Semantic Segmentation using Implicit Representation
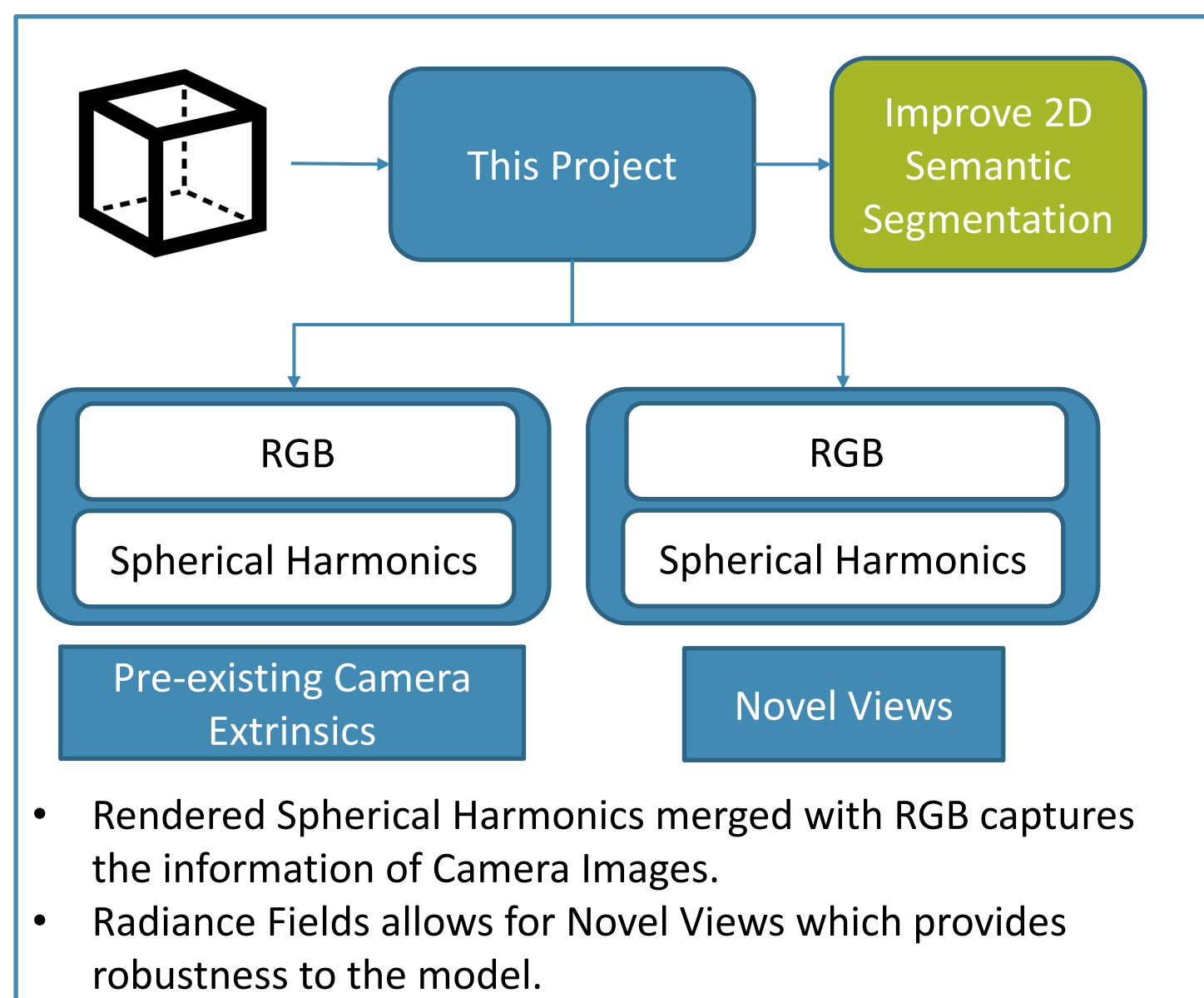
Karim ElGhandour   Mohammad Rashed   