challenging for real time ray tracing denoise. We propose the unifiednet combining denoise with super resolution. It uses only the RGB noisy image and motion vector, which reduces the bandwidth of rendering output. Also, it reduces the dominant computation as 1/4, which is estimated to be about 40G FLOPs.

## Methodology

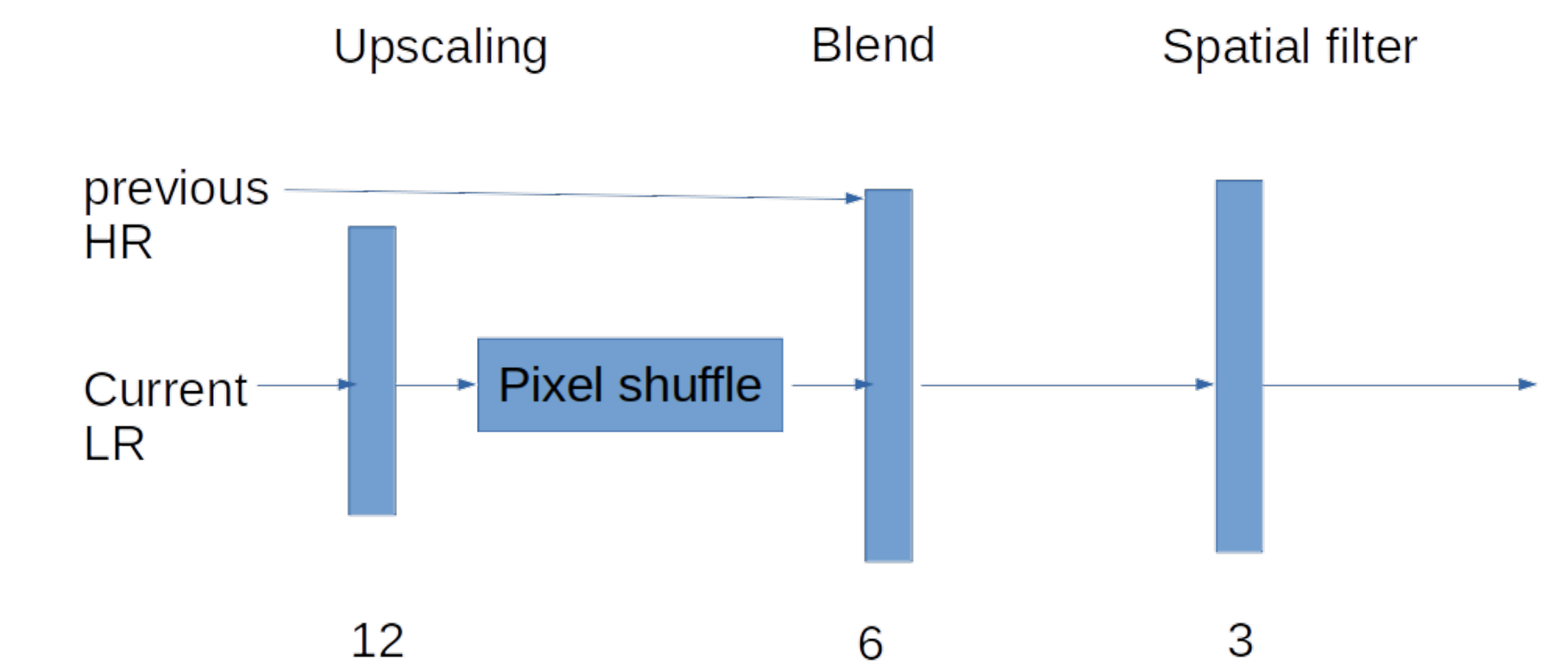
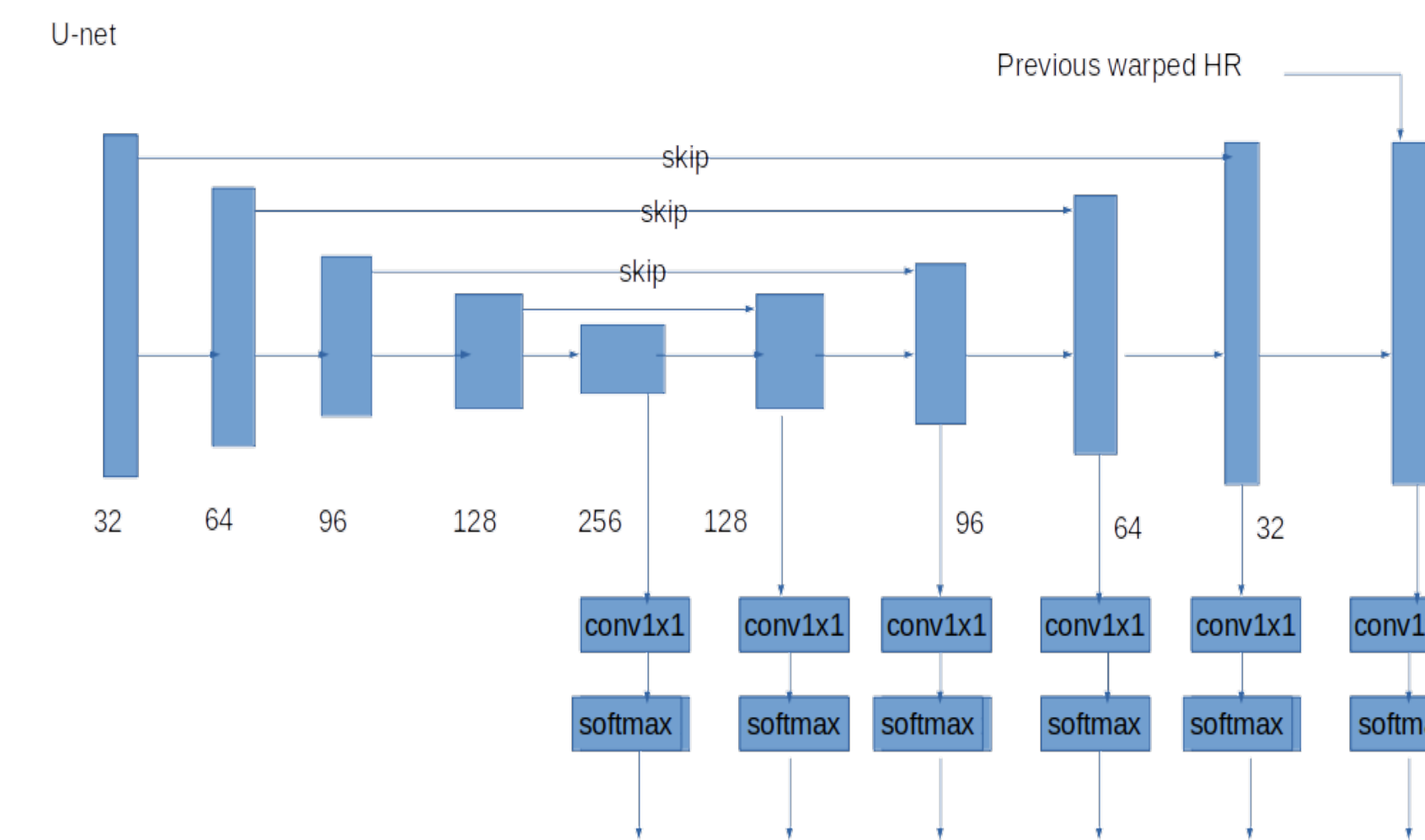


