



2D Floor Plan Reconstruction Using Cool Deep Learning Methods

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CS 231n: Convolutional Neural Networks for Visual Recognition

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Overview

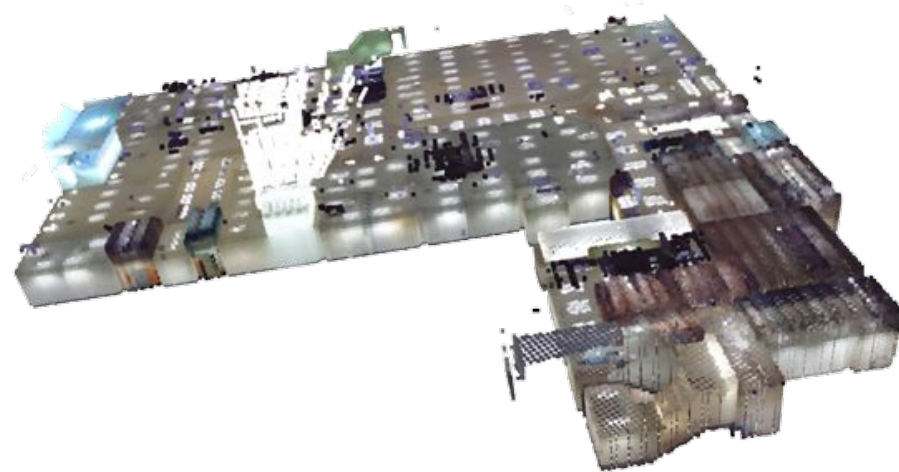
- Buildings lack floor plan information
- Point clouds are becoming cheaper
- A building floor plan can be extremely useful

Problem Statement:

“Reconstruct a 2D floor plan from 3D point cloud data”

Dataset

- 31 buildings with multiple floors and dozens of rooms on each floor
- Point Clouds have irregular format
- Point Density is an additional feature



Visualization of point data for one area in the dataset

Methods

PointNet

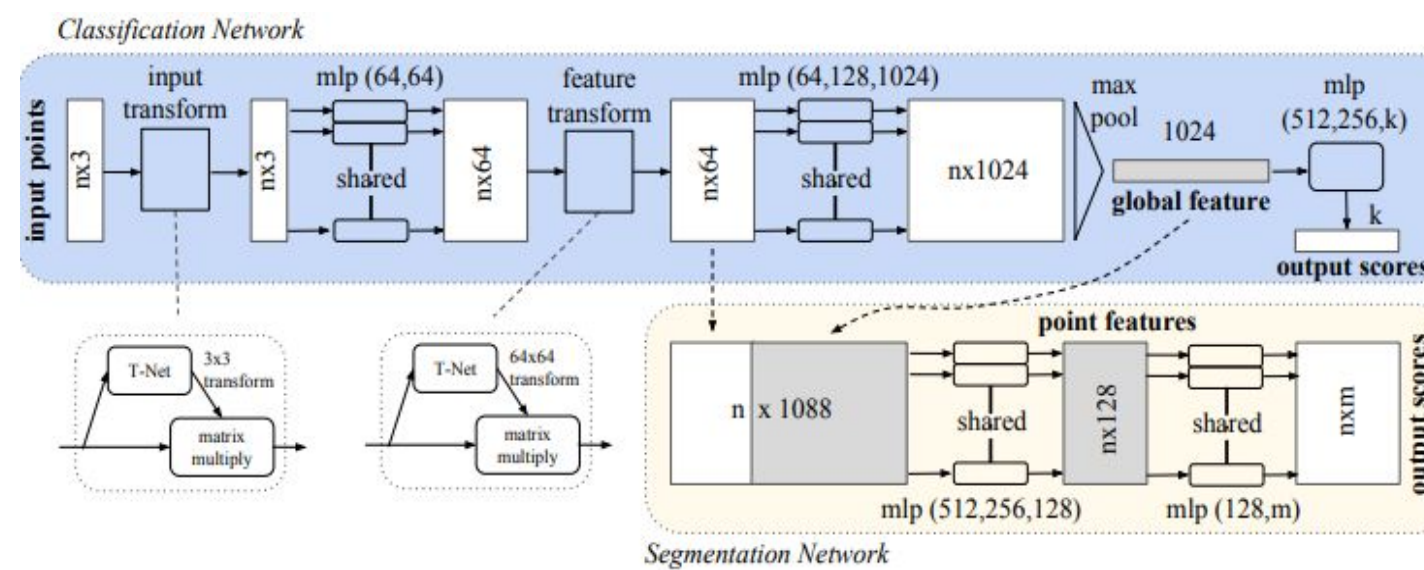
- We train PointNet from scratch on our dataset.
- Deep convolutional architecture for segmentation
- consumes raw point cloud data without voxelization or rendering.
- Concatenates the global features with the local features to generate pointwise scores for segmentation

