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].

- 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 most probable in the distribution

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

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

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References