Supervised by: David Rozenberszki
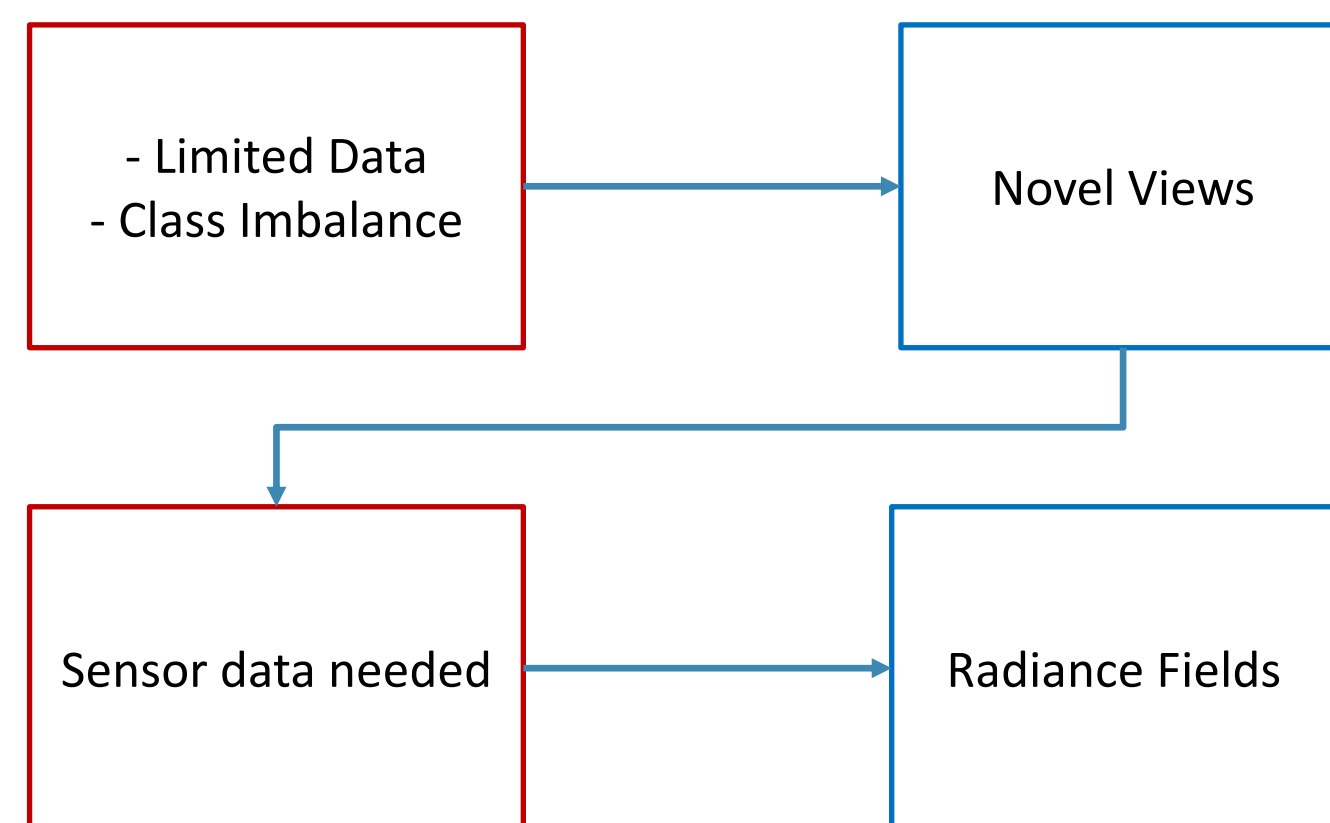
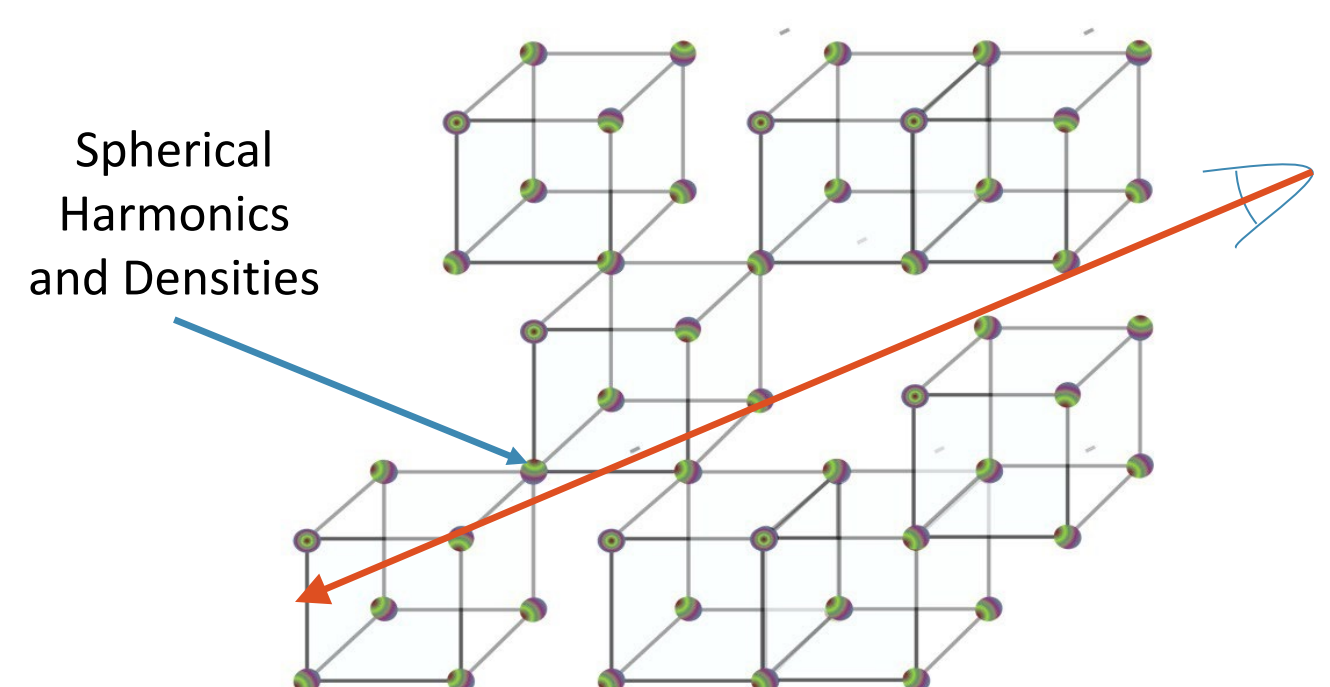## CONTRIBUTION

