INFORMATION PROCESSING FOR FOLIAGE PENETRATING LIDAR

Chhabra Puneet †., Pr. Andrew Wallace., Heriot Watt University
{psc31, a.m.wallace}@hw.ac.uk

James Hopgood
James.hopgood@ed.ac.uk

University of Edinburgh

1. Abstract

This ongoing work addresses the following problem: How best to combine and filter 3-Dimentional point cloud data acquired from ground based/aerial LiDAR sensors. In particular we are interested in extracting structural and physiological properties of targets of interest. This project aims to:
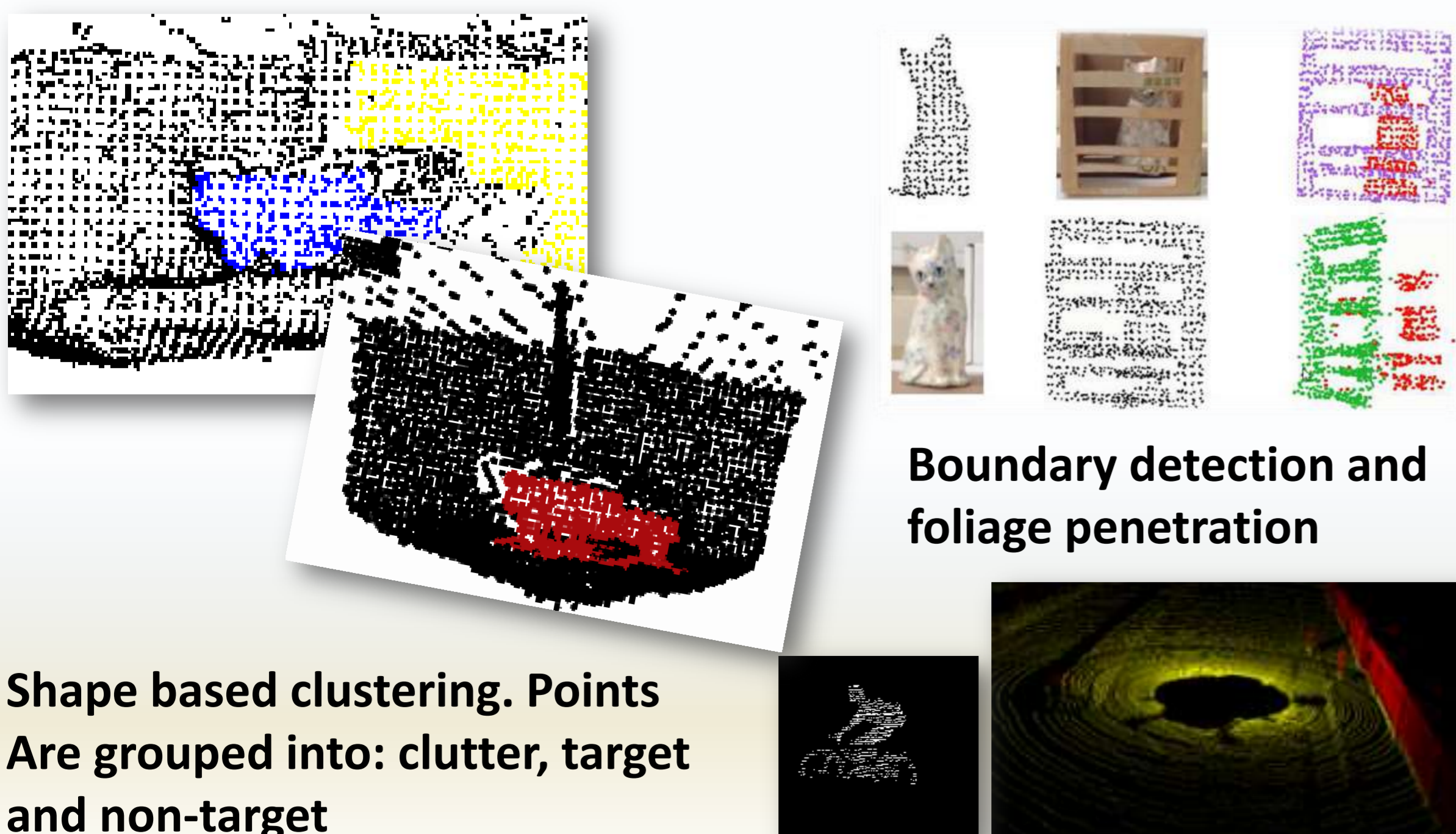
❖ Maximise information capture of LiDAR in order to support *effective foliage penetration* and provide effective *situational awareness*; and

❖ Develop *Cueing algorithms* to reduce target search space for *automatic target recognition.*

2. Technical Challenges

Problem: Detect and recognise objects hidden behind dense foliage by establishing techniques and algorithms to manage noisy 3D point cloud data. We have identified the following research questions:

❖ How to solve *Data Correspondence:* does a point belong to the **target**, **non-target** or **clutter**?

