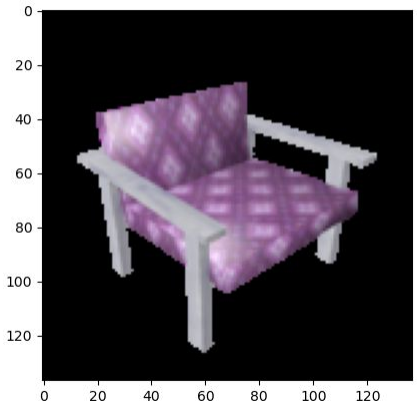
Pytorch DISN

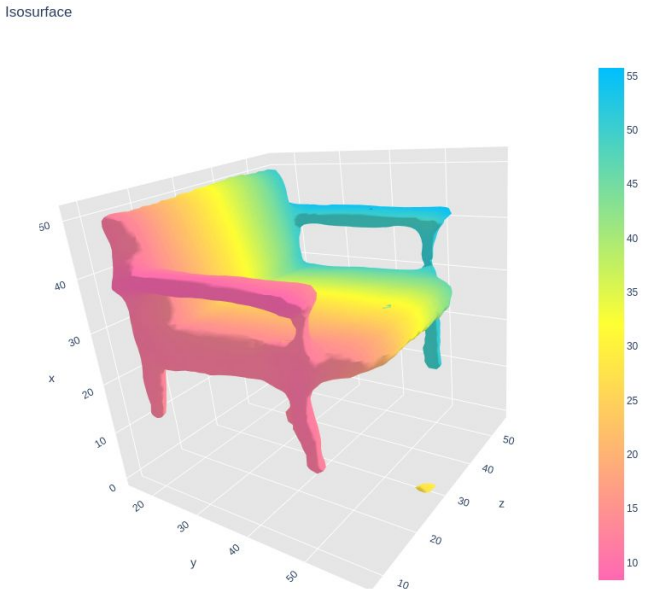
Deep Implicit Surface Network for High-quality Single-view 3D Reconstruction

Hee Hwang, Edward Schneeweiss, Catherine Huang

What is the challenge?

From a single RGB image to 3D



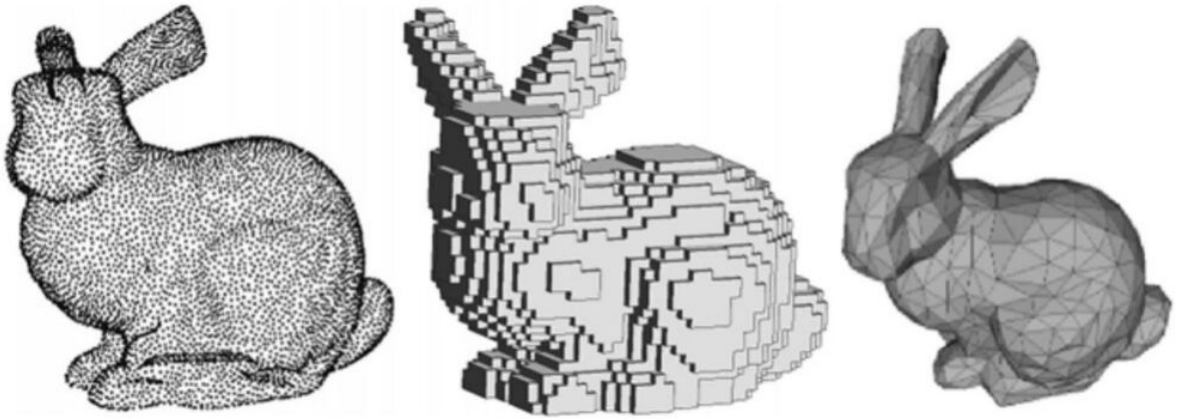


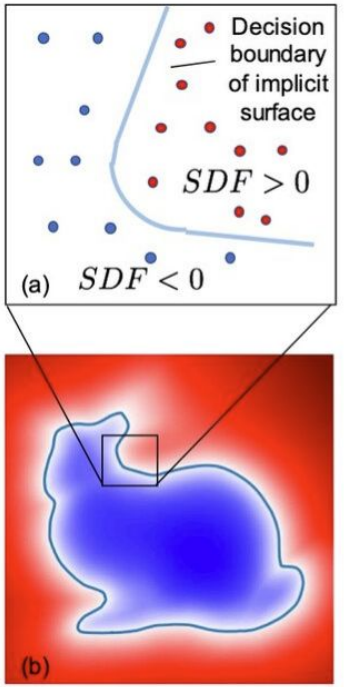
Introduction

- Deep Implicit Surface Network (DISN)
- Input an RGB image and output a signed distance field (SDF) that represents the shape of the object.
- Outperform state of art at the time, ex. OccNet, DeepSDF, IM-NET, etc.
- Uses two key improvements over older approaches, SDF's and local features.
- Tensorflow → PyTorch
- Experiment with different models using local and global features