Native denoise network

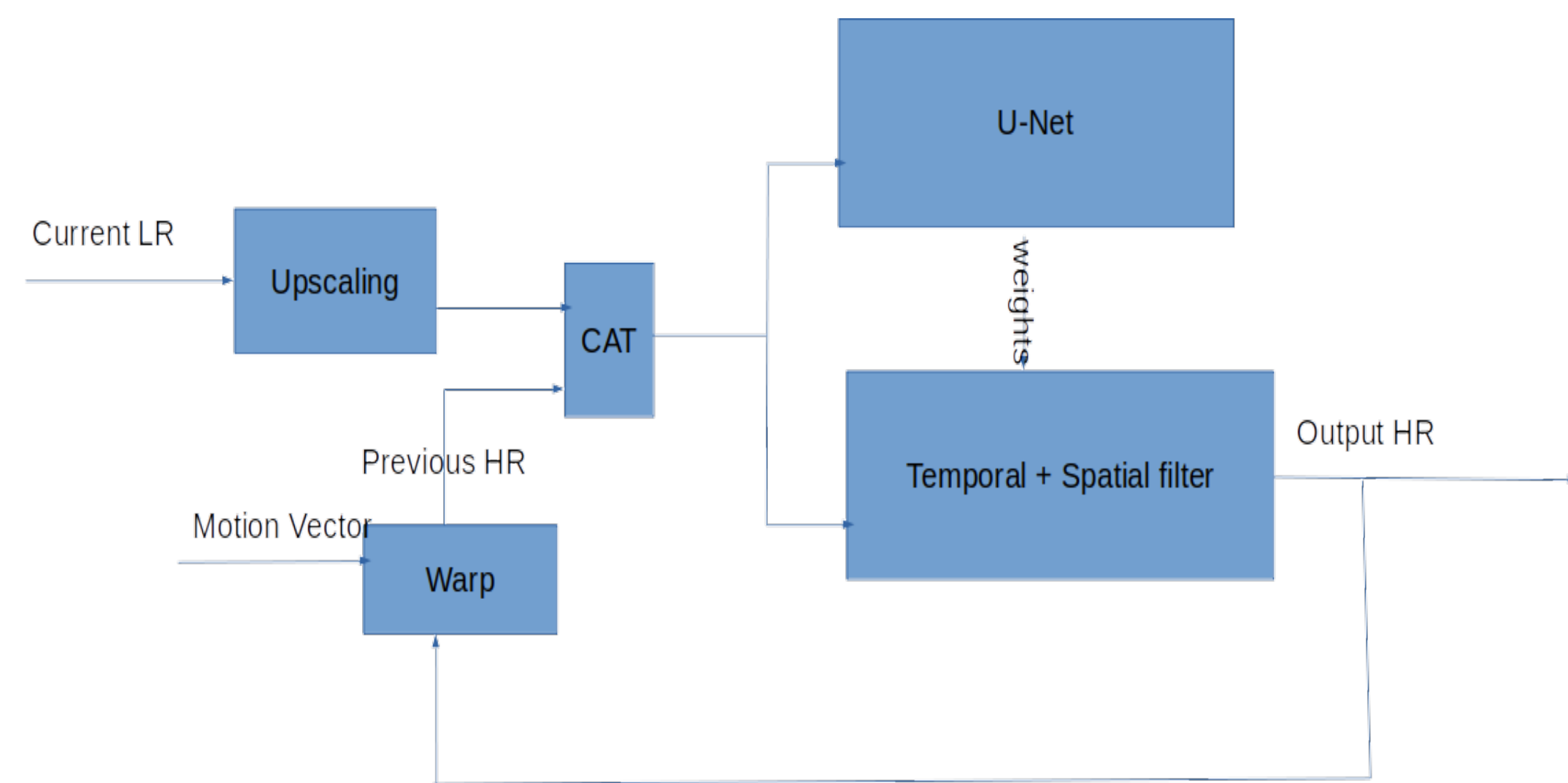


Our Approach

## Implementation



## Related Work



Super resolution network

Spatial NN filter  
KPCN[Bako et al. 2017]

