3D Object Detection of 9-million LiDAR Point Cloud Using Semi-Supervised Machine Learning

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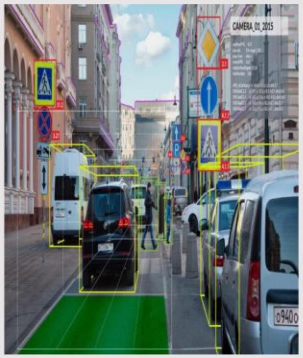
Problem Definition

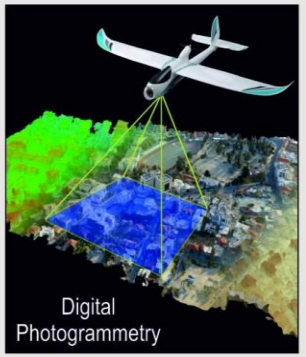
Objective: Reconstruct the 3D objects in a local neighborhood with minimum dimension

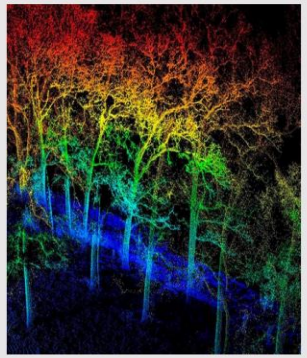
Motivation: Minimize the Misclassification

Applications:

- Autonomous Driving
  (LYCMU, CVPR '19), (CKZBMFU, NIPS '15), (FDU, NIPS '12)
- Digital Photogrammetry
  (HH, ISPRS '18)
- Forestry & Vegetation
  (DMS, CVPR '12)

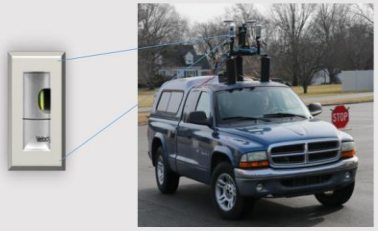


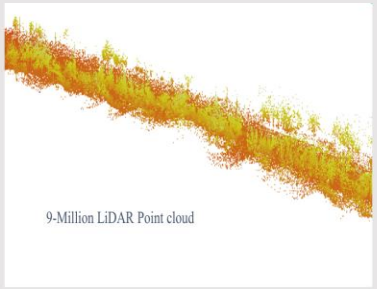




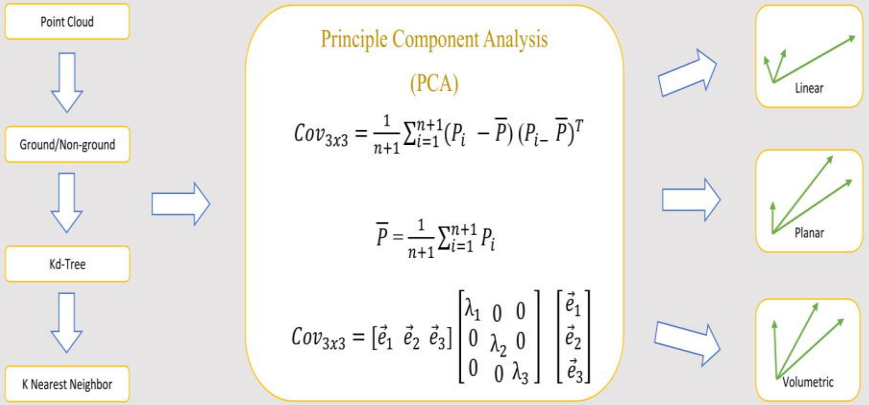
Data Collection & Preparation

- The dataset are acquired by HDL-32E
  - ± 2 cm accuracy
  - 32 Channels
  - 80m-100m Range
  - 700,000 Points per Second
  - 360° Horizontal FOV
  - +10° to -30° Vertical FOV
- The dataset has been labeled
- Metric: Misclassification Rate