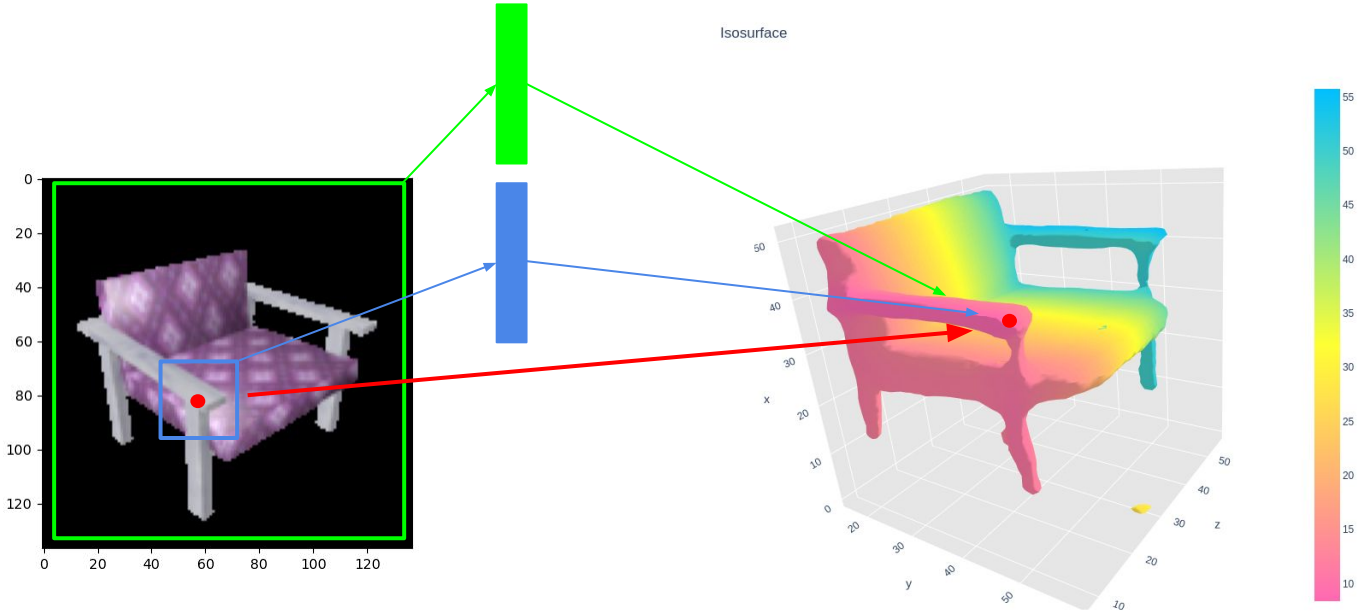
3D representations

Point clouds, voxel grids, meshes and signed distance fields

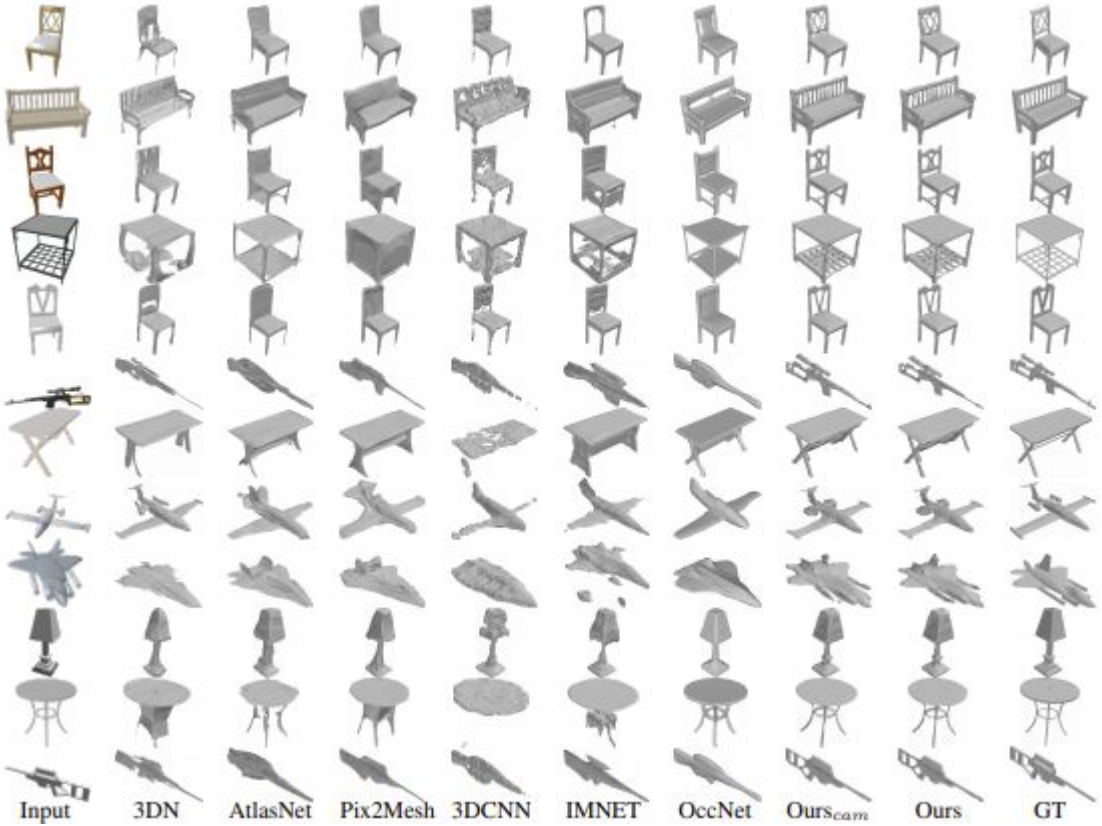




Local and global feature representations