Temporal and spatial NN filter

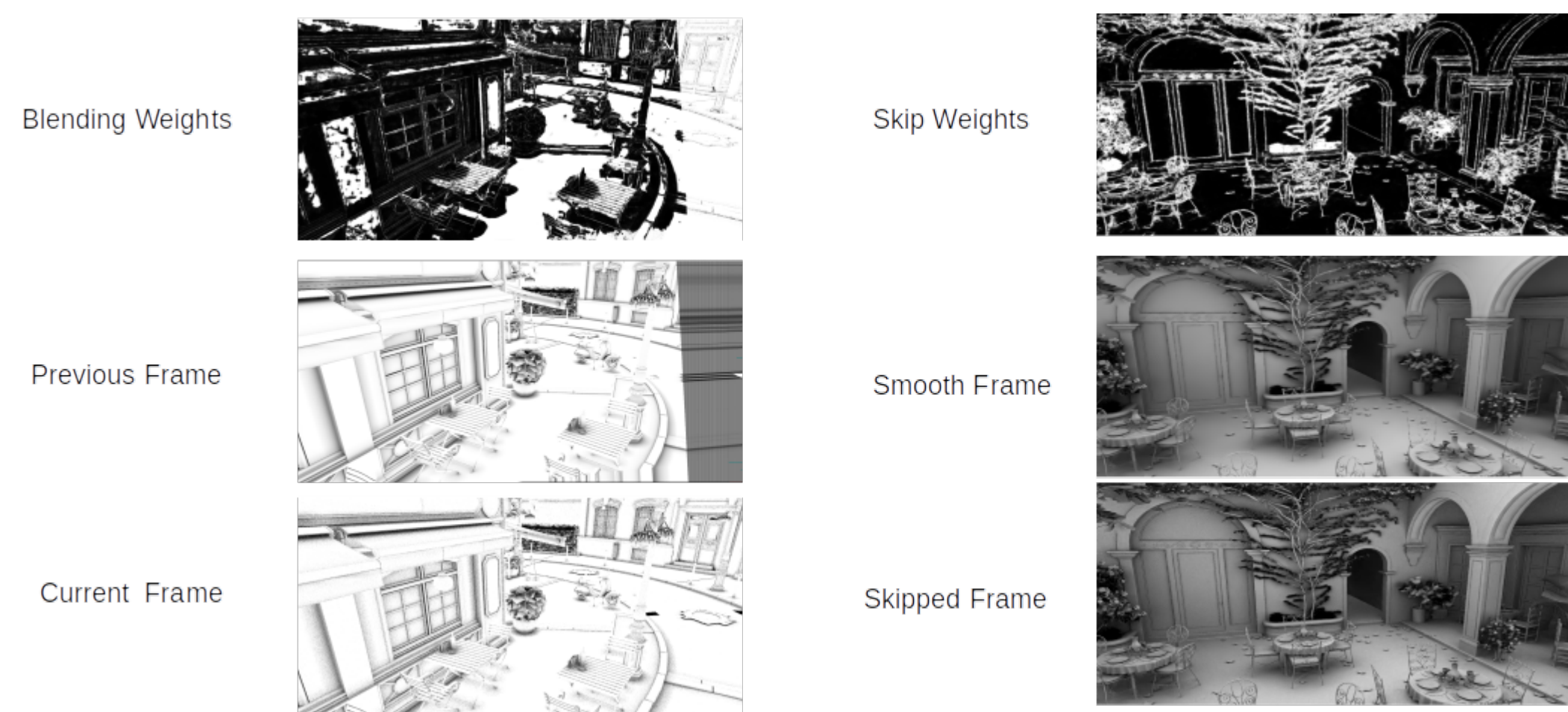
RAE[Chaitanya et al. 2017]  
Neural Bilateral Grid [Meng et al. 2020]  
NTASD[Hasselgren et al. 2020]  
[Isik et al. 2021] warps the previous frame's embedding  
Weight Sharing Kernel Prediction Network[Fan et al. 2022]

Transformer block to process over the embedding  
[Yu et al. 2021]