- This Project → Improve 2D Semantic Segmentation
- RGB / Spherical Harmonics / Pre-existing Camera Extrinsics
- RGB / Spherical Harmonics / Novel Views

- Rendered Spherical Harmonics merged with RGB captures the information of Camera Images.
- Radiance Fields allows for Novel Views which provides robustness to the model.

INTRODUCTION

Segmentation Issues

- Limited Data
- Class Imbalance → Novel Views
- Sensor data needed → Radiance Fields

Plenoxels

Spherical Harmonics and Densities

METHOD

Rendering Pipeline overview

- Groundtruth Camera Extrinsics
- Novel Camera Extrinsics
- C
- Plenoxels Rendering Pipeline → PeRFception 3D Dataset
- Annotation Rendering Pipeline → ScanNet 3D Segmentation Mesh
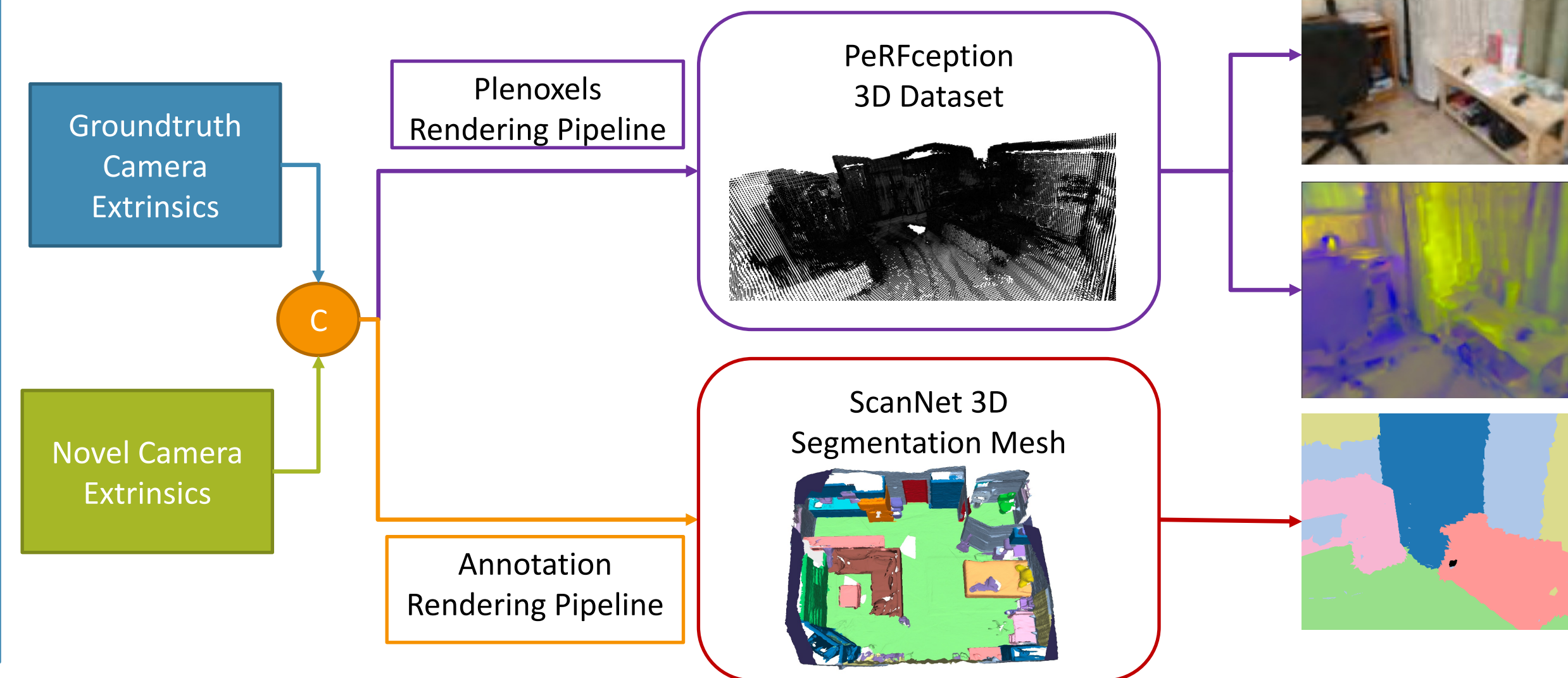
Approaches for merging Spherical Harmonics (SH) with color (RGB)

(a) Direct concatenation

(b) Convolve and concatenate
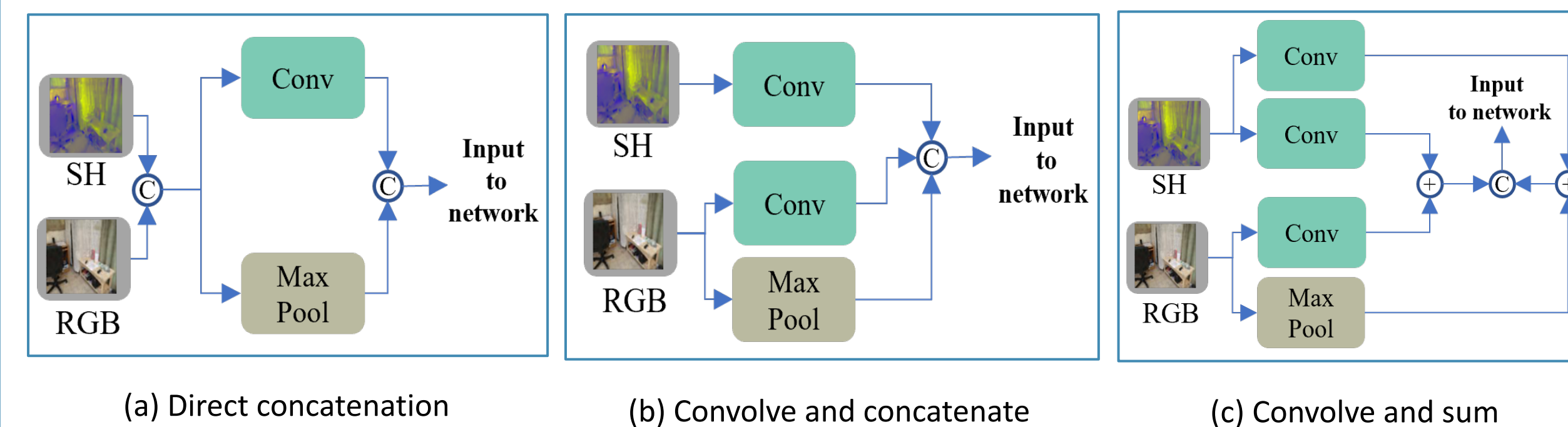
(c) Convolve and sum