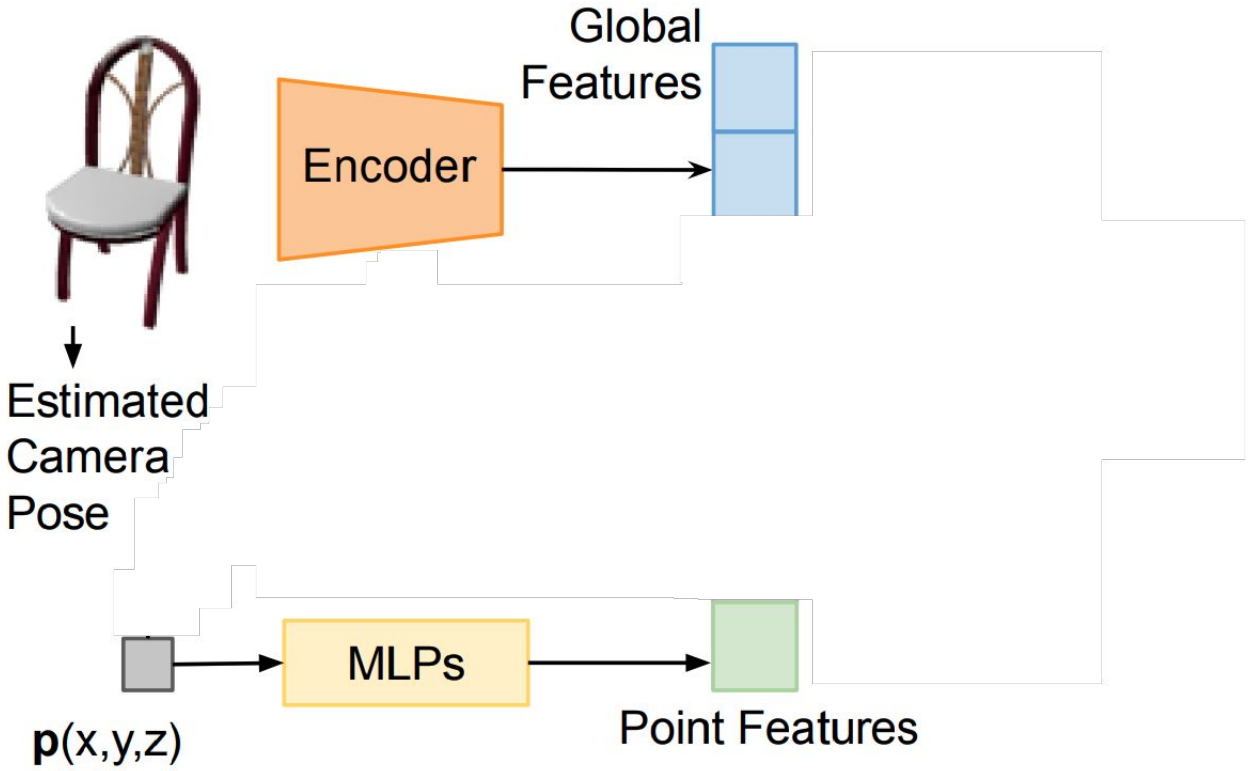


Comparison to related works

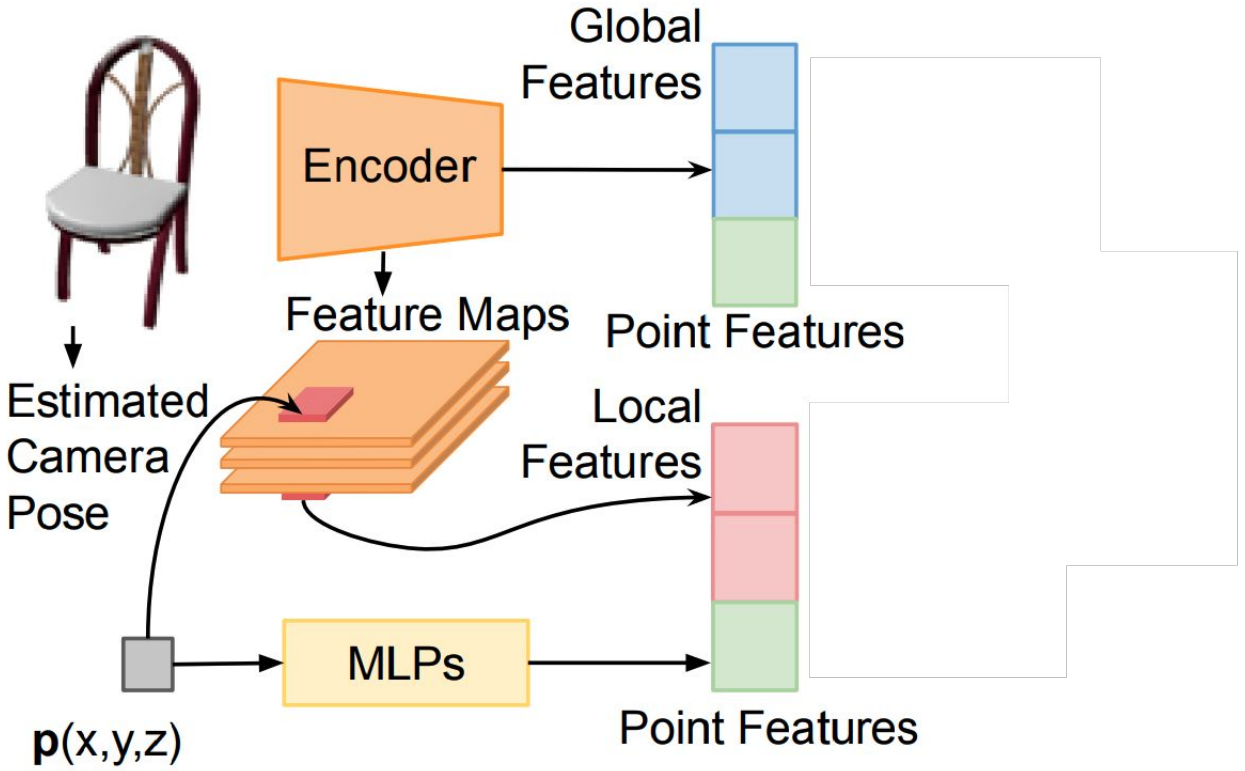


DISN

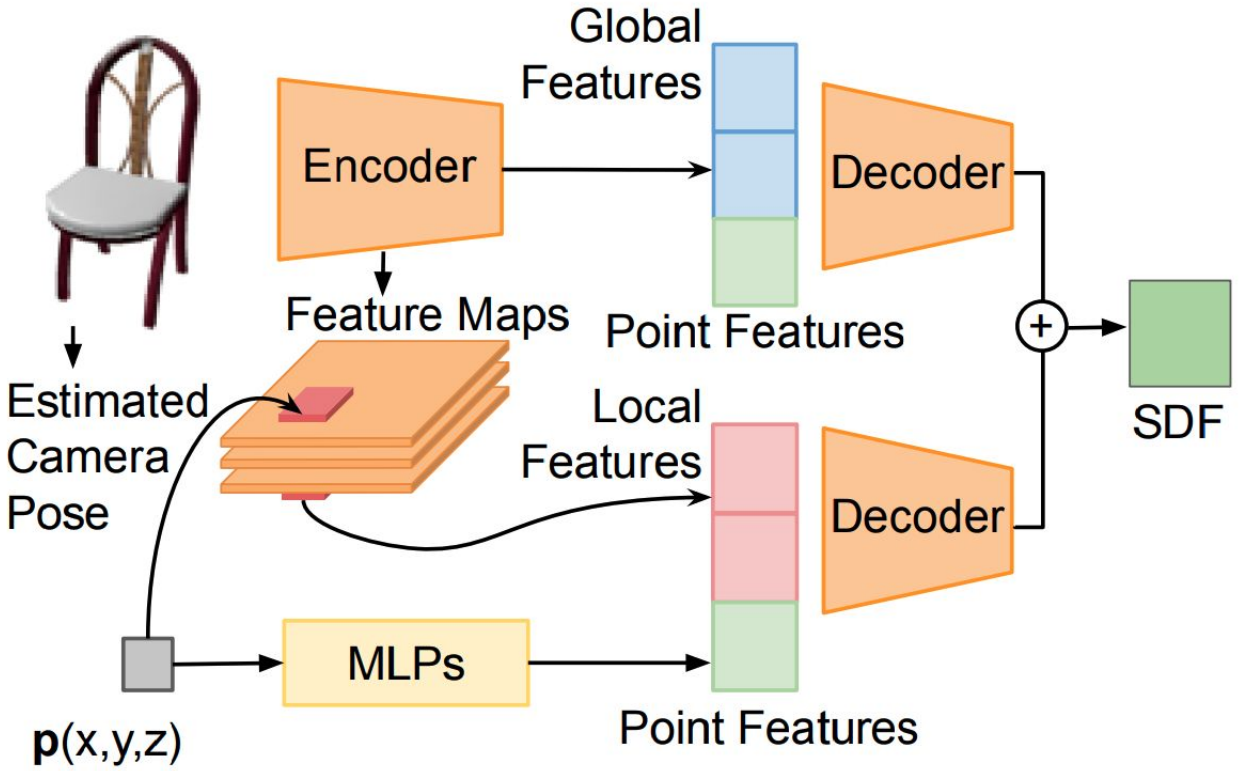
DISN


Global
Features
Encoder
Estimated
Camera
Pose
MLPs
p(x,y,z)
Point Features

DISN


Global
Features
Encoder
Feature Maps
Point Features
Estimated
Camera
Pose
Local
Features
MLPs
p(x,y,z)
Point Features

