# Mip-Grid: Anti-aliased Grid Representations for Neural Radiance Fields

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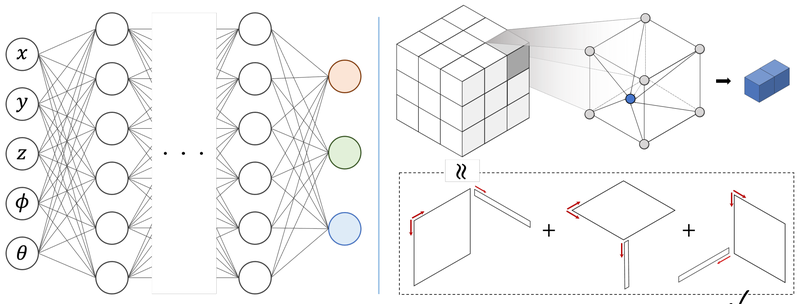
## INTRODUCTION

### ❑ Motivation & Contribution

- Neural radiance fields (NeRF)
  → ***struggles from aliasing artifacts*** (e.g., jaggies)
- Mip-NeRF
  → renders conical frustums instead of rays
  → relies on MLP and ***requires long training time***

- Mip-Grid
  → an anti-aliasing method for ***grid-based NeRF***
  → ***fast to train*** and ***minimizes additional #params***
- Our method ***outperforms mip-NeRF*** in PSNR while achieving ***40x faster training time***

### ❑ MLP-based NeRF & Grid-based NeRF

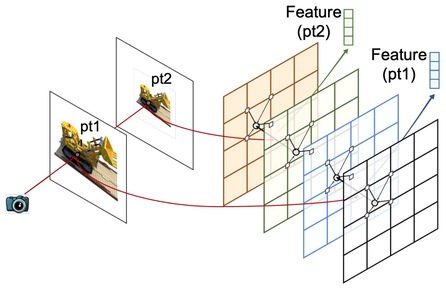



compact / slow, ~~aliasing~~

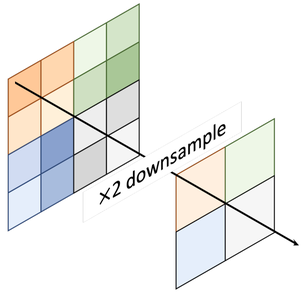


fast / reasonable size / aliasing ✓

### ❑ Explicit Multi-scale Grids & Supersampling



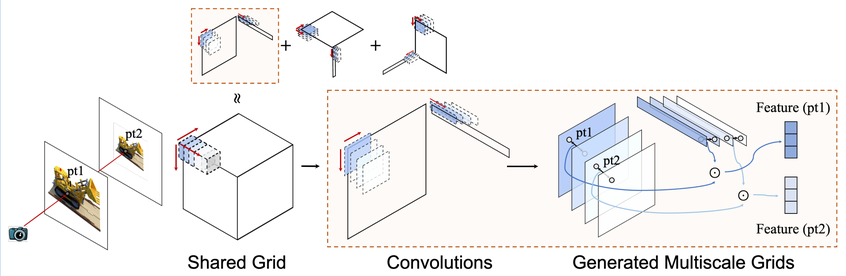

high disk usage (×4)




