PPSurf
Combining Patches and Point Convolutions for Detailed Surface Reconstruction

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Motivation

Photos

Unoriented Point Cloud

Mesh

3D Print

Surface Reconstruction

Surface Reconstruction

Surface Reconstruction

Reconstruction Difficulties

PPSurf - EG2024
Method Categories

Non-data-driven Methods
Non-Data Driven Methods

Neural-IMLS

SAP (unlearned)

PGR


Method Categories

Non-data-driven Methods

Data-driven Methods

learned


Predicting Implicit Surfaces

Occupancy Probability

- TSDF: [-1, +1]
- Occupancy: [0, 1]
- Occupancy Probability (POCO):
  - In: [0, 1]
  - Out: [0, 1]
  - Occ\_prob = (Out – In)

Global and Local Information

Only Local

Only Global

Local + Global
Global and Local Information

- **GT**
- **Only Global**
- **Local + Global**
Idea

Global POCO

Merge Features

Local POCO

$P$

$X$

$O(X)$
Idea

Global POCO

Local PointNet

Merge Features

$P \ x \ o(x)$
PPSurf Architecture

Uniform Subsample

Global Features

POCO

MLP

Nearest Neighbors

PointNet

Local Features

Global Features

MLP

POCO

Uniform Subsample

Nearest Neighbors

PointNet
PPSurf: Local Branch

Points → MLP → Per-Point Features → Sym Op → Features

Self-Attention
Data Driven Methods

POCO

PPSurf (ours)

Ground Truth


Data Driven Methods

POCO

PPSurf

Ground Truth


Quantitative Comparison

Chamfer Distance (x100) ↓

- Neural IMLS
- PGR
- SAP O
- SAP
- P2S
- POCO
- PPSurf 50nn
Ablation Study

Chamfer Distance (x100)

- PPSurf 10NN
- PPSurf 25NN
- PPSurf Full
- PPSurf 100NN
- PPSurf 200NN
Real-World Examples
Limitations

ground truth

Neural IMLS

PPSurf (ours)
Limitations

noisy input  ground truth  PPSurf (ours)
PPSurf Live System

https://huggingface.co/spaces/perler/ppsurf