DISN


Global
Features
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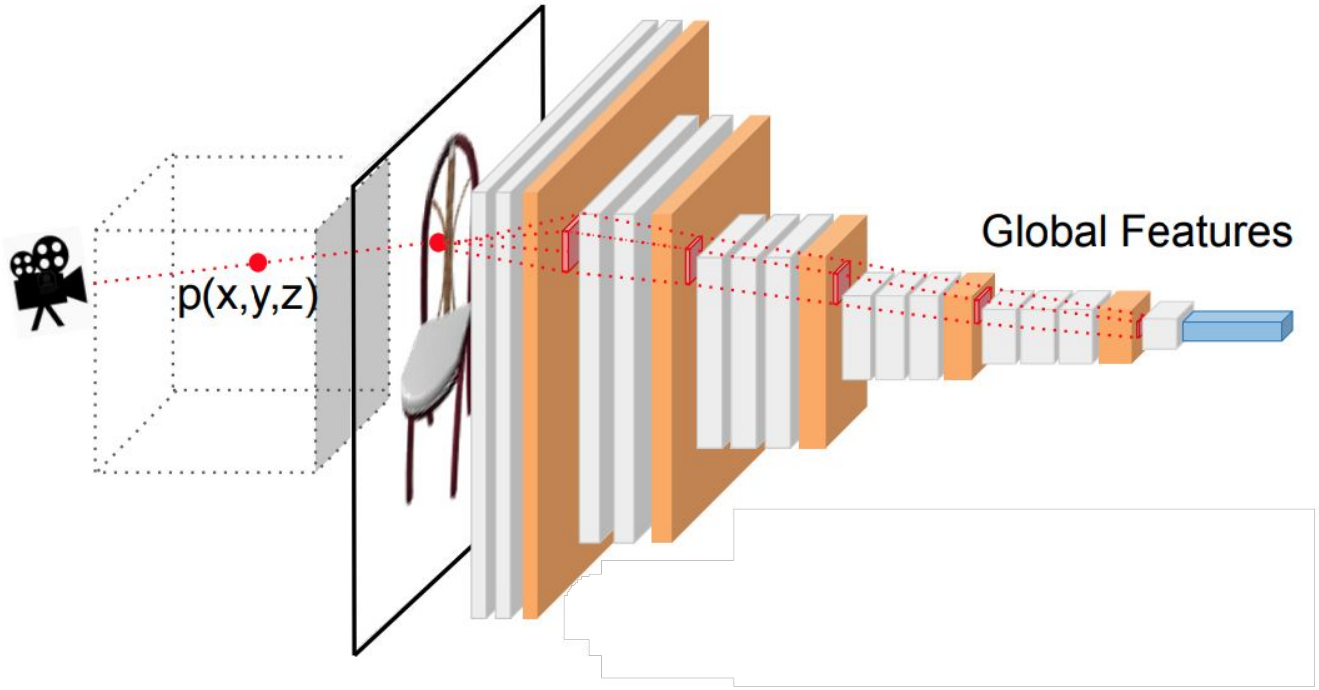
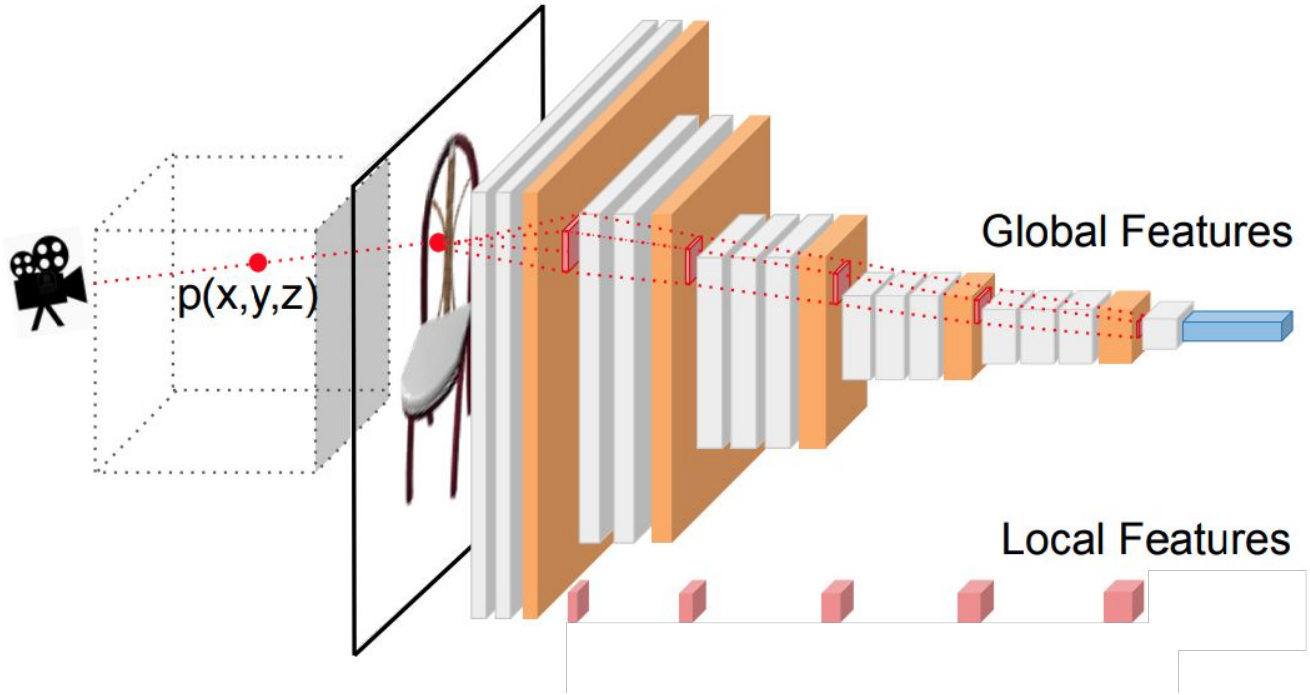
Decoder
Feature Maps
Point Features
Estimated
Camera
Pose
Local
Features
Decoder
SDF
MLPs
p(x,y,z)
Point Features