Novel View Generation Pipeline

Target Class → Target Oriented Sampling → Scenes / Depth / GT Camera Pose / Annotation

(a) Target Sampling

Depth to point / Y - Difference / X - Difference

(b) Dome Generation

Target Object / Blocking line-of-sight

(c) Redundant View Filtration
(Full Occlusion + Major Occlusion)
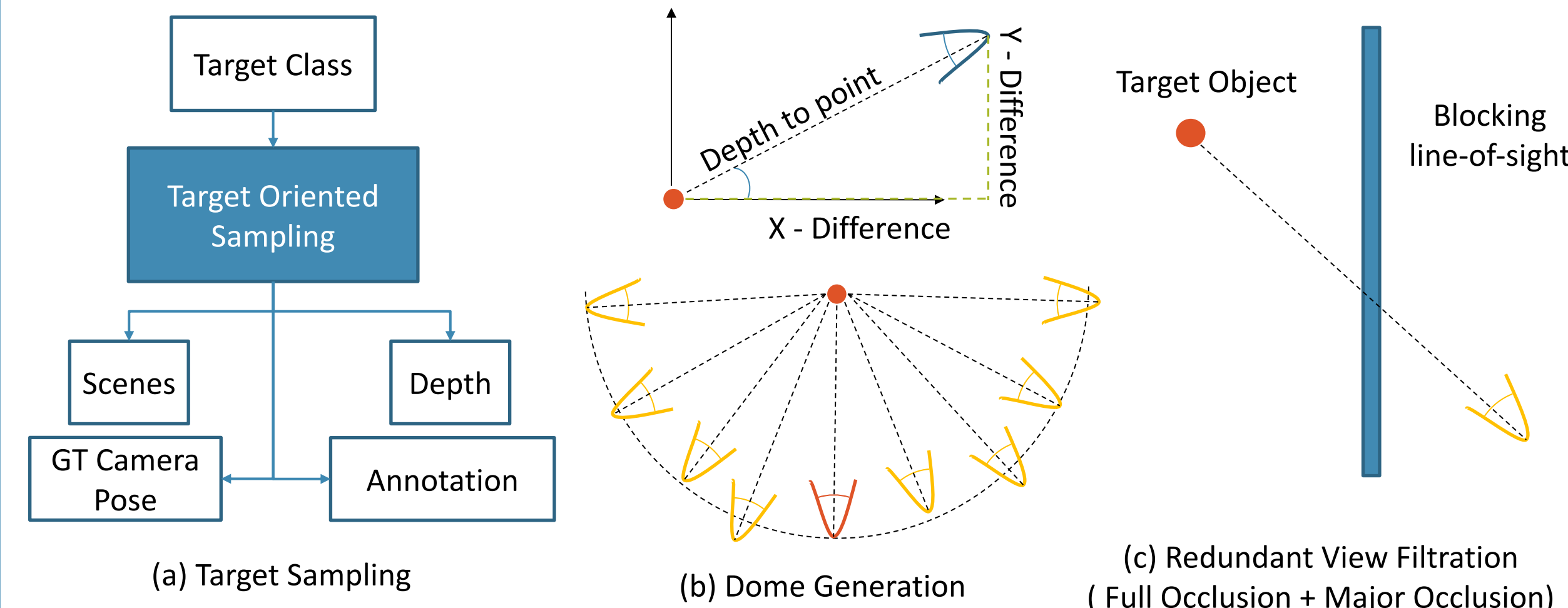
RESULTS

