Learning to Sample

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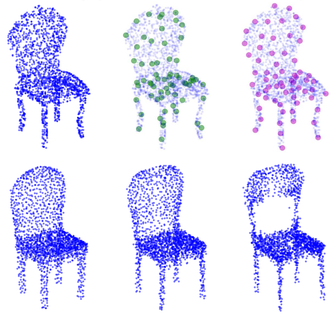
Code is Available!

A task-specific data-driven sampling approach for point clouds

Motivation

Too many points... How to sample?



Complete Input S-NET FPS

Problem Statement

Given:

Point set $P = \{p_i \in \mathbb{R}^3\}_{i=1}^{n}$

Sample size k, $k \leq n$

Task network T

Task objective f

Find:

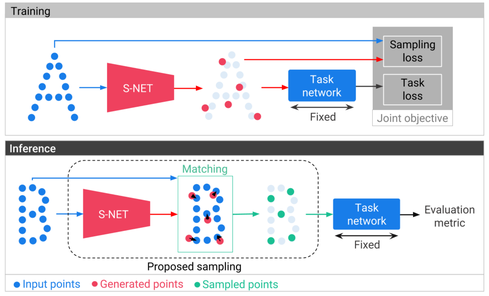
Subset $S^* \subseteq P$ of k points:

$$S^* = \arg\min_S f\big(T(S)\big)$$

Challenge: Sampling is non-differentiable and can not be trained directly

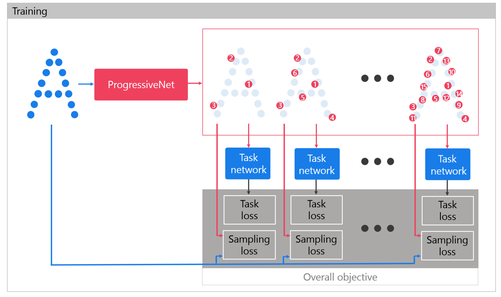
Learned Sampling

S-NET



Learns to sample a pre-defined number of points

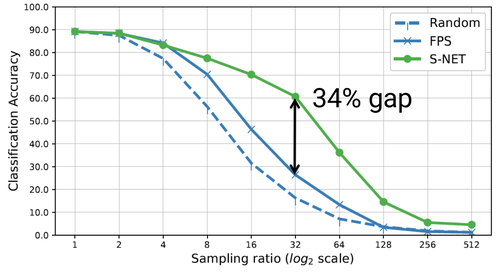
ProgressiveNet



Learns to order the points by importance to the task, so any sample size can be chosen at inference time

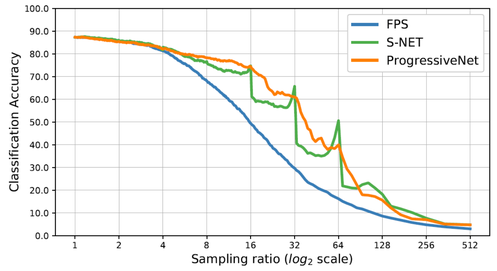
Classification

Overall Accuracy



S-NET is equal or better for all sampling ratios

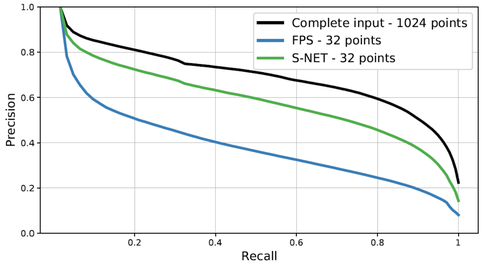
S-NET vs. ProgressiveNet



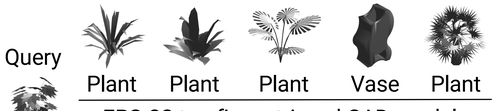
S-NET is better at trained sampling ratios
ProgressiveNet is almost monotonic in # of points

90% time reduction with only 5% increase in space!

Retrieval

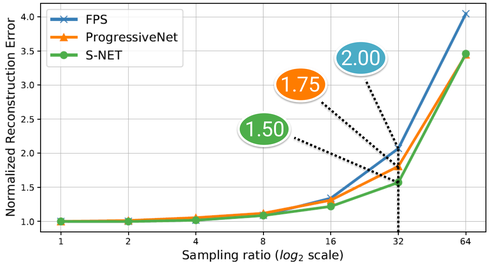


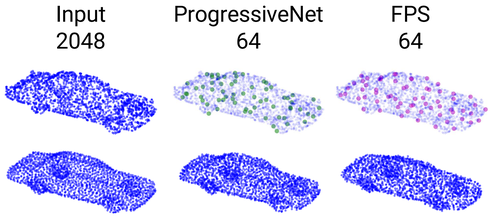
S-NET-32 top five retrieved CAD models



FPS-32 top five retrieved CAD models

Reconstruction





Adversarial Simplification