ROBUST OBJECT-AWARE SAMPLE CONSENSUS WITH APPLICATION TO LIDAR ODOMETRY

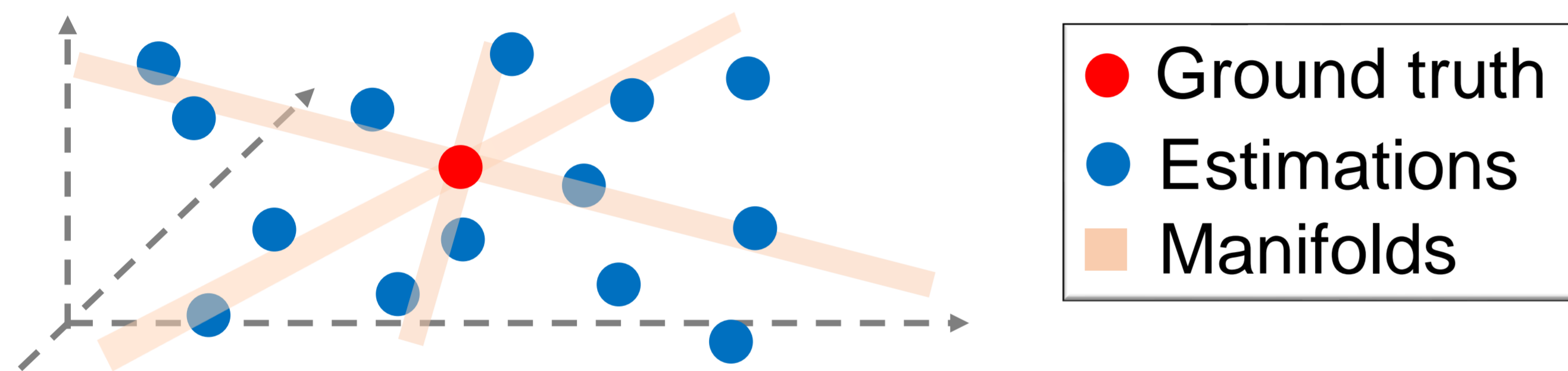Hui Cheng, Yongheng Hu, Chongyu Chen, and Liang Lin   *School of Data and Computer Science*, **Sun Yat-Sen University**

We propose a new paradigm for sample consensus and apply it to the estimation of rigid transforms of 3D point clouds in LiDAR odometry.

From RANSAC to ROSAC (applied to 3D registration)

Randomly select N sets of 3D points → Select N sets of object-aware 3D points

Generate N parameter estimations individually

Choose the estimation with the largest number of inliers

Determine the outlier estimation by subspace analysis

Fusing the inlier estimations

RANSAC

New insights

1. An estimation of **n** parameters ➡ A point in **n**-D space
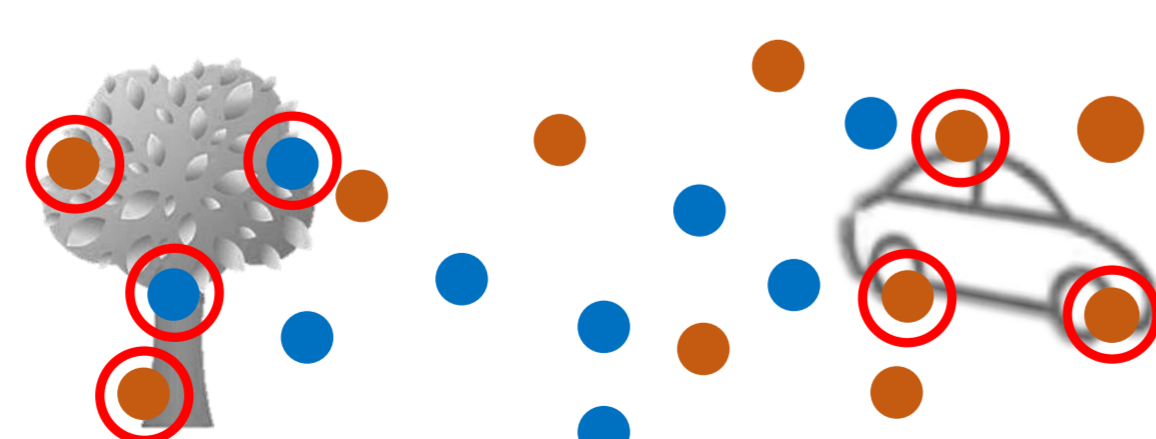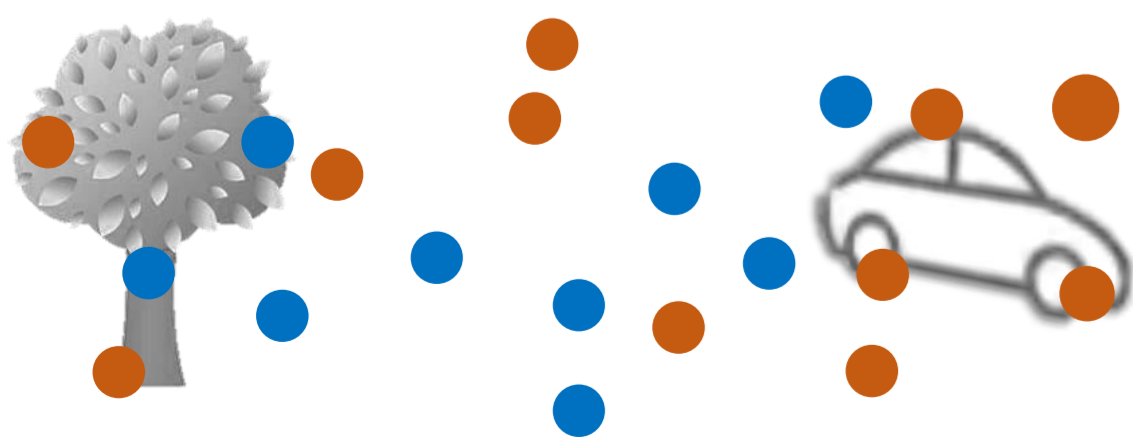2. Such points essentially lie on low-dimensional manifolds defined by the ground-truth parameters