Rendered Novel Views and Tail Class Sampling
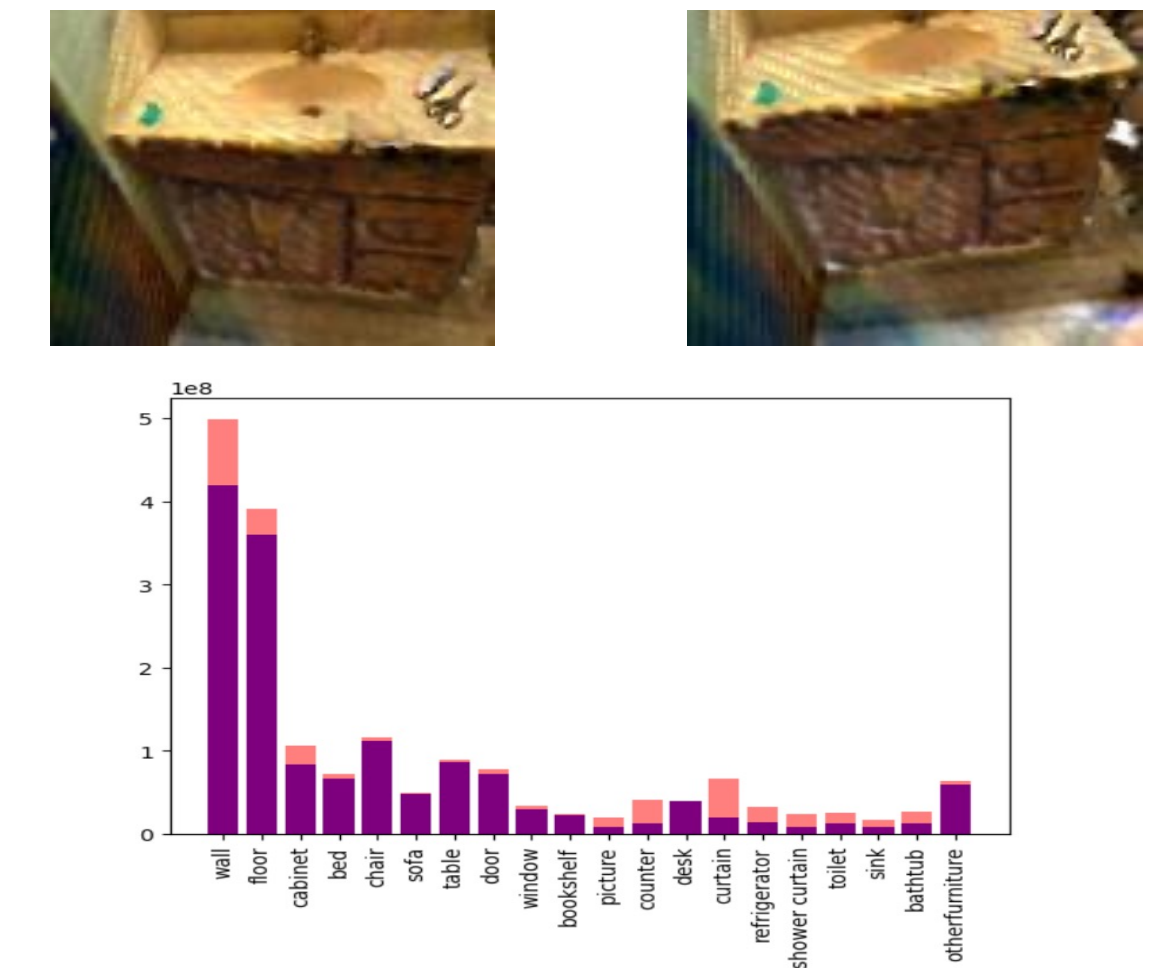
Visual Results