slow rendering

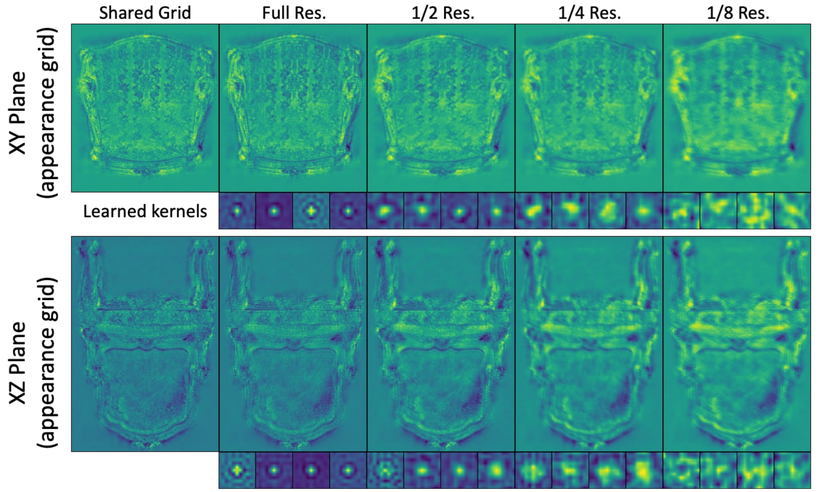
## METHOD

### ❑ Mip-Grid (Generating Multi-scale Grids)



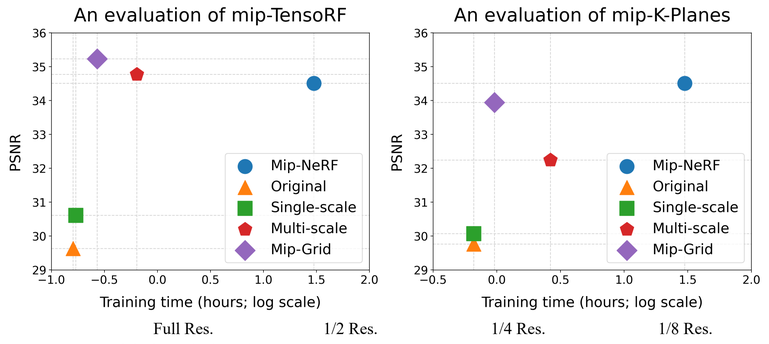

- The figure shows the overall architecture of mip-TensoRF
- ***Generates multi-scale grids*** instead of using explicit grids
  → convolution over a single-scale grid with ***learnable kernels***
- Interpolate the two multi-scale grids ***closest to given scales***

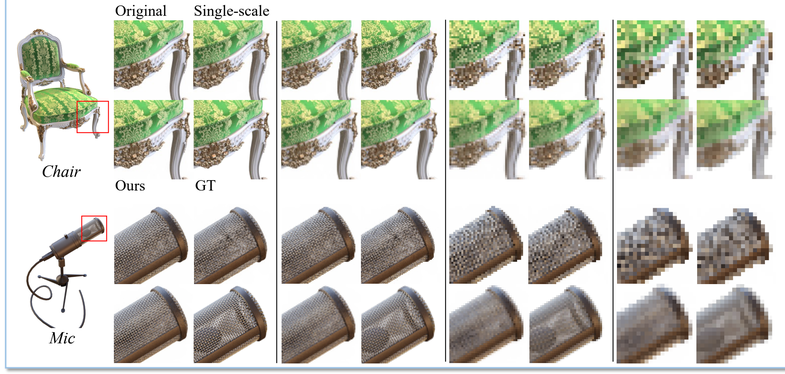
### ❑ Generated Multi-scale Grids & Learned Kernels



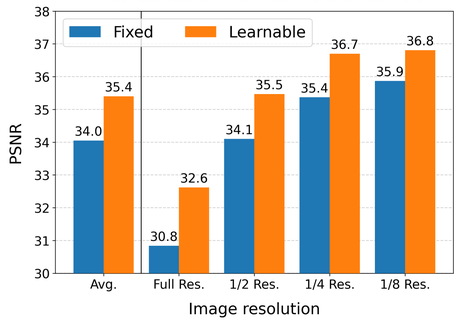

## RESULTS

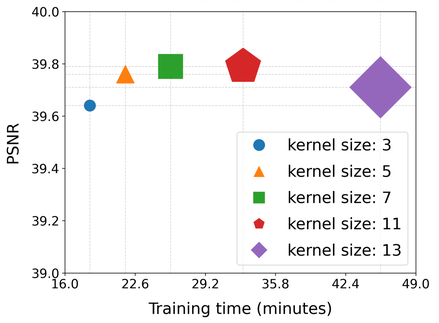
### ❑ Experimental Results on Blender Dataset




### ❑ Ablation Studies




### ❑ Summary of Experimental Results

- Mip-Grid is ***fast to train, reasonably compact, anti-aliased***
- Implemented and tested on TensoRF-VM-192 and K-Planes
  → both methods outperform their respective baselines
  → mip-TensoRF ***achieves the best PSNR*** including mip-NeRF
- Learnable kernels give better quality images (***+1.4 in avg. PSNR***)
- Kernel size has a minor effect on PSNR, but determines training time