- ● Ground truth
- ● Estimations
- ▨ Manifolds

Such points are inevitably with noise and outliers
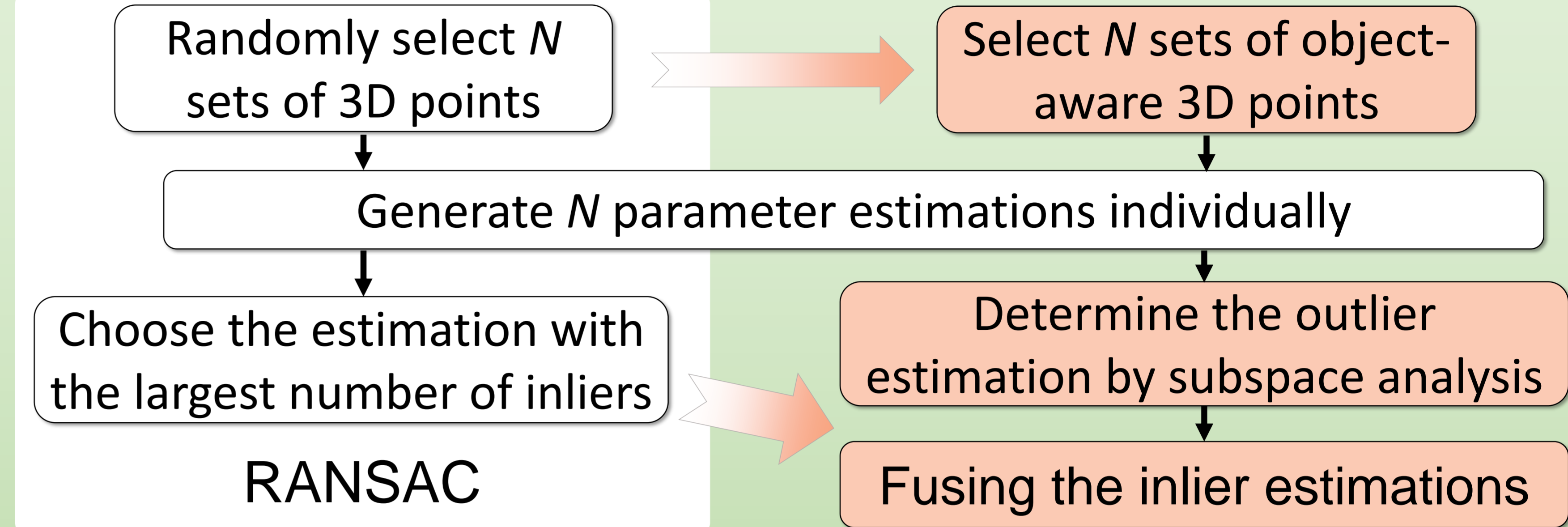
From random sampling to object-aware sampling
(in the 3D registration of LiDAR point clouds)

- ● 1st ● 2nd
- ● 1st ● 2nd ○ Object-aware

Object-aware samples are preserved in each selection

Main results

Object-aware sampling is generally better

Uniform sampling	Random sampling	Object-aware sampling
0.0622	0.0683	**0.0457**

Accuracy improvement up to 67.00%

Method	ROSAC ICP		RANSAC ICP		Original ICP	
Metric	Translation error	Rotation error	Translation error	Rotation error	Translation error	Rotation error
Average	**0.0754**	**0.0036**	0.3642	0.0059	0.2285	0.0037

Speed improvement of 4x (can be further increased)