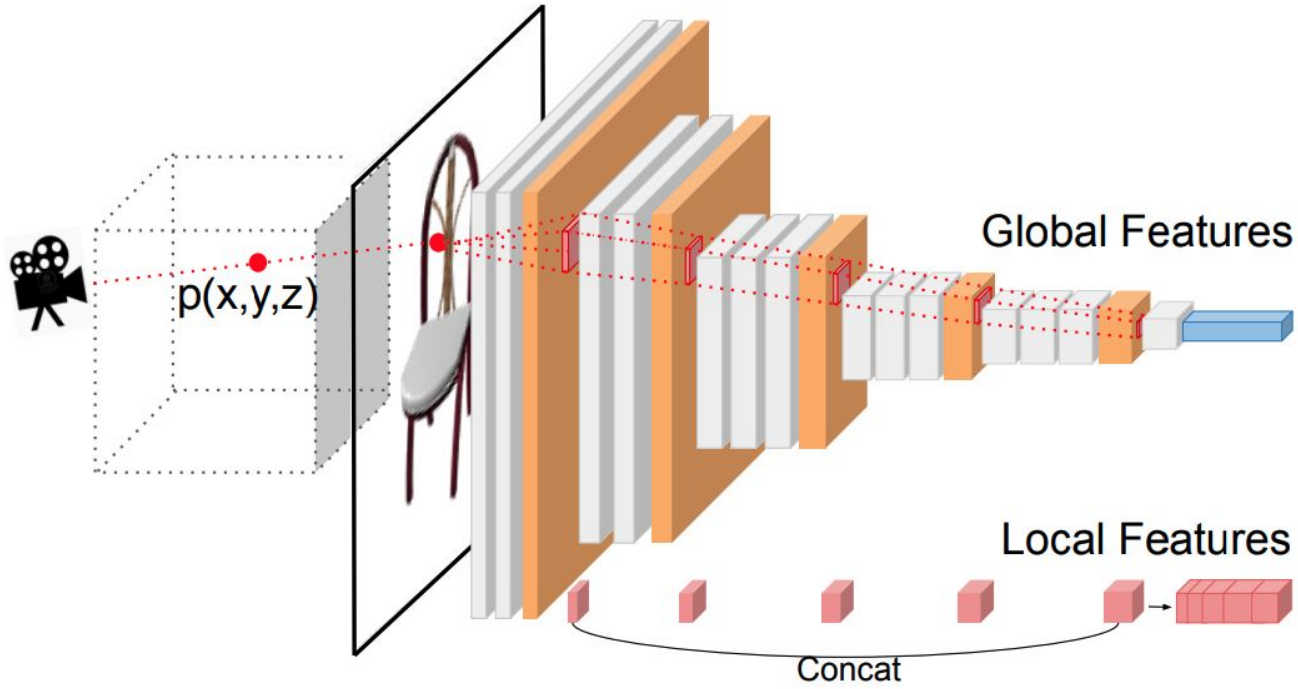
DISN - Feature Extraction



DISN - Feature Extraction

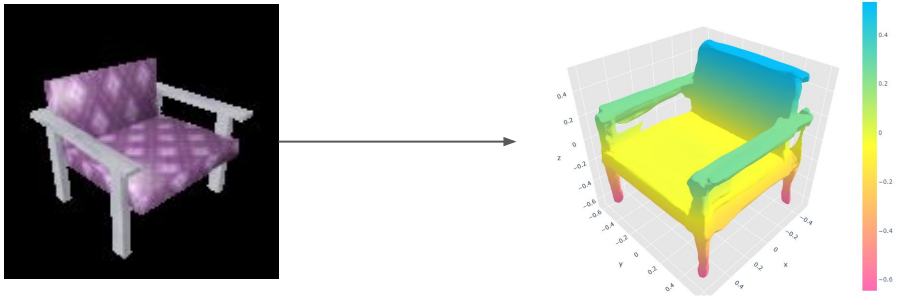


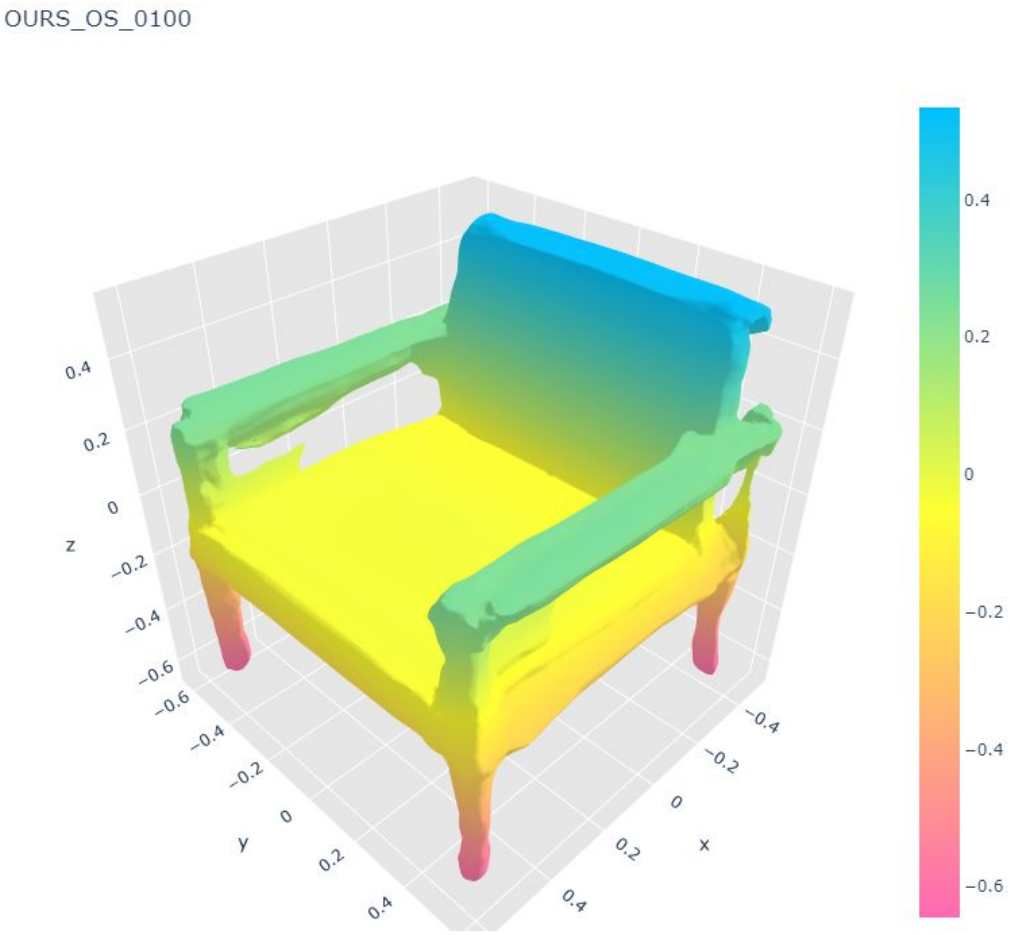
DISN - Feature Extraction



Experiment

- Global features only
- Local features only
- Global + local features
- Chairs

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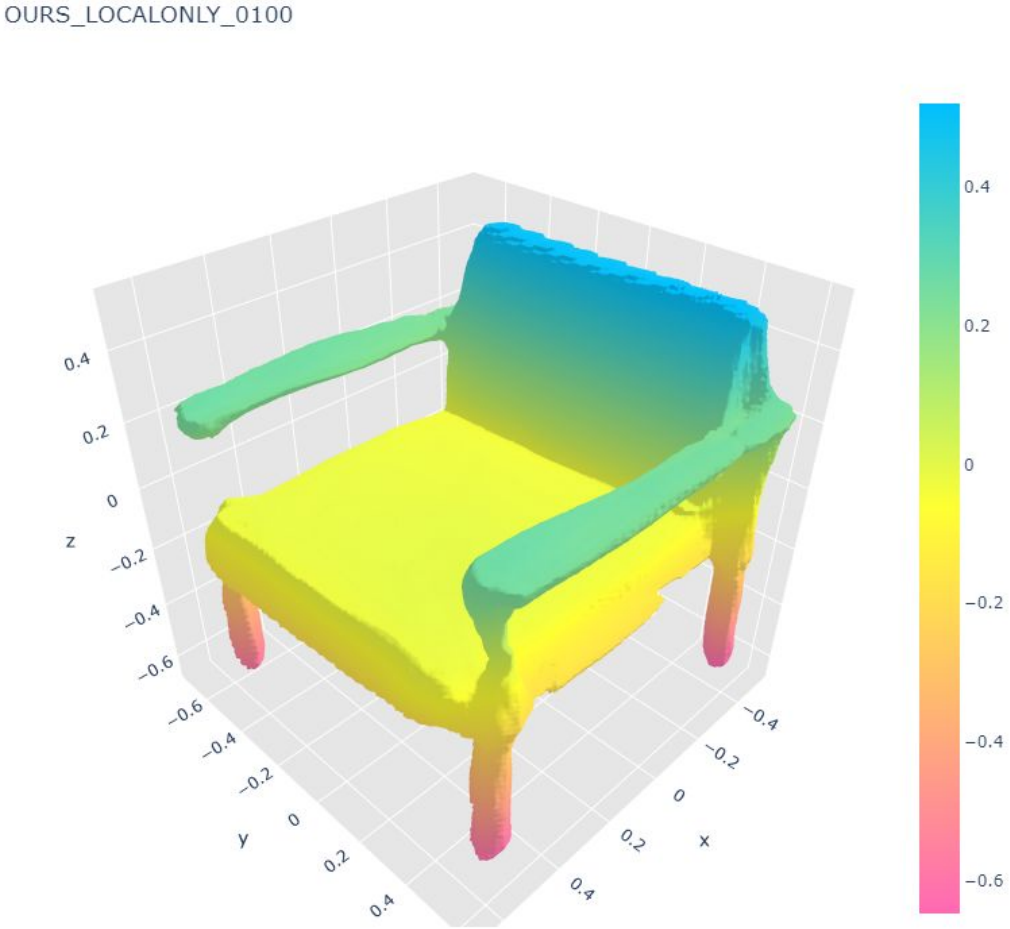