U-Net

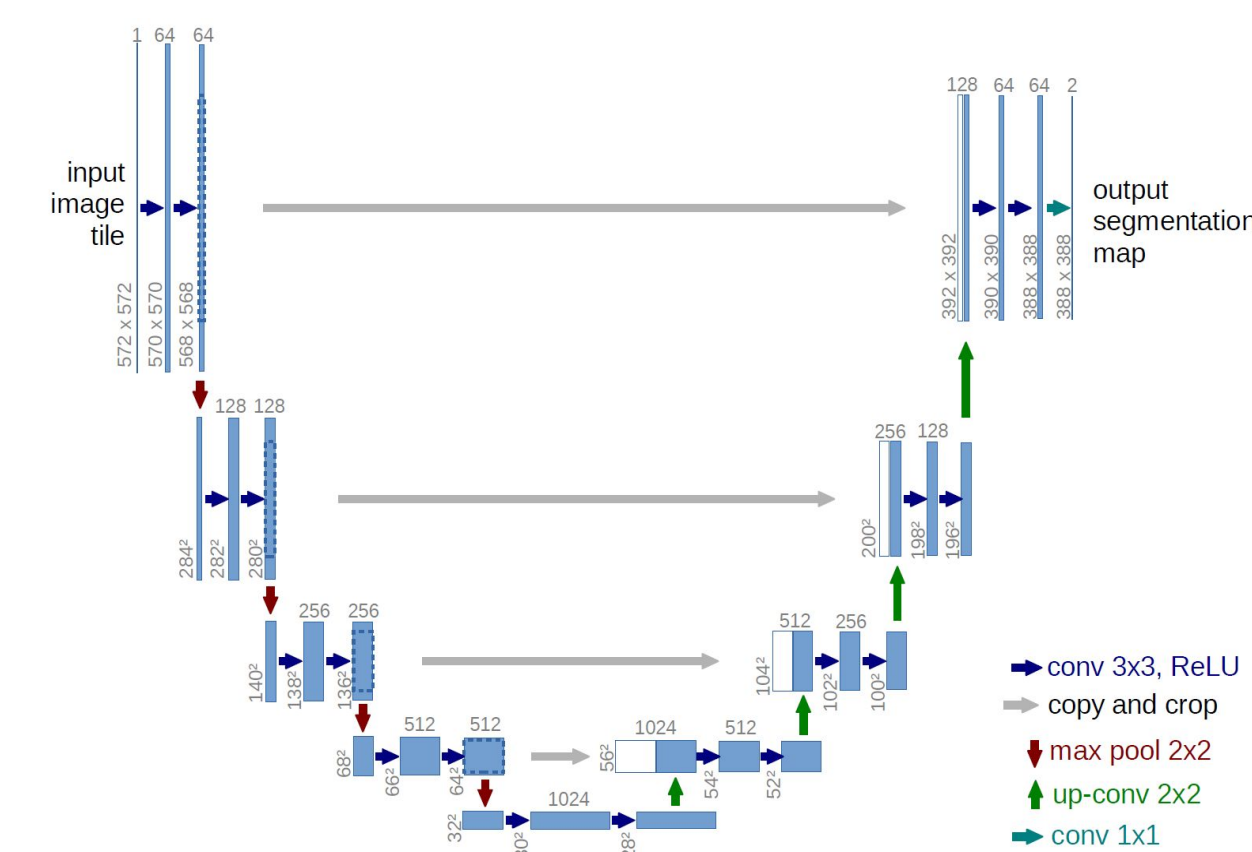
- We use transfer learning.
- ResNet backbone, pretrained on ImageNet, with Jaccard Loss
- Fully convolutional Architecture

