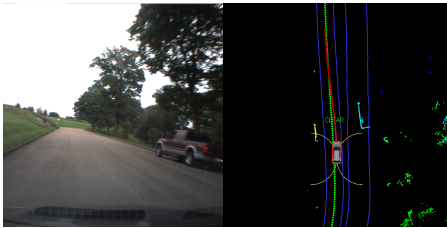# Particle Filter Approach to Tracking Multiple Vehicles Over Time

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Problem

- Within the field of autonomous vehicle control, and really the field of computer vision entirely, tracking multiple objects over time is an integral problem, with many approaches [1].


Pre-segmented data: the L-shape on right is the laser-range finder picking up vehicle seen on the left

- Beyond segmenting (or identifying) the vehicles in a frame, tracking vehicles is important to ensure occluded vehicles are still taken into account and aren't entirely forgotten because they can't be seen

- **The goal is to solve the tracking problem using a particle filter approach**

Approach

- The particles are sampled from a three dimensional Gaussian distribution, with the dimensions being x position, y position, and heading of the given object.
- The association step is completed by a prediction step and comparison of the proximity of each target's predicted location with the given frame's objects.
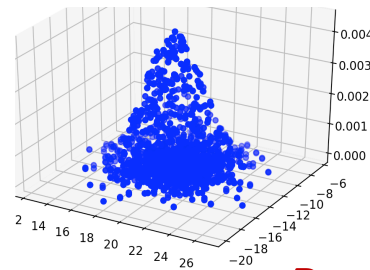
- A particle filter after initialization around a single vehicle. Each particle represents a possible belief, with the particles closest the segmented vehicle being moto st probable in the distribution

Results
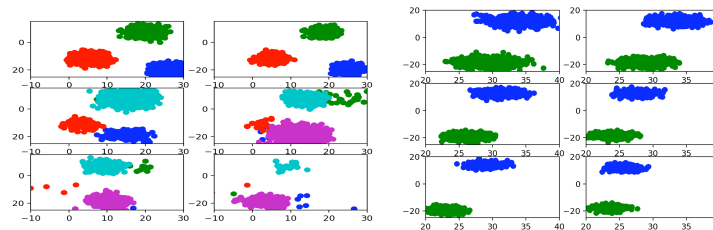
- In this case, due to the proximity of two of the targets, new filters were initialized – due also to sparseness of particles

- Algorithm tracking two vehicles moving left (frame sequence goes left to right, top to bottom). Note the clustering of particles gets more dense as the frames progress, indicating a higher certainty of the location and heading of the tracked vehicles

Future Work

- Comparison of how a linear assignment approach for data association (like the hungarian algorithm) might compare to the JPDAF approach (as used in [2] and [3])

- Could also do away with assumption of independent position and heading, consider its effects on implementation's success

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References

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[2] A. Almeida, J. Almeida, and R. Araujo, "Real-time tracking of moving objects using particle filters," in Industrial Electronics, 2005. ISIE 2005. Proceedings of the IEEE International Symposium on, vol. 4. IEEE, 2005, pp. 1327–1332.

[3] M. Jaward, L. Mihaylova, N. Canagarajah, and D. Bull, "Multiple object tracking using particle filters," in Aerospace Conference, 2006 IEEE. IEEE, 2006, pp. 8–p