Object Tracking

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1 Introduction

1.1 Single Object Tracking

Single object tracking is essentially a filtering problem. We are dealing with sequential processing of a noisy sensor measurements in order to determine the state of the object.

Remark 1.1. When we say state we actually mean the position of the object together with properties that describe its motion e.g. speed and direction

The filtering problem is not so easy to solve since the state of the object is neither fully not directly observed.

Definition 1.1. Multiple Object Tracking (MOT)

Multiple Object Tracking is defined as the sequentioal processing of noisy sensor measurements in order to determine the number of dynamic objects in each dynamic state of the object.

Typically MOT is based on sensor detections. common sensors in MOT are

- Cameras
- Radars
- LiDARs

In addition, the sensor data serves as input to a detector. The block diagram in Figure 1 illustrates the concept.

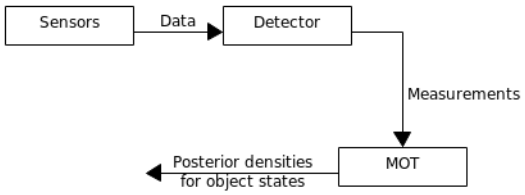

Fig. 1: MOT block diagram.

1.2 Questions

1. Which property or properties hold(s) for the track-before-detect method?
2. Which property or properties hold(s) for the point object tracking method?

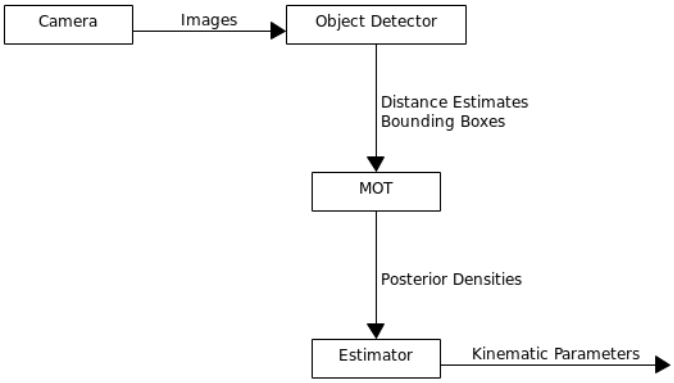

Fig. 2: Camera block diagram.

3. Which property or properties hold(s) for the extended object tracking method?
4. Which property or properties hold(s) for the group object tracking method?
5. Which property or properties hold(s) for the tracking with multi-path propagation method?
6. Which property or properties hold(s) for the tracking with unresolved measurements method?

1.3 Assignements

1.4 Answers

1. Which property or properties hold(s) for the track-before-detect method

   Answer:

   (a) The approach can be used in tracking scenario with very low Signal-to-Noise-Ratio

   (b) Doesn't use a detector, input raw sensor data into MOT.

2. Which property or properties hold(s) for the point object tracking method?

   Answer:

   (a) At most one detection per object per time scan.

   (b) Possibly provide object extent estimate

3. Which property or properties hold(s) for the extended object tracking method?

   Answer:

   (a) Possibly provide object extent estimate.

   (b) Possibly multiple measurements per object

4. Which property or properties hold(s) for the group object tracking method?

   Answer:

   (a) Possibly provide object extent estimate. correct .

   (b) Possibly multiple measurements per object

   (c) The tracked object consists of smaller "sub-objects" that move in common formation.

5. Which property or properties hold(s) for the tracking with multi-path propagation method?

   Answer:

   (a) Measurements resulted from multiple propagation paths.

   (b) Possibly multiple measurements per object.

6. Which property or properties hold(s) for the tracking with unresolved measurements method?

   Answer:

   (a) A group of close objects that collectively result in a single measurement

References

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[2] Karl Granstrom, Markus Baum, Stephan Reuter, *Extended Object Tracking:Introduction, Overview and Applications* Available at `https://arxiv.org/pdf/1604.00970.pdf`, last accessed 13/04/2019.

[3] `https://en.wikipedia.org/wiki/Multipath_propagation`