Architecture

PointNet

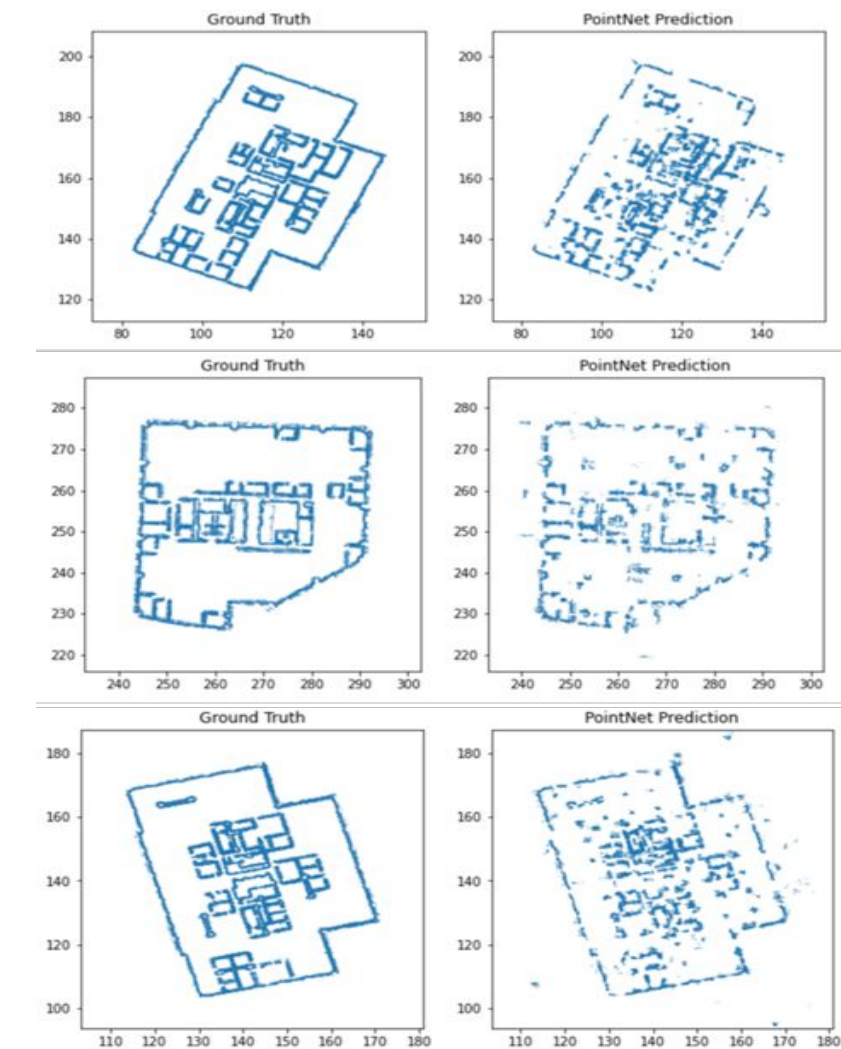


U-Net