Groundtruth / Ours
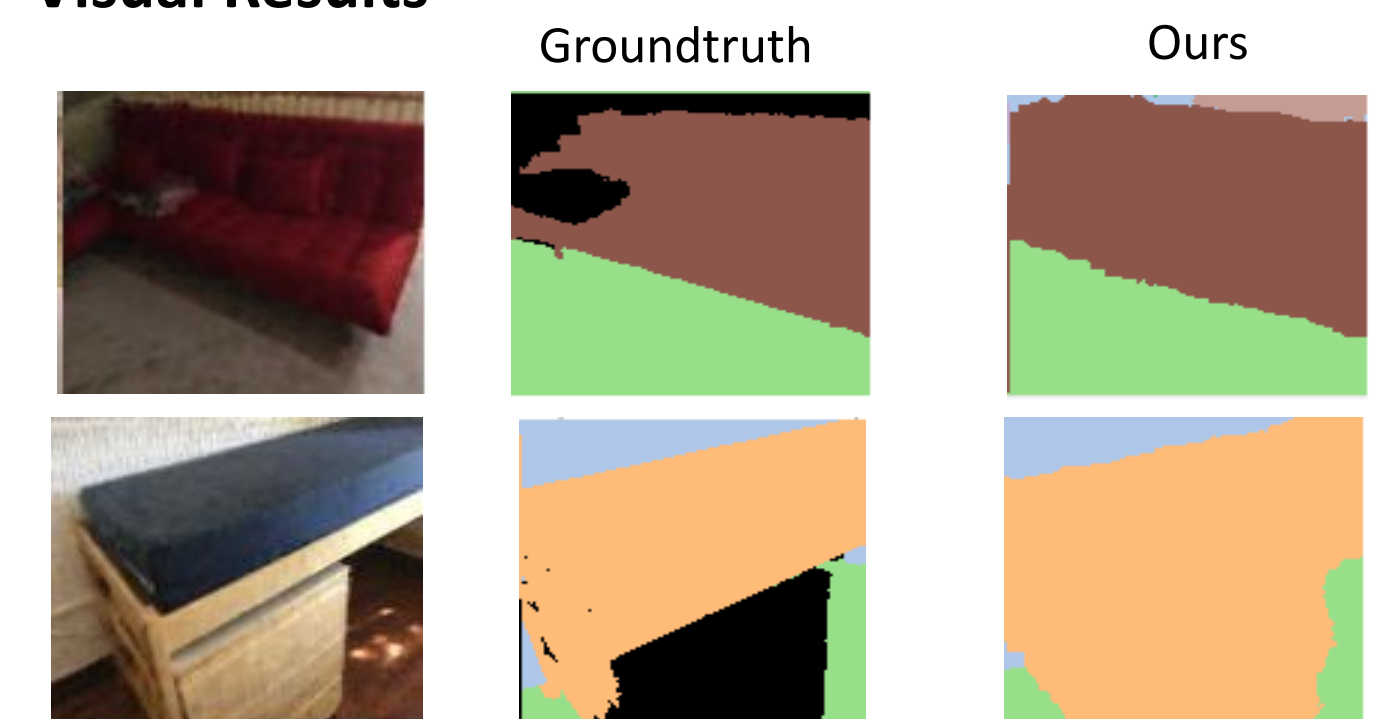
Quantitative Results

Approach	$mIoU_\%$
Direct Concatenation	39.6
Convolve and Concatenate	40.6
Convolve and Sum	41.0

Image Type	Novel Views	Input	$mIoU_\%$
Camera	×	RGB	41.2
Rendered	×	RGB	40.0
Rendered	×	RGB + SH	41.0
Rendered	✓	RGB	39.5
Rendered	✓	RGB + SH	38.6 (ongoing)

Future Work and Limitations

- Training using a larger model.
- Filtration of extremely blurry images
- Spherical Harmonics augmentation.