Scene-level Point Cloud Colorization
with Semantic-and-Geometric-aware Network

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Problem setting

Given the point cloud coordinates $XYZ \in R^{N \times 3}$ (where N is the number of point clouds as input, our method generates RGB values $R^{N \times 3}$.

Contribution

✓ We propose a novel colorization method, i.e., Semantic- and- Geometric-aware colorization Network (SGNet), for scene-level point cloud colorization.

✓ To facilitate the color learning and model training, we also present two novel losses into point cloud colorization, including a colorfulness metric loss to produce visually vibrant colors and boost the performance.

✓ We validate the proposed method on indoor scene dataset, and achieve superior performance to the state-of-the-art point cloud approaches quantitatively and qualitatively.

Semantic-and-Geometric-aware Network

SGNet is proposed to do scene-level point cloud colorization task.

- It explores **semantic** and **geometric** features from the point cloud with only coordinate as inputs.
- It is a **sparse** fully convolutional based network which is applicable in complex scenarios.
- Two novel **losses** are proposed to generate visually vibrant colors and boost the learning.
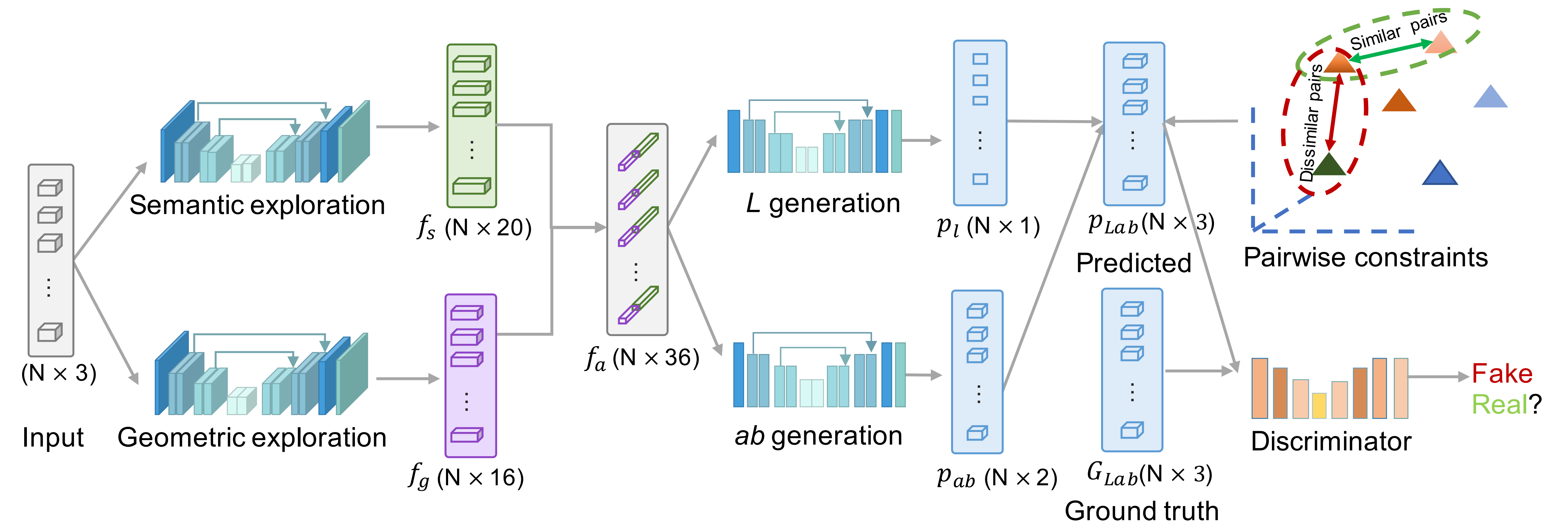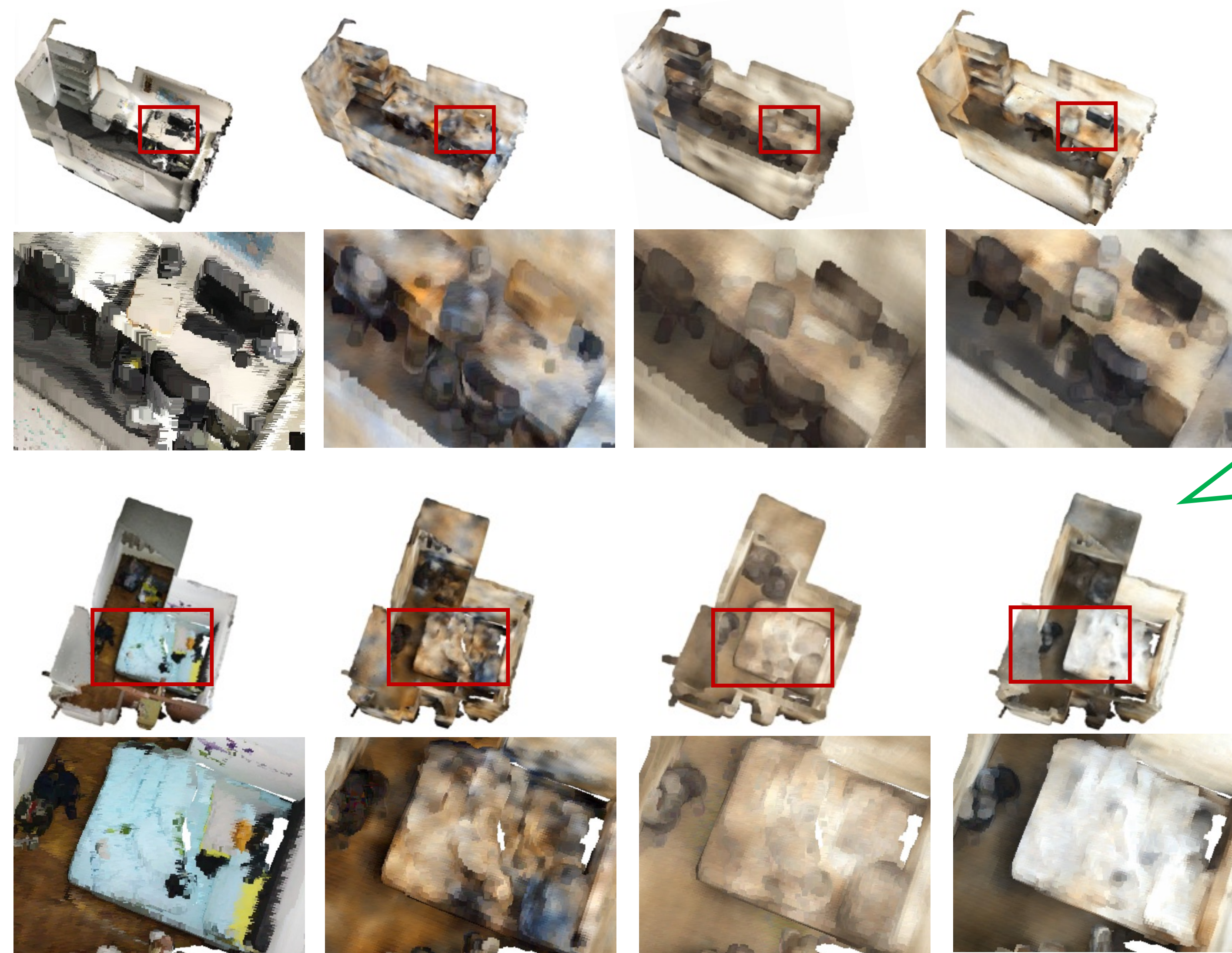

Figure. The overall framework of the proposed SGNet.

Results

(a) Ground truth (b) Regression (c) DensePointNet (d) Ours

State-of-the-art performance.

Good balance on semantic characters and scene colorfulness.

User friendly.

Evaluation

TABLE I: Quantitative comparison with other methods for point cloud colorization using three evaluation metrics. "↓" or "↑" indicates that the method with the smaller or larger metrics is better than the others. The best results are highlighted in bold.

Method	MSE ↓	FPD ↓	CM ↑
Regression	0.084 ± 0.015	3.333 ± 1.676	0.064 ± 0.013
DensePointNet	0.081 ± 0.009	4.106 ± 1.273	0.080 ± 0.010
SGNet (ours)	$\mathbf{0.041 \pm 0.019}$	$\mathbf{2.116 \pm 1.440}$	$\mathbf{0.221 \pm 0.008}$

TABLE II: Preference score in the user study for the colorization results of different methods. The best results are highlighted in bold.

Method	Regression	DensePointNet	Ours
Percentage	3.3%	30.4%	**66.3%**

Find the project here!

Paper, code, and data are available:
https://rrgao.github.io/projects/ICRA23/index.html