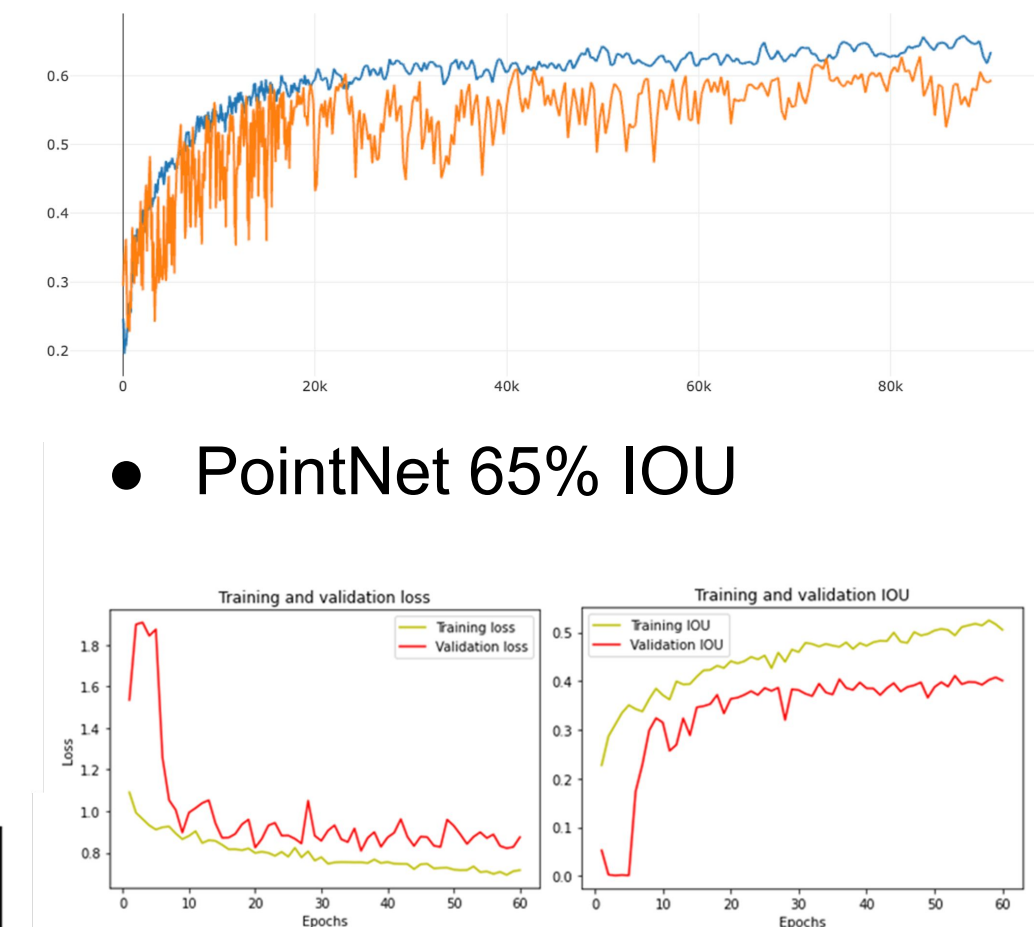
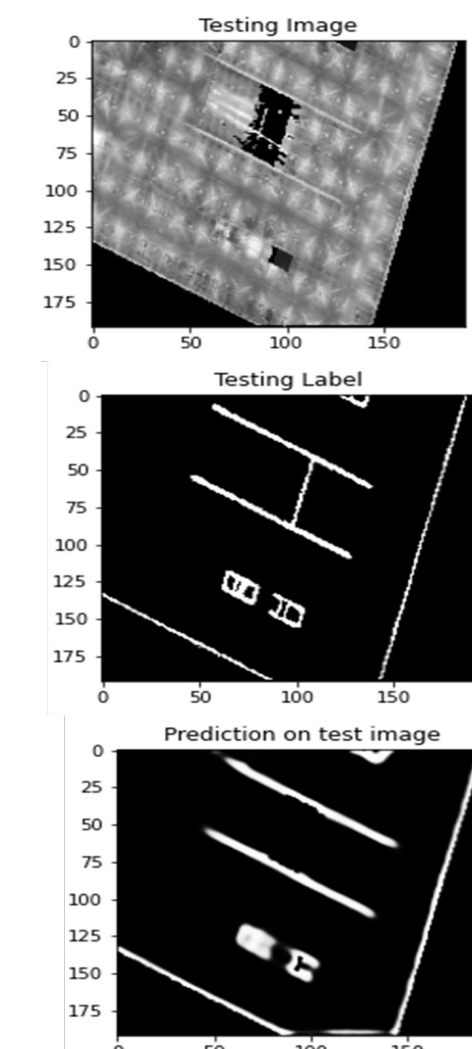