❖ How to parameterise targets: using a *part based (clusters)* or a *point-based feature* approach?

❖ What are the benefits of *combining multi-spectral* and *geometric* saliencies?

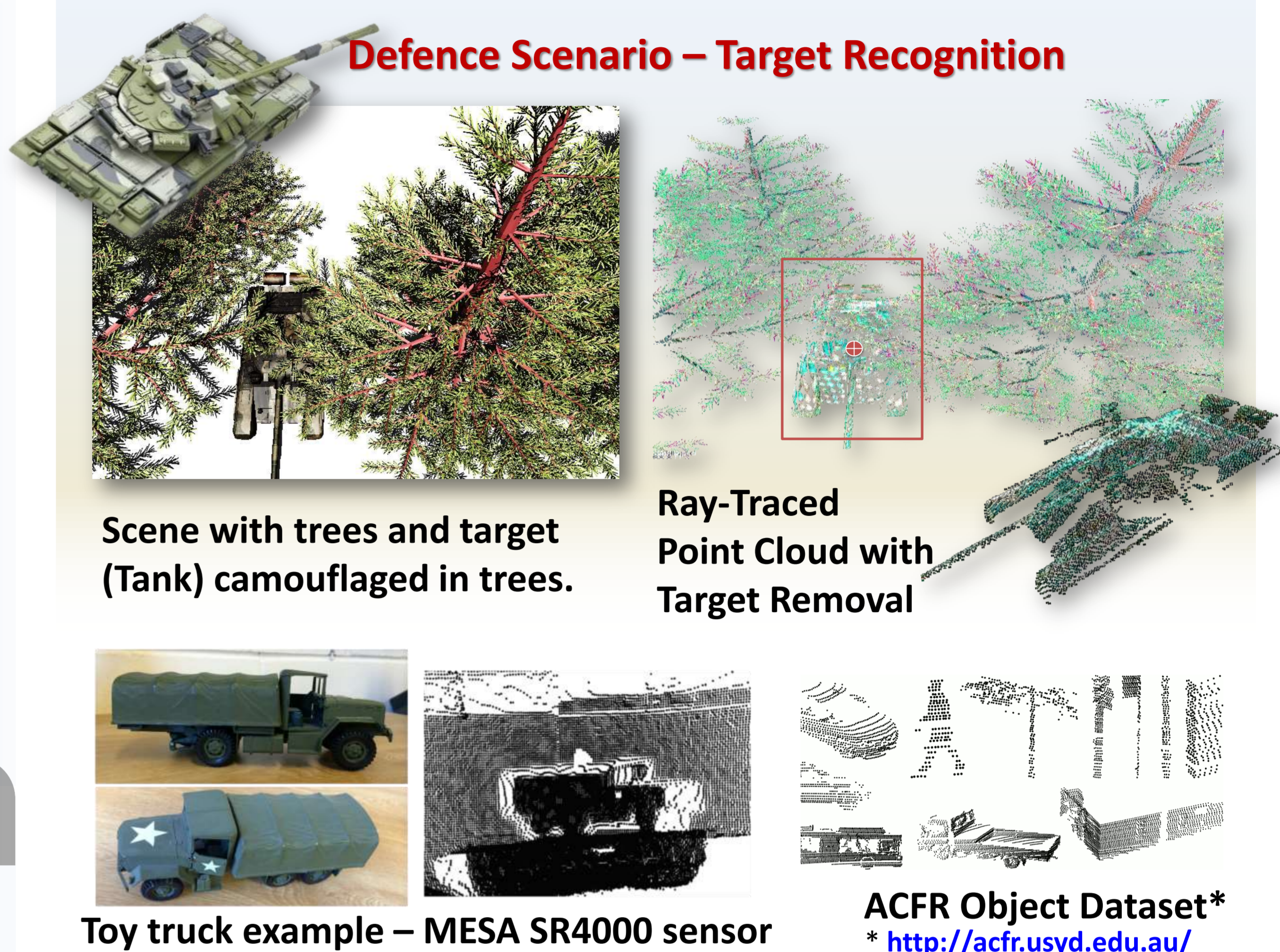❖ *Object Boundaries:* Can we achieve better segmentation using multi-spectral features?

3. Data sets and Simulations

Defence Scenario – Target Recognition

Scene with trees and target (Tank) camouflaged in trees.