0
−0.2
−0.4
−0.6
z
−0.6
−0.4
−0.2
0
0.2
0.4
y
−0.4
−0.2
0
0.2
0.4
x
0.4
0.2
0
−0.2
−0.4
−0.6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z
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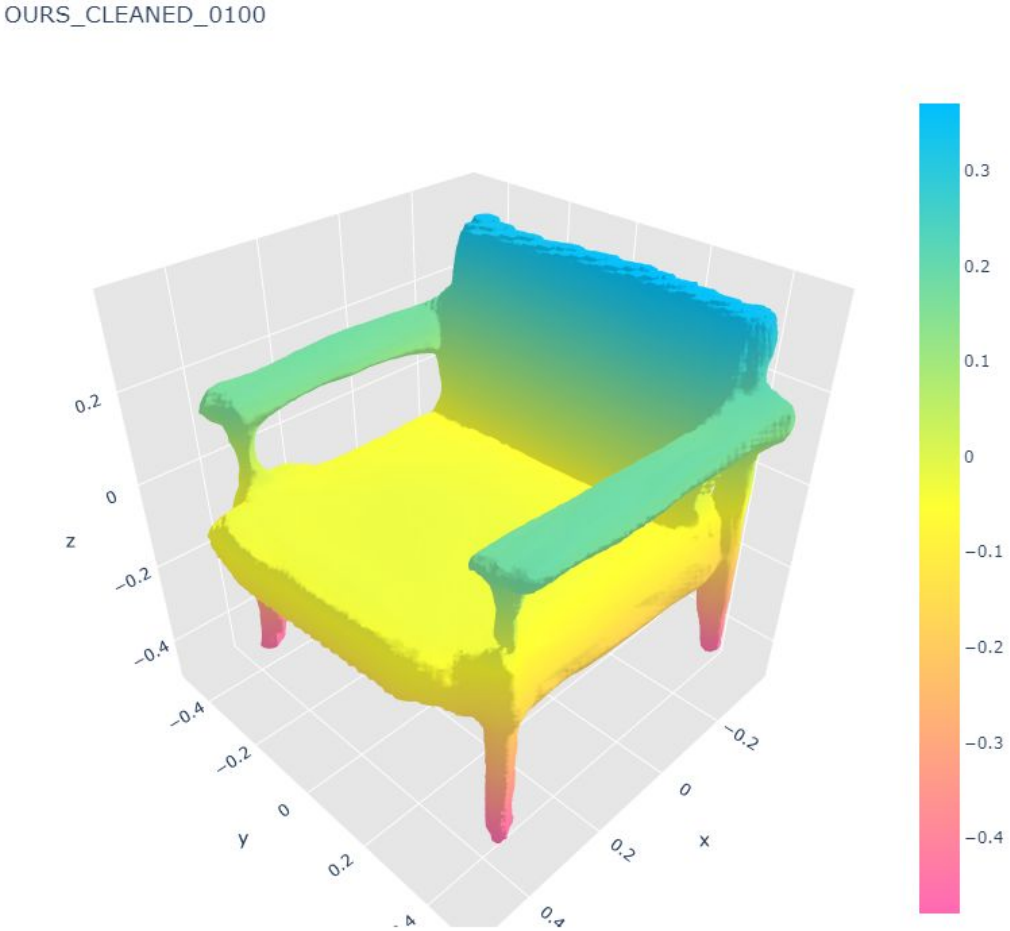
−0.2
0
0.2
0.4
y
0.4
0.2
0
−0.2
−0.4
x
0.4
0.2
0
−0.2
−0.4
−0.6


