Towards Efficient 3D Point Cloud Scene Completion via Novel Depth View Synthesis

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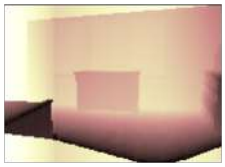
Introduction

- We propose an end-to-end trainable network which can generate dense and complete 3D surface scene point clouds from a single shot depth map input.
- We introduce a coarse-to-fine point cloud completion schema. In conjunction with predicting novel view depth maps for completion, depth inpainting network is added to further complete the whole point cloud.
- To the best of our knowledge, this is the first work to use an end-to-end method to conduct the 3D indoor scene point cloud completion task. The experiments demonstrate the effectiveness of our proposed method which achieves comparable performance with state-of-the-arts on the SUNCG dataset.

Motivation

Depth Image

Completion result



1. Large-scale of million points
2. Variations of scenario and objects
3. Difficult and cumbersome to prepare and annotate.

Method

Structure Overview

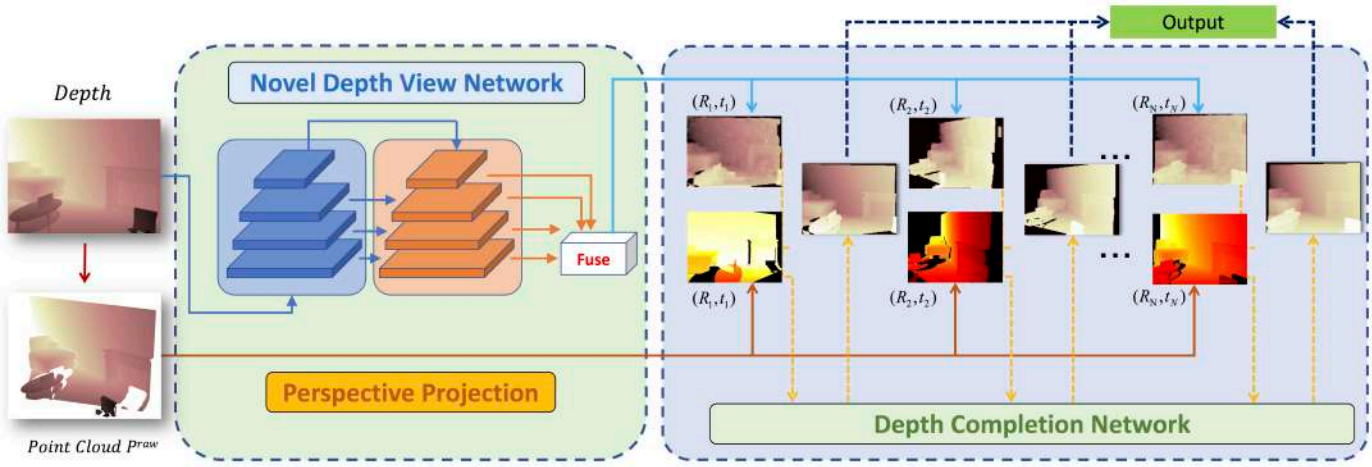


Fig. 1. Architecture of our proposed end-to-end scene point cloud completion network which takes a single depth map with original size as input. The whole structure has two subnetworks: NDVNet (Novel Depth View Network) and DCNet (Depth Completion Network).

Perspective Projection

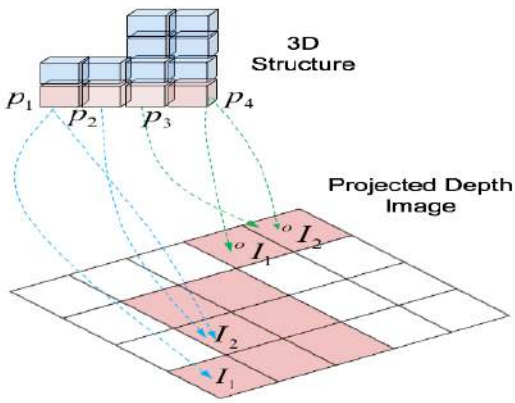
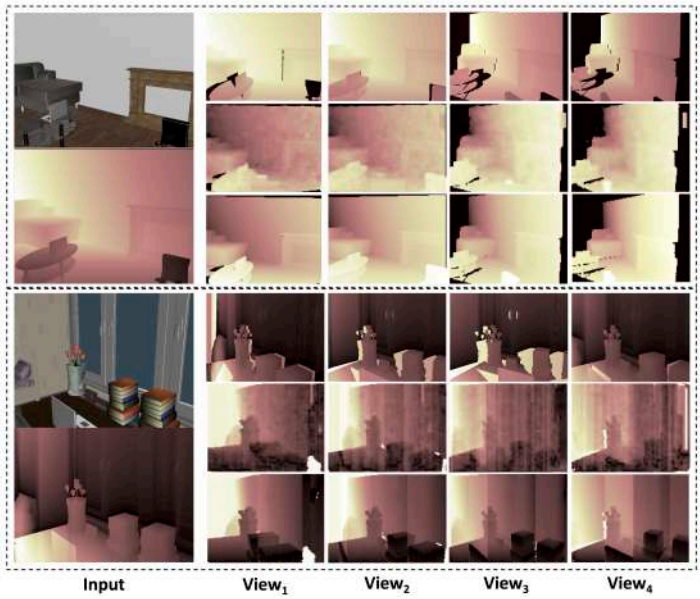


Fig. 2. Coarse depth rendering is performed through a ray- tracing and casting approach, Where the point collision is considered as a fusion to obtain the depth map. Since we use a cube to represent a point in 3D space, there may exist several cubes cast into one pixel or one cube cast into multi-pixels.

Qualitative Results



Quantitative Results

TABLE I: Results comparison with other methods in CD distance and completeness.

	SSCNet [34]	*ScanComplete* [7]	$DQN_{w/o-hole}$ [14]	*DQN* [14]	*Ours*
CD	0.5162	0.2193	0.1495	0.1148	0.1221
$C_{r=0.002}(\%)$	14.61	34.46	79.22	79.26	80.01