Ray-Traced Point Cloud with Target Removal

Toy truck example – MESA SR4000 sensor

ACFR Object Dataset*
* http://acfr.usyd.edu.au/

4. Framework for Experiments

Training

Target Point Cloud → Target Class Labels

Spectral Signatures

Pose Information

Feature Extraction

Shape | Spectral response

Feature Database
• View Dependent Features,
• Invariant Features, …

Future work (Year 2): *Spectral Signatures* using Multi-Spectral LiDAR
If pose information is available we can use view-dependent point feature descriptors.

Testing

Point Cloud → Clustering/Segmentation

Spectral Signatures

Pose Information

Feature Extraction

Feature Database
• View Dependent Features,
• Invariant Features, …

Probabilistic Reasoning
Feature Matcher
Verifier

Query

Result

A Decision on whether to perform segmentation or not is not taken yet.
If part-based matching approach is taken this step is critical.

5. Progress to Date –Experiments

Boundary detection and foliage penetration

Shape based clustering. Points Are grouped into: clutter, target and non-target
Saliencies are computed and compared against a model library

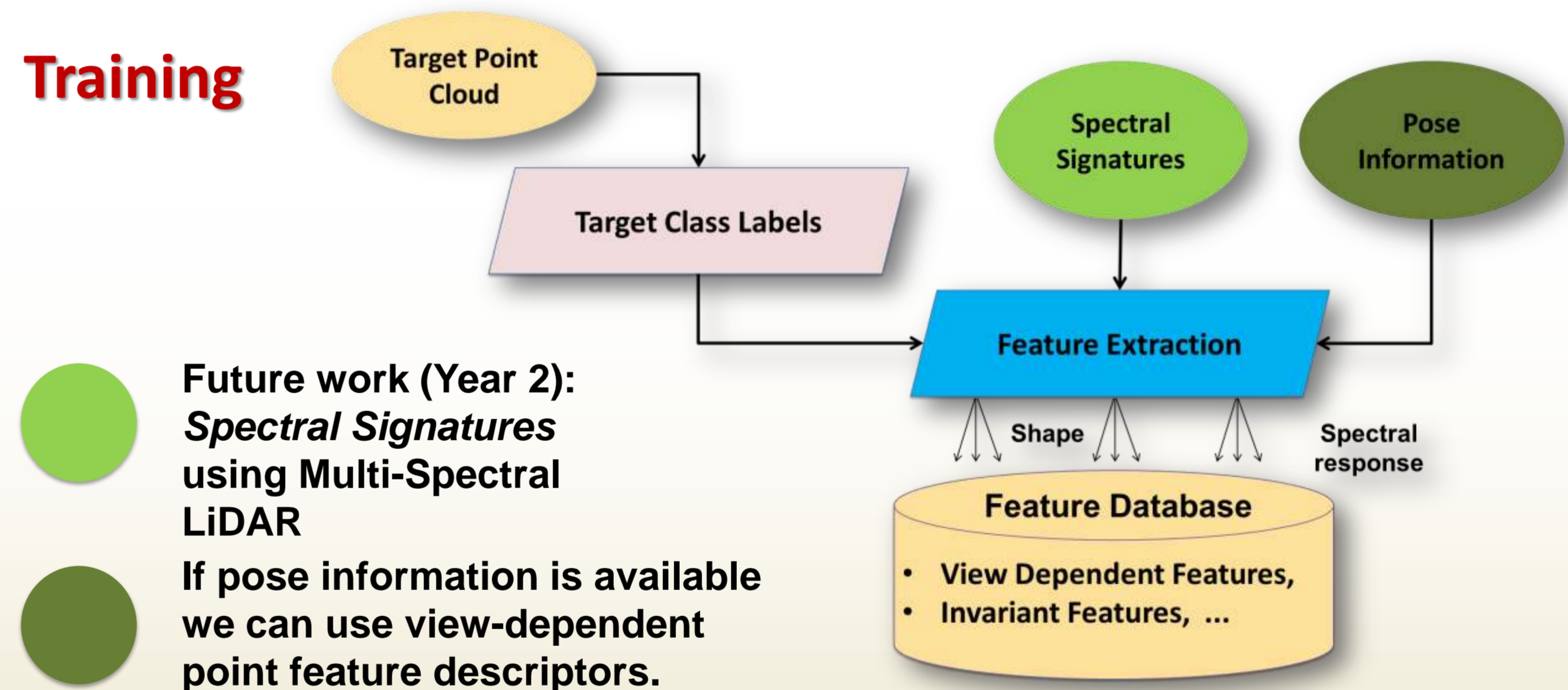Object removal on KITTI Dataset*
*http://www.cvlibs.net/datasets/