OURS_CLEANED_0100
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z
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−0.2
0
0.2
0.4
y
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0
0.2
x
0.3
0.2
0.1
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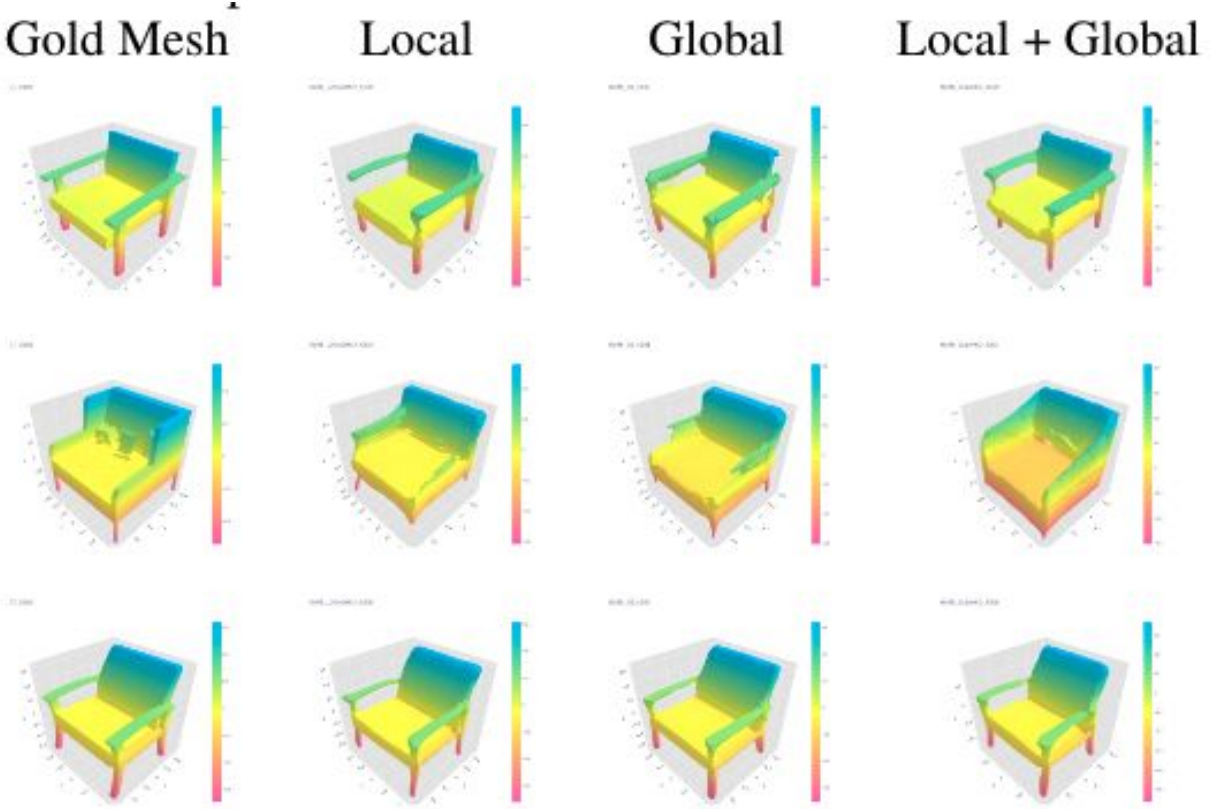
−0.2
−0.3
−0.4

Result



Evaluation

(b) Chamfer Distance

Test Object	Local	Global	Local+Global	Theirs
0100	**9.56**	12.35	9.60	10.89
0201	16.07	16.45	25.04	**16.18**
0300	4.40	4.34	3.96	**3.50**
0400	12.84	16.17	**10.27**	14.75
0500	16.20	**15.41**	17.34	15.96
0550	17.96	13.84	18.86	**7.49**
1150	26.98	29.14	23.60	**16.93**
Average	14.85	15.38	15.52	**12.24**

(c) Earth Mover's Distance

Test Object	Local	Global	Local+Global	Theirs
0100	166.74	167.62	**165.29**	172.92
0201	**186.80**	200.02	221.51	205.03
0300	126.12	109.47	108.83	**107.20**
0400	217.58	222.34	**194.50**	236.00
0500	194.82	216.64	199.67	**183.27**
0550	176.87	168.63	180.81	**147.89**
1150	240.26	243.54	237.28	**208.73**
Average	187.02	189.75	186.84	**180.14**