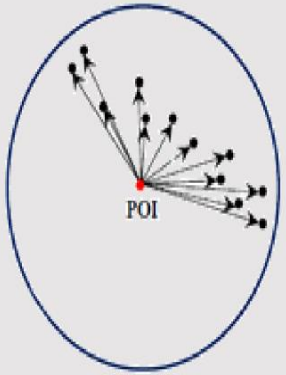


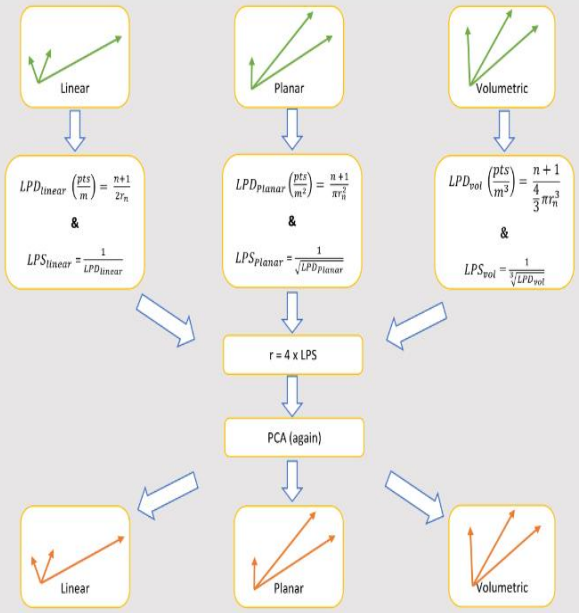
Method



Dynamic PCA

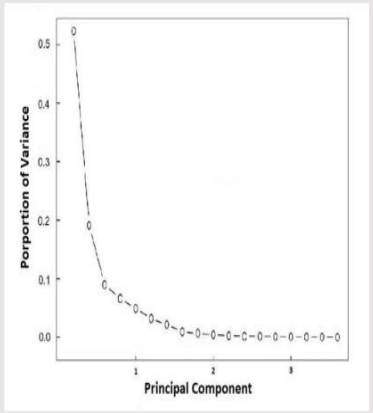
- Local Point Density (LPD)
- Local Point Spacing (LPS)

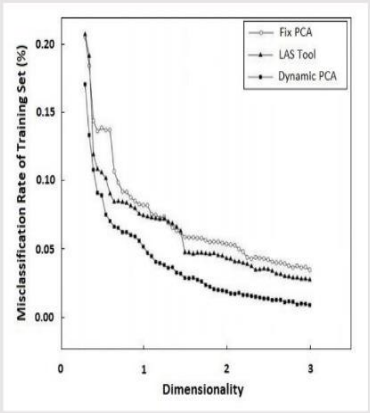




Misclassification

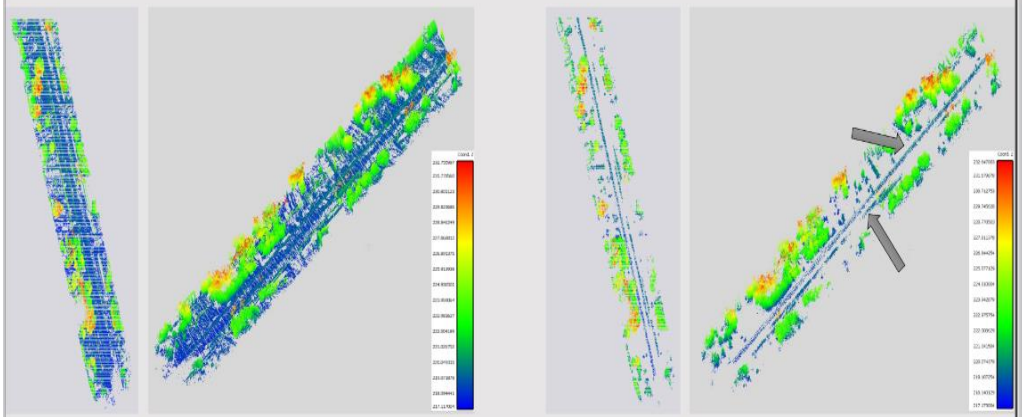
Misclassification Rate: $\frac{1}{n}\sum_{i=1}^{n} I(y_i \neq \hat{y}_i)$





Result

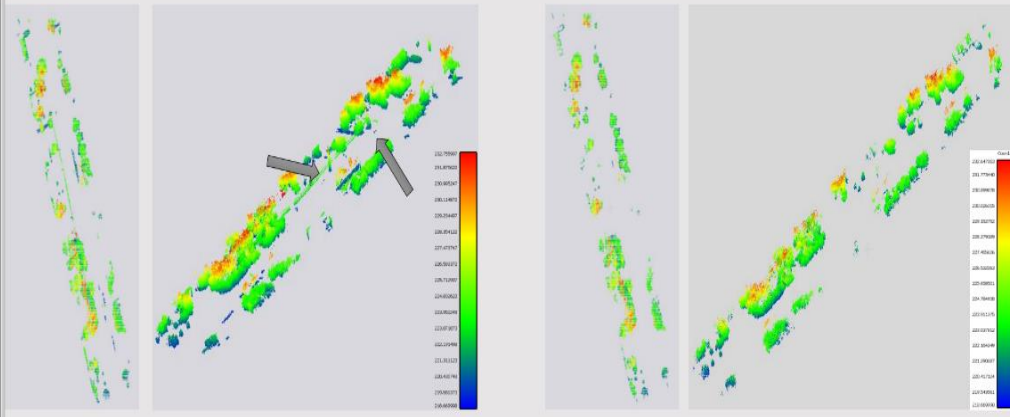
Top View Side View Top View Side View



Original Data FIX 70-NN

Result

Top View Side View Top View Side View



LAS Tool Dynamic PCA