Results

PointNet



U-Net



• PointNet 65% IOU

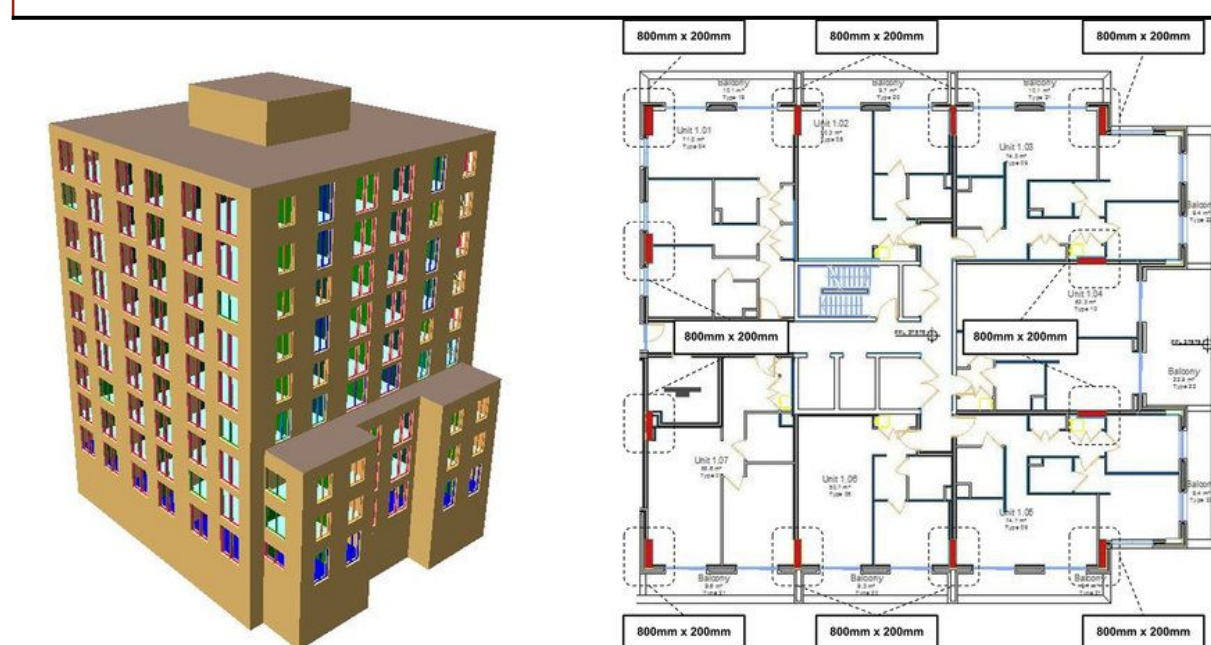
• U-Net 40% IOU

Conclusion

- The PointNet segmentation network achieves 65% IoU on the validation dataset.
- Trained only on 49 scenes, with noisy point cloud.
- PointNet works great for large geometrical structures.
- Deep learning can outperform traditional techniques for building layouts.
- 2-D projection and pixelization are not suitable for point cloud data.

Future Work

- Extend to other floor plan structures including stairs / doors / different wall types.
- Understand the effect of noise distribution on point cloud data for segmentation networks.
- Generate 3D building model from Point Cloud.



3D Building model reconstruction from floorplan