Ensemble denoising  
[Zheng et al. 2021] combine different methods

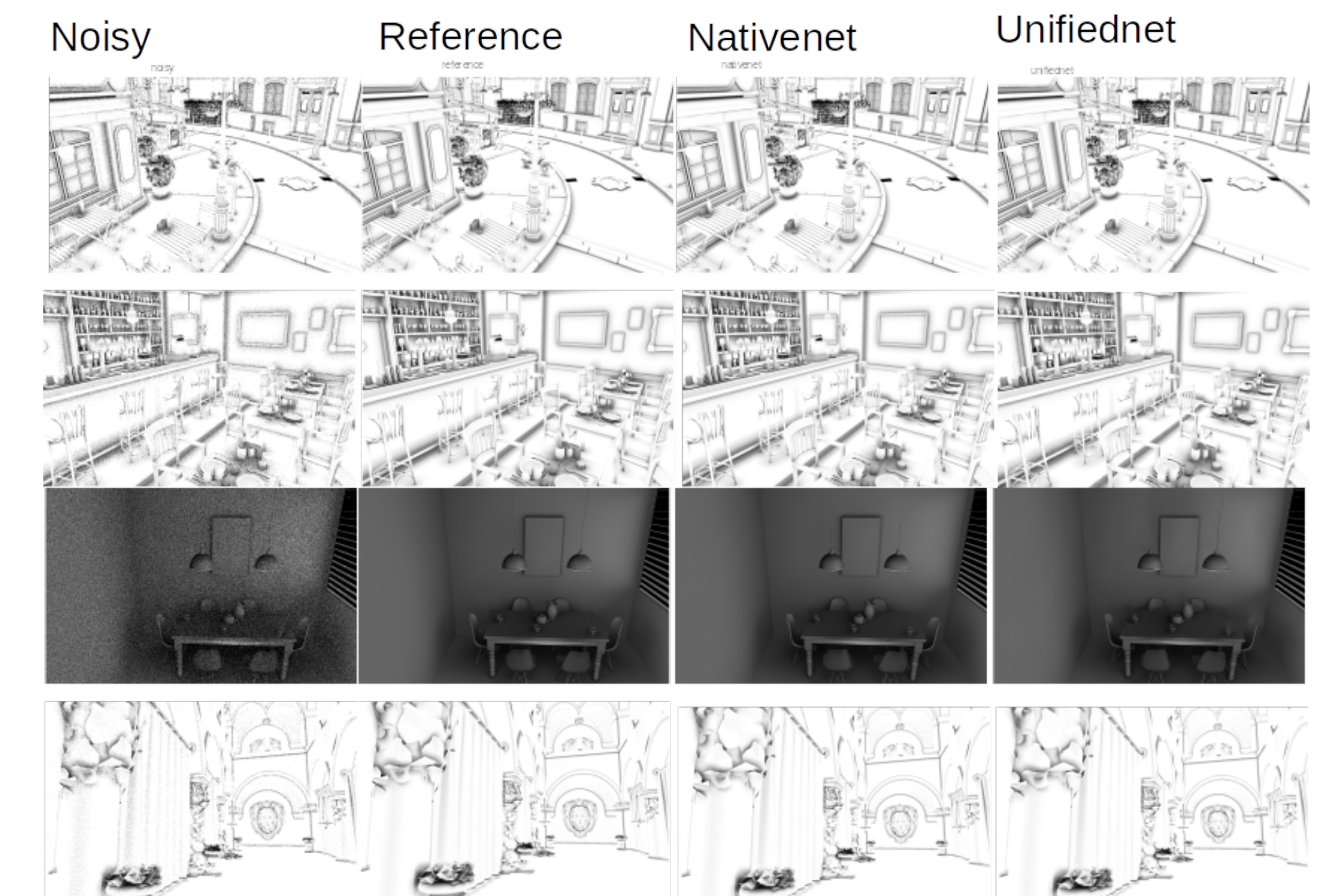
Super Resolution  
pixel shuffle [Shi et al. 2016]

## Visualization



1. Blending weights smaller for those invalid history samples in previous frame
2. The slim edges in the chairs have bigger skip weights, which mean they rely more on the temporal filtering. It avoids the overblur of by the coarse resolution filtering in the U-shape filter. The skip weights image is roughly the segmentation of the surfaces. It makes sense as the pixels in one surface are likely to share the similar rendering parameters. It indicates that the segmentation backbone networks other than U-net may benefit the denoise task..

## Results



## Future Work

Our solution is orthogonal to the reparameter and quantization optimizations. For example, it would benefit from the reparameter method to reduce the inference computation further. Beside, it would benefit from the reduced precision int8/int4 method.